

Institutional and Individual Selection: The Case of High-Skilled Immigrants in the U.S.

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Abstract

The self selection of high-skilled immigrants to the U.S. has been documented but less is known about the process of institutional selection. Building on the labor market institutionism literature, we suggest that the policy shift encapsulated by the 1990 Immigration Act may have caused two institutional selections of foreign-born skilled workers. One adjustment is a dual institutional selection process for temporary workers — at the initial recruitment on foreign soil and subsequently at the sponsorship for permanent status while in the U.S. The other adjustment concerns easier requirements for recruiting foreign students upon their degree completion while they are still on American soil. These institutional selections combined with self selection influence high skilled workers' productivity and shape their group salary patterns. We predict that both selection processes will be manifested in the salary patterns among groups defined by entry visa, current visa, and policy cohorts, both observed and estimated after controlling for other demand and supply factors that determine salary. Using the quantile regression models on data from the National Survey of College Graduates 2003, our analysis shows that the observed and estimated salary patterns are largely consistent with the predictions. In particular, the net advantage of temporary-turn permanent workers over native-born and other foreign-born workers is greater for the cohort after the policy was shifted. In addition, temporary workers before obtaining permanent status earn less than comparable workers who have obtained a permanent status. In contrast, the net advantage of student-turn permanent workers over the native born and permanent resident visa holders is weaker for the cohort after the policy was shifted.

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Introduction

The self-selection of immigration has been conceptualized as individual/household decision making (Borjas 1987; Jasso and Rosenzweig 1990; Massey et al. 1993). In this paper we argue that labor market institutional selection may be an important part of the story. Because federal policy defines the legal environment for the workplace (Selznick 1969; Edelman 1990; Dobbin and Sutton 1998), labor market institutions may respond to shifts in the policy environment caused by an immigration law and adjust the institutional regulations, rules, and practices. As most contemporary immigrants to the U.S. seek better employment prospects, changes in labor market institutions pertaining to immigrant labor should in turn play a role in selecting immigrants for their entry and permanent stay. This paper investigates the consequences of a change in institutional selection of skilled immigrants in the 1990s.

The 1990 Immigration Act increased permanent residence (PR) visas for skilled immigrants and for the first time established temporary-to-permanent worker programs (the major one being H-1B), which has attracted college-educated foreign workers and allowed firms to retain good-quality workers. The policy shift contributes to the permanent-temporary composition of entry visas for skilled foreign workers. During the interval between the 1965 Immigration and Nationality Act and the 1990 Immigration Act skilled immigrants arrived with the permanent-residence and foreign student entry visa types. After the 1990 Act, the temporary worker entry visa type became an additional important source of skilled immigrants. Both the policy shift and the population composition shift provide a unique window to examine the potential institutional selection of skilled immigrants.

Our examination of institutional selection requires information on the entry visa types of a large, nationally representative sample of all foreign born, currently permanent or temporary. The National Survey of College Graduates (NSCG) 2003 is the only source containing a nationally representative sample with the key information. Drawing data from the NSCG 2003, we analyze the observed and model-based salary patterns among various entry visa types in comparison with natives. These comparisons are made within an older cohort of workers who entered the labor market before the 1990 Immigration Act was implemented and within a younger cohort after the policy was implemented. These salary patterns suggest the operation of the institutional selection of skilled immigrants.

Background

Temporary Skilled Non-immigrants

The potential immigration of a skilled temporary worker depends on a job offer from a US employer, who selects employees in accordance with the skilled immigration policy guidelines and criteria. The 1965 Immigration Act reserved two preference categories for professional, technical, and skilled workers in short supply in the country. It placed a cap of 50,000 of such immigrants per year and provided them with a permanent resident visa. A small temporary high-skilled foreign worker category H-1 (originally from the 1952 Immigration Act) was the legal basis for the small H-1 visa program initiated in the 1970s which provided high-skilled foreign workers with nonimmigrant visas.

