HOW DO HIGH-SKILL FOREIGN WORKERS ASSIMILATE IN THE UNITED STATES? TRACING THE WAGE TRAJECTORIES OF FOREIGN AND AMERICAN IT PROFESSIONALS

Completed Research Paper

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Abstract

This paper seeks to understand how high-skill foreign IT professionals assimilate in the United States by examining the wage trajectories of foreign and American information technology (IT) professionals. While prior research shows that on average foreign IT professionals earn more compared to US citizen IT professionals, our focus here is on temporal evolution of differences in wages to understand how the wages of foreign and American IT professionals evolve over time. We use data on skills and compensation of more than 50,000 IT professionals in the U.S. over the period 2000-2005 to test our hypotheses.

The results indicate that IT professionals on H-1B or other work visa earn a significant salary premium over the entire duration of work experience when compared with IT professionals with U.S. citizenship. Interestingly, the difference in wages appears to grow over time suggesting that foreign IT professionals with substantial work experience on work visa earn significantly more premium than those with less work experience. The IT professionals on H-1B or other work visa exhibit steeper wage trajectories than either greencard holders or American workers; the wage trajectories of greencard holders and American workers have similar slopes. The wages of IT professionals on H-1B or other work visa with somewhere between 15-20 years of work experience is higher than that of greencard holders. We discuss implications for researchers, policy-makers, managers and individual workers.

Keywords: Wage trajectories, IT professionals, high-skill immigration, H-1B, work visa, managing IT resources, compensation, IT human capital, globalization
Introduction

Foreign-born workers play an important role not only in labor markets of United States and many other developed nations, increasingly they are also beginning to make their presence felt in emerging economies. They exemplify a major integrative force in the contemporary global economy. In the context of the theme for this year’s International Conference on Information Systems titled “East Meets West: Connectivity and Collaboration through Effective Information Systems,” foreign-born workers, particularly those in information systems field, help to integrate East with the West. Therefore this paper is timely and directly relates to the Conference’s call “to think more deeply about how information systems and information and communication technologies can contribute to the connectivity and collaboration of people, organizations, countries, and international institutions.”

Although low-skill immigration in the United States has received a great deal of attention in media and academic research, high-skill immigration is a relatively nascent area of research. The United States receives thousands of high-skill foreign temporary workers (through visa programs such as H-1B and L1) and immigrants every year, even though the absolute numbers pale in significance compared to low-skill immigration or the overall job market. IT professionals, who create the IT infrastructure to support critical business processes of firms (Ang and Slaughter 2000; Bartol and Aspray 2006; Ferratt et al. 2005; Harter and Slaughter 2003; Josefek and Kauffman 2003; Slaughter et al. 2007), form a significant proportion of these high-skill workers. They perform boundary spanning and related roles to coordinate the development of IT artifacts in a distributed environment (Espinosa et al. 2006; Espinosa et al. 2007; Oshri et al. 2007; Ramasubbu et al. 2008; Rottman and Lacity 2006), help to innovate, design and deliver products and services for global markets, and create new start-ups. Many foreign-born IT workers become entrepreneurs: it is estimated that 25% of high-tech start-ups in the last decade were founded by foreign-born workers, and start-up companies were responsible for almost all net job creation in the U.S. from 1980 to 2005 (Friedman 2010).

Despite the importance of high-skill immigrants for competitiveness and growth of U.S. firms and economy, few studies have examined the assimilation of high-skill IT professionals in the United States. Much of labor economics literature that focuses on assimilation of foreign workers has generally studied low-skill immigrants (Borjas 1985; Friedberg 2000; Green 1999). Although it is useful to know how foreign IT workers are paid compared to American IT workers on average, it is also important to know how relative wages change over time. This is because even if foreign workers earn more than American workers on average (Mithas and Lucas 2010), one of the possibilities may be that foreign workers earn less initially but they may be making up far more than that in subsequent years. We are not aware of any study that has rigorously studied such longitudinal patterns with respect to IT professionals. Moreover, studies of evolution of wages can also inform us how high-skill foreign IT workers assimilate in the U.S. economy.

This paper examines wage trajectories of American and foreign IT professionals employed in the United States. Using a sample of more than 50,000 foreign and American IT professionals in the U.S., we study relative wages of foreign and US citizen IT professionals over time. Our work complements prior research on the compensation of IT professionals in general (e.g., Ang et al. 2002; Levina and Xin 2007; Mithas and Krishnan 2008; Mithas and Krishnan 2009; Slaughter et al. 2007), but with a unique twist that draws attention to the longitudinal dimension of wages and we focus here on temporal evolution of wages instead of overall wage differences. Our work is related to that of Mithas and Lucas (2010) but extends that in significant ways: while Mithas and Lucas (2010) report some exploratory findings with respect to how firms value education and IT experience of foreign IT professionals vis-à-vis American IT professionals, they do not study how their relative wages change over time which is the focus of this study.