The Immigration Act of 1990 nearly tripled permanent resident visas for skilled immigrants and increased the number of nonimmigrant visas for skilled temporary workers. The Act replaced the existing small H-1 visa program with a new H-1B visa program with an

annual cap of 65,000.¹ This new program enables employers to offer jobs to foreign-born workers in specialty occupations on a three-year, one-time renewable visa, after which the nonimmigrant visa can be adjusted to permanent residence visa contingent on the employer's sponsorship (PL 101-649, 1990). The unique feature of the H-1B visa program is that it allows applicants to have a *dual intent*. That is, H-1B status is legally acknowledged as a possible step towards permanent residency. Such a shift in policy enables employers to selectively recruit foreign workers for filling permanent jobs that will be available in 3-6 years.

By legal stipulation, H-1B workers are to be paid the prevailing wage in the labor market or stiff penalties are to be applied. This is a strong incentive for employers to be very selective in their recruitment effort. During the temporary 3-6 year period, H-1B holders who intend to stay in the US often strive for excellent performance in order to increase the probability that the employer sponsors their permanent residency applications. The legal binding between the H-1B employer and employee, from the point of recruitment to the point of adjustment to permanent residency, may have complex consequences. Employers may assign temporary workers to tougher work conditions and more difficult and complex tasks while enjoying their loyalty and top performance. The employee, in turn, can work in the US legally. On the other hand, it is difficult for H-1B employees to move to a competitor and citizens or permanent residents cannot compete for the H-1B jobs.

The H-1B program also affects foreign students upon their conferment of a college or advanced degree in US universities. In recent years US universities admit a large number of foreign students each year, e.g., 565,000 in 2006 (Institute of International Education 2007). Before 1990, a relatively small proportion of foreign students found employment in the U.S. through the high-skilled employment based immigration provision of the 1965 Immigration Act

¹ The numerical limitation was temporarily raised to 195,000 in 2001-2003.

that sets a relatively high bar (national and international reputation in specialties of supply shortage). The relatively lower bar (college graduates) of the H-1B program expands employment opportunities for foreign-born college graduates and advanced degree holders from U.S. universities, many of whom may not meet the pre-1990 standard. In response, foreign students have gravitated toward the fast-growing fields and the source countries of students have increasingly shifted to developing countries (National Science Board 2008). Recruiting foreign students graduating from American universities and recruiting temporary workers from foreign countries are fundamentally different at where the recruitment occurs. In domestic recruitment, the job market treats native-born and foreign-born new graduates similarly for the entry-level permanent jobs. In other words, there is no separate domestic labor market for graduating foreign students. Once offered a job, the H-1B program facilitates a routine of legal paper work. Regardless whether the H-1B program is involved or not, all new workers are formally in the permanent worker pool for promotions along the career ladder. In general, foreign-born job candidates are treated in a similar way as native-born job candidates after 1990. They are less “special” as those student-turn permanent workers before 1990.

The Highly-Skilled Foreign Born

Economic bifurcation and the growing demand for college graduates have attracted a continuous influx of the college-educated foreign nationals, particularly after the 1990 Immigration Act. About one half of H-1B visa holders stay after the 3-6 years limit (Lowell 2001). Luthra (2009) argues that temporary skilled workers are channeled to contingent employment and finds that while temporary skilled workers receive prevailing salaries they are less likely to receive employer-provided health care and retirement. Bean and Brown (2005) show that the pathway from temporary non-immigrant status to permanent immigrant status

particularly helped foreign graduate students to obtain immigrant status in the U.S. Most of the science and engineering (S&E) foreign graduate students have stayed and worked in the U.S after graduation and they have become a key source of S&E labor force in the U.S. (Bean and Brown 2005; Freeman 2007).

While numerous studies have examined the impact of immigration on the U.S. labor market after the seminal work reported in Smith and Edmonston (1997), there has been little emphasis on the higher end of the U.S. labor market. Borjas (2006) analyzes how the rapid growth in the number of foreign doctoral students enrolled in American universities and their stay in the U.S. after graduation changes the supply of doctorates. He finds that increasing the supply of foreign-born doctoral degree holders by 10% decreases natives' earnings in S&E occupation fields by 3-4%. The finding suggests that immigrants compete with native workers for the limited number of jobs, a point at odds with the argument of unmet demand for the college-educated S&E talent (e.g., Katz and Murphy 1992; Auto et al. 2003; Bean and Brown 2005). In addition, doctoral graduates are only a small portion of the college-educated. This study intends to cover the entire college-educated population.

Conceptual Issues

The conceptual issues regarding skilled immigration are related to theories on the self-selection and incorporation of immigrants and labor market demand, segmentation, and the institutional of internal labor market. Building on these theories, we develop an "extended internal labor market" (EILM) argument to explain skilled labor market outcomes.

Self-Selection of Immigrants

International migration theories are contentious about whether and how immigrants are self selected on observed skills and unobserved ability, motivation, and work ethic (Borjas 1987;

Jasso and Rosenzweig 1990; Massey et al. 1993). Costs of migration and anticipated adjustment difficulties in the destination are a common source of positive selection whereas relative economic inequality within countries determines which immigrants are positively or negatively self-selected. This at-migration self-selection receives most scholarly attention. The post-migration self-selection is tied to return migration that selects the less fit (Palloni and Arias 2004) and disproportionately male (Jasso et al. 2004). Both at- and post-migration self-selection ideas focus on the decision of immigrants and their families. Much less attention is paid to potential labor market institutional selection even though a large portion of skilled immigrants are recruited directly by firms.

Modes of Incorporation

The foreign born are received in multiple contexts, including legal, labor market, and community. The modes of incorporation thesis points to the importance of these contexts (Portes 1981; Portes and Rumbaut 2006). First, the policy of the receiving government, including policies regarding immigrants and non-immigrants can be characterized as exclusion, passive acceptance, or active encouragement. Although the US government has not pursued an explicit selective strategy to encourage skilled immigrants based on a point system as used in Canada and Australia, certain provisions of US immigration law, such as the skill preferences of the 1965 Immigration Act and the visa expansion for both permanent and temporary skilled workers in the Immigration Act of 1990, have encouraged high-skilled immigration. While highly-educated immigrants arriving on the family-based program are only passively accepted as they are not recruited by employers, temporary skilled workers are actively received as they are recruited by specific firms. Second, labor market reception determines the economic prospect of the foreign-born population. The growth in high-tech industries (for example the information and

communication technology industry) and higher-end service sectors (for example the financial industry) sustain an overall increase in labor demand with fluctuations following the economic cycle. Given its high-pay and stable jobs, high-skilled labor is in the primary labor market (Piore 1979). Two distinctive arrangements in the primary labor market are occupational ladders for selecting the presumably most productive and innovative (Doreiger and Piore 1971) and the internal segmentation between stable jobs and flexible jobs (Tilly 1998). A third dimension of reception contexts focuses on how the existing ethnic community can shield newcomers from directly confronting the host labor market and provide an alternative route for upward mobility. Since the skilled labor market is much broader than ethnic economies, the community reception context is less relevant for skilled immigrants and non-immigrants.

Of the three contexts for incorporation, government policy and labor market reception may determine the incorporation of skilled immigrants. The labor market reception is particularly important for temporary skilled workers because specific policies are designed to attract them. Below we focus on extending theories on the labor market to address the temporary skilled worker phenomenon.

High-Skilled Labor Demand

College-educated workers have experienced a large variation in returns to the same level of formal education and work experience. It is suggested that this increasing variation is induced by skill biased technological change (Goldin and Katz 2008). The variation was found to be concentrated in the 1980s, the innovation era of information and communication technology (ICT) (e.g., Lemieux 2006). In the 1990s ICT increased the productivity of other industries via revolutionizing firm administrative functions (Bresnahan et al. 2002). As a result the demand for college educated workers, particularly those with ICT-related and administrative skills,

continued to grow and outpaced the supply of Americans students in these fields (National Science Board 2008).