Background and Hypotheses

This study focuses on non-US citizen IT professionals, a subset of foreign-born people in the U.S. because a large fraction of foreign-born IT professionals who initially enter US on a temporary work visa eventually become US citizens. Foreign-born people constitute less than 3% of the population of the
world, or, approximately 200 million people in 2010. The foreign-born constitute about 9% of the population in developed countries (about two-thirds of all the immigrants) while they constitute about 1.5% of the population in developing countries (Freeman 2006). Most of the foreign-born IT professionals enter the United States through permanent immigration, and nonimmigrant or temporary work visa. Permanent immigration can be either employer-sponsored or family-sponsored; IT professionals immigrate to the U.S. using this route after working for a few years under some temporary work visa programs such as H-1B, L1 or TN.

Among temporary work visas, visas in the H-1B category exceed those in other visa categories in specialty occupations (Constable 2007; McGee 2006). According to a study, about 60% of H-1B visas are issued to the IT industry (Park 2007). The total number of new H-1B professionals in the U.S. economy, particularly those in the IT profession, is less than 0.1% of the U.S. labor force; but these workers are valued and important members of the workforce of high-technology companies such as Microsoft, IBM, Intel and Google (NFAP 2007), firms which are engines of the information economy.

Although H-1B is a non-immigrant visa, it permits a worker to apply for legal permanent resident (LPR, also called “green card”) status while holding the H-1B visa. The maximum number of new H-1B visas issued per year had an annual cap of 65,000 from fiscal years 1991 to 1998; 115,000 in 1999 and 2000; 195,000 from 2001 to 2003 and 65,000 thereafter. Beginning with the 2005 fiscal year, Congress allowed 20,000 additional visas for foreigners graduating from U.S. universities with a master’s or a higher degree, thus effectively increasing the cap to 85,000. Because H-1B visa applications have exceeded the annual caps for new H-1B visas in recent years, the U.S. Citizenship and Immigration Services allocated visas using first-come-first-served or a lottery process, denying some H-1B petitions from high tech companies such as Microsoft. Microsoft reportedly opened a complex in Canada for 150 foreign professionals that it could not bring to the U.S. due to restrictive H-1B visa caps in 2007 (Whoriskey 2008) and that complex, according to an official, employs about 5000 professionals in the year 2010.

Prior Literature

High-skill immigrants or temporary workers represent an important facet of globalization in terms of inward mobility of foreign workers, the other facet being outward mobility of work to foreign workers at remote locations as reflected in outsourcing or offshoring of business processes and services (Apte et al. 2008; Carmel and Agarwal 2002; DiRomulado and Gurbaxani 1998; Han et al. 2010; Lacity et al. 2003; Mithas 2008; Mithas and Whitaker 2007; Ramasubbu et al. 2008; Rottman and Lacity 2004). While prior research has devoted some attention to organization of global IT function (Ives and Jarvenpaa 1991; Jarvenpaa and Ives 1993) and global mobility of work (Davis et al. 2006; King and Torkzadeh 2008; Oshri et al. 2007), relatively fewer studies focus on the mobility of high-skill IT professionals across country borders.

Prior work suggests that high-skill workers enhance innovation in American companies, Universities and the US economy and have positive economic impact (Chellaraj et al. 2008; Friedberg 2007; Kerr and Lincoln 2010; Saxenian 2002). They are important for US companies to develop products and services for world markets. According to a study, about 48% of the revenues of S&P 500 companies in 2008 (Vigna and Shipman 2010) and more than 35% of the profits of U.S. companies came from abroad in 2008 helping to offset lagging revenues and profits in the U.S market (Cooper 2008). Saxenian (2002), based on her study showing that 1 percent increase in the number of first-generation immigrants from a country is associated with 0.5 percent increase in exports to that country from California, argues that high-skill immigrants create new jobs in the United States and new ties with other economies to enhance trade and investment flows. During the 1999-2009 period, international sales have grown for all major technology firms in the U.S. (Lohr 2010) and these firms are key employers of foreign-born IT workers.

Critics of temporary worker visa programs frequently allege that foreign workers are exploited in early years, despite doubts about the extent and veracity of such exploitation and dearth of rigorous evidence to support that claim. Among academic studies, Lowell and Avato (2007) analyzed data from the National Survey of College Graduates (NSCG), a 2003 follow up survey of the 2000 U.S. Census sponsored by the National Science Foundation, which sampled individuals with a bachelor’s degree or higher. The NSCG survey includes the initial entry visa and the year of adjustment to permanent status; and the visa status
variables capture the status at the time of the survey, i.e., permanent/naturalized immigrant or temporary visaholder—and four temporary statuses: student, working, dependent or other visa.

Lowell and Avato report that foreign students earn substantially less than natives and they continue to earn less than natives after changing to temporary work status. However, temporary workers who initially enter on a temporary work visa actually earn more than natives. Their findings imply that U.S. educated students are not as highly selected as individuals who enter first as temporary workers. These findings are somewhat mixed and should be viewed with caution because the paper is yet to be published and findings or their interpretation may change with changes in models or results during the peer-review process.

Economic assimilation of immigrants is generally defined by how quickly immigrants catch up with native workers in terms of earnings. Since the pioneering work of Chiswick (1978), the studies on immigrants’ assimilation have attempted to measure the skill differentials between immigrants and natives at the time of entry and investigate how these differentials and the resulting earnings gaps evolve over time as immigrants assimilate to the host country’s labor market (Borjas 1985; Borjas 1999; Chiswick 1978; Lalonde and Topel 1997; Wilson and Portes 1980).

Prior studies in the context of low-skill immigration suggest that immigrant entry earnings are negatively related to immigrant earnings growth. In addition, the number of years since migration has a positive association with the earnings of immigrants (Borjas 1999). Using the 1970 U.S. Census data, Chiswick (1978) finds that despite initial lower earnings of immigrants than natives, this earning gap narrows with their labor market experience in the U.S. and immigrant earnings exceed those of their native counterparts after 10 to 15 years in the U.S. Studies suggest accumulation of human capital as a reason for the steeper experience-earnings profiles in immigrants’ wages. Researchers have argued that immigrants have a high degree of motivation and incentive to invest in training and education and acquire US-specific knowledge and skills over time to improve their chances in the labor market. Some studies indicate that assimilation rate is likely to be faster in early stages of immigration: immigrants have strong incentives to invest in human capital and these investments are likely to be higher for the first several years after immigration and diminish over time (Ben-Porath 1967). In addition, job search and matching is likely to be higher among new immigrants. To the extent job mobility increases the possibility of finding jobs that have a better fit with the skills of new immigrants, immigrants’ productivity and as a result their earnings is likely to rise rapidly over time in the host country.

Borjas (1985) suggested an alternative explanation for steeper earning profiles of immigrants and argued that the steeper profiles might reflect a decline in the quality across immigrant cohorts rather than accumulation of host country-specific human capital. To the extent the size and country composition of immigration to the U.S. has changed significantly over time (Friedberg and Hunt 1995), these changes may have resulted in decrease in quality of more recent cohort of low-skill immigrants which may reflect in steeper earning profiles in cross-sectional analyses. LaLonde et al. (1992) used data from the 1970 and 1980 US Census to test this conjecture. Although they find that immigrant skills, on average, had declined sharply, they found that cross-sectional estimation and cohort analysis both produced similar results and concluded that there was no significant evidence of the decline in quality within immigrant cohorts.

Other explanations for the immigrant earnings profile suggest that the incentive to invest in host country-specific skills is influenced by factors such as admission criteria, portability of skills across countries, and family investment strategies (Duleep and Regets 1997). These factors often increase the willingness to invest in skills in the host country, but may also lead to lower earnings at entry. Hence, a decline in immigrant earnings across cohorts may not mean a drop in immigrant ability or quality, but a natural outcome arising from many external factors which is often compensated by rapid earnings growth later (Akresh 2007; Duleep and Regets 1997; LaLonde and Topel 1992). Duleep et al. (1997) suggest that kinship admissions are more likely to be associated with lower entry earnings but higher earnings growth than skills-based admissions. This body of research generally supports the conclusion that earnings growth is steeper for immigrants than for natives (Duleep and Regets 1997).

Among other studies on immigrant assimilation, some show that the national origin of immigrants' education and labor market experience matter (Friedberg 2000). Human capital acquired abroad is significantly less valued than that obtained in the host countries. Friedberg (2000) shows that in the context of Israel immigrants, the returns to education in foreign countries are higher for immigrants from Europe than for immigrants from Asia and Africa. Immigrants, especially when they have no formal
education in the host countries, have lower returns to education than natives (Lalonde and Topel 1997; Schoeni 1997). Studies that investigate the impact of language proficiency on immigrants’ earnings in the United States (Akresh 2007; Bleakley and Chin 2004), Israel (Friedberg 2000), and Germany (Dustmann and Van Soest 2002) suggest that language proficiency is a crucial determinant of earnings of immigrants. This relationship depends on the type of production processes and industries in which immigrants participate. In general, lower level of language proficiency is associated with lower earnings of immigrants when workers need to communicate in production processes, or when consumers demand customized products (Lalonde and Topel 1997).

Although a majority of studies compare earnings of immigrants to those of the natives with comparable education and experiences, some studies investigate earning differentials between new immigrants and individuals in the host country of the same ethnicity (Borjas 1985; Borjas 1987). Borjas (1987) shows that increases in the supply of immigrants have a significantly negative impact on the earnings of other immigrants, while they have little impact on the earnings of natives. Other studies investigate whether and how acquisition of U.S. citizenship by immigrants influences the assimilation process (Bratsberg et al. 2002). Citizenship can impact earnings growth of immigrants in many ways. Citizenship may be necessary for immigrants to get certain jobs such as those with federal agencies and think tanks. Bratsberg et al. (2002) show that citizenship enables immigrants to have access to public sector and white collar jobs leading to higher wage growth. In addition, citizenship may prevent immigrants from being discriminated against by employers or unions (Becker 1971; Bucci and Tenorio 1997). Also, employers may prefer naturalized citizens, because noncitizens may have less incentive to invest in accumulation of US-specific human capital (Mincer and Polachek 1974).

We contextualize the arguments and findings of the prior literature to develop hypotheses for assimilation of high-skill IT professionals.

**Hypotheses**

**Wage Trajectories of Non-US-Citizen and US-Citizen IT Professionals**

Prior studies on economic assimilation of low-skill immigrants suggest that high-skill immigrants may also experience differential growth in earnings over time compared to those of natives. Although some of the underlying mechanisms may be same, we account for some additional mechanisms that may be relatively unique to high-skill IT professionals.

Drawing on human capital arguments, we posit that high-skill foreign IT professionals may have higher earnings growth than comparable natives because of three reasons. First, due to positive self-selection, foreign IT professionals may have higher intangible human capital compared with the American IT professionals (Mithas and Lucas 2010). Migration is generally regarded as an investment that involves several direct and indirect costs (Chiswick 1978). Immigrants won’t leave their home country unless the returns to immigration surpass the costs. This self-selection in immigration implies that for the same observable characteristics, immigrants may have more innate motivation than their native counterparts (Chiswick 1978). The positive selection effect is even more salient for high-skill IT professionals. Because of limited number of temporary work visa annually, the competition is fierce among IT professionals trying to gain entry to work in the U.S, and firms also screen foreign IT workers more rigorously. Because of the positive selectivity of foreign IT workers, we expect that they will have relatively higher earnings growth (Duleep and Regets 1997).

Second, skill transferability can be a critical determinant for earnings of foreign IT workers. The imperfect transferability of country-specific human capital might lead to lower entry earnings for high-skill IT professionals, but a greater incentive to invest in accumulation of necessary U.S. specific skills (Chiswick 1978). This incentive will result in faster earnings growth for foreign IT professionals than for similar American IT professionals. Mincer and Ofek (1982) describe this pattern as “a reflection of ‘depreciation and restoration’ in the rental price of an immigrant’s human capital ....”. Furthermore, acquiring U.S. education or labor market experience might increase the return to human capital foreign IT professionals acquired abroad (Friedberg 2000). Investments in U.S.-specific skills, such as English learning or training for professional licenses, might enable foreign IT professionals to adapt their previously acquired human capital to U.S. labor market. This complementary relationship between US-specific human capital and foreign human capital would increase the steepness of a foreign IT professional’s experience-earnings growth.
profile. Given that foreign IT professionals working for U.S. firms frequently serve as boundary spanners to facilitate interaction with foreign outsourcing vendors or customers located outside the U.S. (Mithas and Lucas 2010), this complementary skill will be more significant for foreign IT professionals.

Finally, job search is often viewed as a possible mechanism to facilitate the assimilation process. Immigrants are likely to have relatively less information during job search than similar natives. Assimilation is believed to occur when this information increases over time since arrival and with repeated job searches (Daneshvary et al. 1992). Increased information useful for job search will increase the possibility of finding jobs that fit new arrivals most, thus making their earning rise rapidly. Note that this argument may be more applicable to green card holders than for IT professionals with a work visa, because employers typically hold work visas which makes it difficult for IT professionals to transfer to other firms.

Relying on the human capital-based arguments, we posit that foreign IT professionals, because of self-selectivity, higher investment and complementarity between foreign and domestic skills, and better search and fit are likely to have steeper experience-earnings profile than U.S. citizen IT professionals. Thus,

\[ H1: \text{ Compared to U.S. citizens, non-U.S. citizen IT professionals show steeper experience-earnings profile after controlling for their education and labor market experience. } \]

**Wage Trajectories of Work-Visa Holders and Green-card Holders**

Whereas non-U.S. citizen IT professionals are likely to have higher earnings growth compared to U.S. citizens, we posit that IT professionals on a work visa will show steeper earnings profile than comparable green card holders. Although green card holders were most likely in a work visa in the case of IT professionals as mentioned before, they have higher bargaining power and job security compared to IT professionals with a work visa (Mithas and Lucas 2010). Because obtaining permanent residency status takes a few years, green card holders have an opportunity to assimilate to American labor market. Therefore, they are less likely to suffer from disadvantage due to imperfect transferability of home country-based knowledge and skills. They are also likely to have made a restorative investment in human capital. In addition, employers also verify the knowledge and skills of green card holders through their screening processes. Thus, they may be more willing to sponsor training and education of the green card holders, which makes the earnings growth of the green card holders less steep. Thus,

\[ H2: \text{ Compared to green card holders, IT professionals with a work visa show steeper experience-earnings profile after controlling for their education and labor market experience. } \]

**Methods**

The United States employs close to 3.8 million IT professionals in an economy that employs about 140 million workers annually. Lowell (2007) estimates about 700,000 temporary high-skill foreign professionals in the U.S. on work visas (approximately 500,000 in H-1B category alone) and about 60% of these are in the IT profession.

This study uses the data previously analyzed by Mithas and Lucas (2010), but it focuses on a different research question. We provide some salient details about the dataset here for readers’ convenience. The data come from national Web surveys for the 2000–2005 period conducted by InformationWeek, a widely circulated IT magazine in the United States. This is the largest and most complete source for salaries of IT professionals in the United States as far as we know and previous academic studies have used data from InformationWeek surveys in a variety of peer-reviewed outlets (Bharadwaj et al. 1999; Mithas and Krishnan 2008; Mithas and Krishnan 2009; Mithas et al. 2005; Mithas and Lucas 2010; Mithas and Whitaker 2009; Rai et al. 1997; Santhanam and Hartono 2003).
The overall sample and sample of non-US citizen foreign-born IT professionals appears reasonably representative of that in the US population (see Mithas and Lucas 2010 for additional details on the data, also see Table A1 in their Appendix). Furthermore, the fraction of non-US citizen IT professionals in our study constitute 4.73% of the total sample, which is close to 5% of non-US citizens that we can derive from prior studies (see Friedberg and Hunt 1995; Gurcak et al. 2001; Lowell 2001; National Research Council 2001).

We also assessed the representativeness of foreign-born non-US citizens in our sample by comparing the fraction of IT professionals on a greencard or work visa by years of IT experience in our study with what is reported in other studies (Gurcak et al. 2001). In our data 54% of non-US citizens with less than 10 years of IT experience are greencard holders (as a percentage of all greencard holders in our sample) and 65% are on H-1B or some other work visa (as a percentage of all IT professionals on H-1B or some other work visa in our sample). These figures which appear in consonance with prior studies (Gurcak et al. 2001) provide further confidence in representativeness of foreign-born non-US citizens in our sample. Results of non-parametric Kolomorov-Smirnov tests suggest that the distribution of American and foreign respondents does not differ across job titles or US States.

After eliminating observations with incomplete or missing data on all variables of interest, we are left with more than 50,000 IT professionals for which the data relevant for this study is available. We used similar questions across the years to construct the variables used in this study and converted the nominal dollar value of compensation each year to 1999 dollars using the Employment Cost Index for all worker computed by the Bureau of Labor Statistics. While some IT professionals (close to 1%) in our dataset are contract employees, to ensure comparability of results we restricted the analyses to full-time IT professionals.

Following previous research (Ang et al. 2002; Angrist and Krueger 1999; Mithas and Krishnan 2008), we specify standard cross-sectional log-linear earnings models to estimate the effect of citizenship and work visa status on compensation. Let \( W \) represent the annual salary of the respondent; \( X \) and \( Z \) a vector of observed characteristics associated with the respondent and the institutional context, respectively; and \( V \) represents the citizenship or work visa status of a respondent (\( V=1 \) for non-U.S. Citizens, H-1B or other work visa holder and greencard holders depending on the context, else zero).

\[
\ln W_i = \alpha V_i + \beta X_i + \gamma Z_i + \delta V_i X_i + \epsilon_i, \quad (1)
\]

where \( \alpha, \beta, \gamma, \) and \( \delta \) are the parameters to be estimated and \( \epsilon \) is the error term associated with observation \( i \).

Results

Table 1 shows the results. It shows that compared to non-U.S. citizens, U.S. citizens have higher returns on education, but lower returns on IT experience (at the current firm or at other firms). Although returns on IT experience are generally higher for non-US citizens, firms value their IT experience at current and other firms differently than they do for US citizens. Firms pay a premium for IT experience at other firms in comparison to IT experience at the current firm of U.S. citizens, but they do not value IT experience at other firms in comparison to IT experience at the current firm of non-US citizens. Relatively higher returns on IT experience but lower returns on education for IT professionals on work visa create the possibility that over time, their wages may overtake that of U.S. citizen IT professionals with higher education.

Assuming that 75% of foreign-born IT professional eventually become US citizens as estimated for other workers, leaves 25% foreign-born who are non-citizens. Furthermore, there are about 20% of foreign-born workers in the IT profession. This 25% times the 20% of foreign-born workers in the IT profession gives an estimate of 5% of foreign-born non-US citizens in the IT profession.
Table 1. Parameter Estimates of the Models For Constructing Wage Trajectories of Foreign and American IT Professionals (Dependent Variable is natural log of cash compensation)

<table>
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<tr>
<td>ln(Cash compensation)</td>
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<td>Non US Citizen</td>
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<td>0.372***</td>
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<td>0.202***</td>
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<td>Bachelor's Degree</td>
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</tr>
<tr>
<td>Firm Specific IT Experience</td>
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<td>0.022***</td>
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<td>General IT Experience</td>
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<td>0.035***</td>
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<td>Non US Citizen X PhD</td>
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<tr>
<td>Non US Citizen X Firm Sp. IT Exp</td>
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<td>Non US Citizen X Genl IT Exp</td>
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<tr>
<td>H-1B</td>
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<td>Greencard</td>
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<tr>
<td>R-squared</td>
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<td>0.358</td>
</tr>
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</table>

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%; All the models use an intercept term, hours per week, total experience, gender(male), firm size, firm type (IT industry, IT-intensive industry, dotcom), visa cap dummy and its interactions with citizenship and visa status, and squared terms for IT experience at current firm, IT experience at other firms.
To explore how wages vary longitudinally, we plotted the wage trajectories of foreign and American IT professionals using the results in Table 1 with some simplifications for clarity and to gain further insights. This is because it is quite hard to fully understand the regression results due to several interactions and a need to simultaneously make sense of a number of parameters related to education, experience and visa status which sometimes move in different directions and with different degree. We plotted results for males only at different levels of education in non-dotcom and for-profit firms in non-IT and non-IT intensive industries, by setting IT experience at other firms to be zero and holding values for other variables at the mean levels.

Figure 1 shows plots for US citizens, H-1B or other work visa holders and greencard holders. The figure shows that male MBAs on work visa have only a very slight edge in compensation to male US citizen MBAs at lower levels of work experience, but the gap widens at higher levels of work experience. Greencard holders enjoy a salary premium over IT professionals with work visa as well as US citizens. However, because male MBAs on work visa have steeper wage trajectories, these trajectories cross the wage trajectories for greencard holders somewhere between 15-20 years of work experience. In other words, temporary work visa holders with substantial work experience enjoy a salary premium over greencard holders despite the relatively lower bargaining power of IT professionals with work visa due to mobility restrictions that come with H-1B visa. This is a surprising and remarkable finding and contrary to what one may be tempted to believe based on media articles and a few anecdotal accounts.
Interestingly enough, even temporary work visa holders with a master’s and bachelor’s degree are able to overtake the wage trajectory of MBA greencard holders. While for master’s it happens close to 20 years of work experience, for bachelor’s it happens close to 30 years of work experience. These findings seem to suggest that firms place a significant value on foreign IT professionals who have substantial work experience and value them significantly more than greencard holders and American IT professionals.

Figure 2 plots only temporary work visa holders and US citizens, while not showing greencard holders, for extra clarity. It shows more clearly that MBAs and Bachelor’s degree holders on work visa start out with only a slight advantage over American workers with corresponding degrees but the gap widens significantly at higher levels of work experience. Notably, master’s degree holders on work visa appear to have significant initial advantage over American master’s degree holder (in relative terms, compared to say that for MBAs or for Bachelor’s). Surprisingly, master’s degree holders on work visa appear to earn more than American MBA degree holders almost from the beginning. This is a surprising finding because prior work suggests that, in general, firms pay more to MBAs than to other Master’s degree holders in the IT profession in the United States (Mithas and Krishnan 2008). Note also that bachelor’s degree holders on work visa overtake American master’s at around 10 years of work experience and American MBAs at around 20 years of work experience. Generally speaking, the wage trajectories for work visa holders are significantly steeper than that of American workers.

Figure 2. Earning profiles of H-1Bs vis-à-vis US Citizens

Note: The plots are for male IT professionals using the results in Table 1 at different levels of education in non-dotcom and for-profit firms in non-IT and non-IT intensive industries, by setting IT experience at other firms to be zero and holding values for other variables at the mean levels.

Figure 3 plots only greencard holders and US citizens, while not showing temporary work visa holders, for extra clarity. The key point to note here is that although greencard holders enjoy a salary premium over American workers, their trajectories are generally similar in terms of slope (they have higher intercept only).
The results presented above show overall support for the hypotheses 1 and 2 which predicted that non-US-citizen IT professionals will show steeper experience-earnings profile than US-citizen IT professionals; and IT professionals on work visa will show steeper experience-earnings profile than IT professionals with a greencard, respectively.

Figure 3. Earning profiles of Greencard vis-à-vis US Citizens

Note: The plots are for male IT professionals using the results in Table 1 at different levels of education in non-dotcom and for-profit firms in non-IT and non-IT intensive industries, by setting IT experience at other firms to be zero and holding values for other variables at the mean levels.

Discussion

Main Findings

This study provides several new insights. First, we find that the salary premiums earned by non-US citizen IT professionals apply over the entire duration of their work experience. The premiums are not limited to only later periods after say they get greencard or in the period after renewal of their three-year contract when in H-1B visa. This finding reaffirms the suggestion in prior studies that American and foreign IT professionals are not perfect substitutes and may in fact be complements of each other (Lucas and Mithas 2011). These complementarities may be a result of unique human capital possessed by foreign IT professionals, consistent with the human capital and expertise-based arguments (Boh et al. 2007; Mithas and Lucas 2010).

While some initial studies suggested that high-skill IT workers are sometimes paid less (see Matloff 2003), they need to be viewed with caution. This is because many of these studies, with a few exceptions, use data prior to 2000; do not show representativeness of their sample and the “comparability” of H-1B and U.S. professionals on attributes such as education, IT experience and institutional factors such as industry and firm size; and sometimes club IT professionals with non-IT engineers making it hard to draw meaningful inference for any identifiable population. Furthermore, these early studies did not report statistical significance and did not use the types of econometric models with appropriate functional form or control variables that are common in compensation studies in labor economics or information systems literature.
Second, IT professionals on work visa exhibit must steeper wage trajectories than greencard holders or American workers. This finding suggests that H-1B workers experience high growth in their wages with each passing year, compared to the growth in wages experienced by greencard holders and American workers. Note that this growth occurs despite the fact that many H-1B workers can not change their employers because of H-1B visa restrictions.

One explanation of the finding may be that the mere possibility of loss of a valuable IT worker may make firms to compensate their foreign workers more competitively, even if legally they are not obligated to pay more than the prevailing wages. Following Rodrik (1997), who argues in the context of offshoring that international trade makes demand for labor more elastic and puts downward pressure on wages by reducing the bargaining power of labor because of the perceived threat of offshoring, it is likely that the perceived threat of loss of intangible human capital of their foreign IT workers makes firms to pay them more.

Third, we find that wages of H-1B and other work visa workers overtake that of greencard holders somewhere between 15-20 years of overall experience. This is an interesting finding because it suggests that firms are willing to pay significantly more money to IT professionals on work visa if they have about 15-20 years of total work experience and at times they can be paid more than greencard holders with comparable work experience. In other words, even though work visa holders have relatively less bargaining power because of visa restrictions, on the whole they are valued highly by firms and exploitation reports in anecdotal stories may be a very small fraction of the overall situation. It may be that such anecdotes may apply more when IT workers have fewer years of overall work experience.

These findings call into question the myth of “type 2” savings conjectured in some studies (see Matloff 2003) which allege that US firms try to save money by displacing their older workers by foreign younger workers who are presumed to be cheaper also according to these reports. As we noted before, previous research has shown that foreign workers are not cheaper on average (Mithas and Lucas 2010). And, the current study raises doubts on claims which suggest that foreign workers are used to displace American workers. If at all, some temporary workers are valued so highly that firms are willing to pay them even more than they would pay to greencard holders with higher education levels.

Also, the definition of alleged “exploitation” of foreign workers needs to be viewed with caution because one can think of at least two aspects of exploitation. One of these aspects relates to how much foreign workers are paid compared to similar American workers (this is the question that Mithas and Lucas (2010) answer).

The other aspect is how much more foreign workers would have been paid had there been no policy loopholes that can potentially allow some employers to exploit some workers. This is a much harder counterfactual question and requires much more care and thought in posing the causal question and approaching an answer to that (see Mithas et al. 2006; Mithas et al. 2009; Mithas and Krishnan 2009). It is likely that restricting foreign workers’ employment in the US economy may only make them more scarce and firms may decide to locate them in offices outside the US, an outcome that does not benefit the US economy or American IT workers. For example, Microsoft reportedly opened a complex in Canada to locate foreign professionals that it could not bring to the U.S. due to restrictive H-1B visa caps in 2007 (Whoriskey 2008) and this location has experienced significant employment growth by 2010. Critics of the temporary visa programs often conflate these two aspects thus making them somewhat oblivious of the common ground for the need to improve existing policies and plug the loopholes, rather than become insular and erect walls which serves none when properly analyzed.

**Implications for Research**

We note several important research implications of our study. First, the finding that firms place a premium on human capital of non-U.S. citizens and work visa holders suggests that intangible human capital associated with immigration and willingness to work in a foreign country is valued by employers for a wide range of work experience. The finding that the premium grows with work experience suggests that foreign IT professionals become even more complementary when they have substantial work experience. There are at least two categories of foreign IT professionals who will have substantial work
experience: those who have substantial experience in their home countries and are brought by firms to work in the U.S.; and those who pursue graduate education in the US after substantial experience in their home countries. What makes intangible human capital of these IT professionals more valuable and what the dimensions of this human capital are requires further study. One place to start may be by directly studying and comparing risk profiles and attitudes of foreign-born and American IT professionals.

Second, our study shows that there is a significant heterogeneity among foreign workers: IT professionals on work visa are significantly different from those on greencard. The finding that IT professionals on work visa have higher wages (if they have about 20 years of work experience) and steeper wage trajectories than that of greencard holders implies that while foreign workers demonstrate a steeper learning curve, as they begin to assimilate in American labor market and after they acquire greencard, their wage trajectories begin to look similar to that for American IT professionals. Some prior research in the context of low-skill immigration has suggested that by about 15 years (Chiswick 1978), immigrants are hardly any different than those who are native-born. What is surprising in our finding is that when it comes to high-skill IT professionals, assimilation happens much more quickly (because even in early stages, foreign IT workers have a salary premium). Whether this phenomenon also applies to their risk propensity and cultural values needs further investigation.

Third, while we document that complementarity of foreign IT professionals with American IT professionals is stronger for foreign IT professionals on work visa with substantial work experience, there remains a need for research how less experienced and more experienced workers directly influence productivity and innovation capacity of firms in their production function. Such studies will also enrich the business value of IT literature because they will illuminate the unique roles and contributions of foreign and American IT professionals in the production function, which extant studies have conventionally assumed to be the same.

Fourth, to the extent supply of high-skill foreign IT professionals in the U.S. economy induces skill-biased technical change (Acemoglu 1998), they not only affect American professionals with whom they are complements by increasing the skill premium for all IT professionals, but they also create spillover effects in upstream and downstream sectors of the economy that benefit from such skill-biased change. It is also likely that some of the skill-biased change may affect some workers adversely. Regardless, there is a need for further studies to understand the impact of different types of foreign IT professionals (those on work visa and those with greencard) and the spillover effects they cause. Such studies will also help to quantify the overall economic impact of foreign IT workers in the US economy. To the extent the United States economy does not have to pay for the education received by the high-skill foreign workers in their countries, benefits from their contributions to the social security and medicare funds (some workers never realize their share if they leave the country before their retirement age), and realizes higher GDP growth and improved quality of life due to the economic output and activities of foreign-born, they appear to be good investments from a societal perspective. How the society should transfer some of these gains to the group which is adversely affected (for example, those who are adversely affected by skill-biased technical change) is also an important issue in this context.

Fifth, there is a need to study differences in preferences and risk profiles of American and foreign IT professionals. For example, they may have different preferences for cash. American IT professionals may value job security, and health insurance, while non-US citizens may prefer cash.

Finally, there is a need to study how American IT workers benefit from interacting with foreign IT workers within the US. Are American IT workers who never get the opportunity to collaborate with foreign IT workers better off compared to those American IT workers who frequently collaborate with foreign IT workers because of more progressive policies of their employers or less restrictive workplace regime (some organizations require security clearances that are almost never granted to non-US citizens)? Comparing the wage and career trajectories of these two types of American workers can be insightful.

**Implications for Practice**

Our findings have important implications for policy-makers, firms and individual workers. From a policy perspective, this study suggests that non-US citizen IT professionals have higher wages than US-citizen IT professionals across a wide range of work experience levels. The study calls into question the demands for making visa policies more restrictive to prevent exploitation of foreign professionals. While any
allegations of visa abuse must be taken seriously, the policy response should be based on rigorous evidence and should serve the larger interest of the US economy considering all benefits and costs. To the extent restrictive visa policies can lead to potential loss of skills, innovation and entrepreneurship of foreign-born IT professionals (Wadhwa 2009), such policies can hurt long term competitiveness of U.S. firms and U.S. economy.

From a managerial perspective, our findings suggest that managers should treat foreign- and American-IT professionals as complementary resources to innovate and create new products and services for global markets for improved competitiveness. From the perspective of an individual knowledge workers who are US citizens, our results imply that they are not adversely affected by influx of foreign IT workers as alleged in some media reports and initial studies which suggested that foreign workers are paid less. Both American and foreign IT workers have much to gain by collaborating with each other and leveraging each others’ complementary knowledge and skills. Some of our findings in this and related work imply that foreign IT workers will likely benefit by acquiring some higher education in the United States, while American IT professionals will likely benefit by making further investments in their understanding of foreign cultures and languages which will continue to be in demand as the economy globalizes further.

To conclude, we study relative wages of American and foreign IT professionals working in the United States over time. We find that IT professionals on H-1B or other work visa earn a significant salary premium over the entire duration of work experience when compared with IT professionals with U.S. citizenship. Interestingly, the difference in wages appears to grow over time suggesting that foreign IT professionals with substantial work experience on work visa earn significantly more premium than those with less work experience. The wages of IT professionals on H-1B or other work visa overtake that of greencard holders somewhere between 15-20 years of work experience. Because foreign-born high-skill IT professionals are a critical resource for innovation, job creation and entrepreneurship, how they assimilate in the labor market and can provide important implications for developing appropriate human resource and immigration policies to harness this resource for everyone’s benefit.

**Acknowledgments**

We thank the Track Chairs, the Associate Editor and the anonymous reviewers of ICIS for their help to improve this manuscript. We thank Keongtae Kim for research assistance. We are grateful to *InformationWeek* for providing the necessary data for this research.
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