Segmented Primary Labor Market

According to the segmented labor market theory, the primary labor market consists of high-skilled, high-paid, and stable jobs (Piore 1979). Piore contends that further segmentation within the primary labor market leads to a use of skilled immigrants, foreign-born non-immigrants, and women to fill peripheral jobs. Tilly (1998) further theorizes the internal division of labor caused by core vs. peripheral job categories within firms. Temporary skilled workers tend to be assigned to peripheral jobs that lack both training in firm-specific knowledge and fringe benefits such as health insurance and retirement. Luthra (2009) measures flexible labor in the primary labor market by contingent employment and a lack of fringe benefits. Using CPS data from 1997 to 2001 she tested the high-skilled segmentation hypothesis and found that temporary high-skilled workers are not cheap labor but flexible labor.

Extended Internal Labor Market

The H-1B's provisions of prevailing pay and future permanent residency laid a legal condition for an extension of the internal labor market. The H-1B program extends the internal labor market to include recruitment on foreign soil and post-recruitment assessment of workers on American soil before formally hiring them as permanent workers.

The notion of internal labor markets (ILM) within firms is defined as a set of institutional rules and procedures that regulate labor pricing, allocation, and promotion (Doeringer and Piore 1971). The concept of "extended internal labor markets" (EILM) was proposed by Manwaring (1984) to describe specific recruitment channels in low-skilled labor markets not open to job seekers at large. The employers have an incentive to reduce recruitment costs and the employee

has an interest in the employer's sponsorship for a permanent job. These interests create a high degree of closure that is normally considered part of the external labor market open to all job seekers.

We adopt the notion of EILM and modify it to fit the skilled labor process enabled by the H-1B program (see Figure 1). This EILM includes two stages: (1) recruiting temporary workers from abroad to fill entry-level jobs; and (2) evaluating productivity for a substantial period of time before converting them to permanent workers. This EILM operates in a high level of closure that does not allow for open competition, especially for the U.S. born. Temporary skilled workers are then legally bound with the firm for 3-6 years under the H-1B provision. Although switching jobs is allowed so long as the new employer applies for a switch of sponsorship from the employer of the existing H-1B visa, firm-specific on-the-job training and the probability of prolonging the worker's transition to permanent status usually deter such movement. Before the H-1B term ends, the employer decides whom to sponsor for permanent residency. These workers then enter the ILM formally. Those temporary workers not sponsored and those who do not wish to stay in the US will return to their home country rather than entering the U.S. external labor market.

(Figure 1 about here)

Unlike ILM that governs the firm's internal operations, EILM gives the employer great latitude to select and channel skilled workers through two selection mechanisms. First, motivated by the legal stipulation about prevailing wages, the employer would make greater effort to recruit high-quality and suitable workers. For example, ICT companies routinely recruit top graduates from the Indian Institute of Technology to fill in software engineering jobs and health care companies regularly hire top graduates from the University of the Philippines to fill

in physical therapy jobs. Second, a second-order incentive at the decision of employer sponsorship for temporary workers' permanent residency is to keep the "good" workers whose work quality has been observed for 3-6 years to ensure their future productivity profile. The fact that the H-1B visa program allows 3-6 years for employers to evaluate temporary workers' productivity provides an unprecedented opportunity to evaluate a worker's productivity before permanent hiring. Normally the employer faces a great deal of uncertainty when hiring permanent workers, because there are few real indices of the prospective employee's productivity prior to hiring. The employer is forced to use signals such as educational credentials to proxy productivity (Spence 1974; Arrow 1973). It is believed that educational credentials certify the completion of a professional or academic program, fulfillment of the minimum requirements and standards of performance, and thus capture the prospective employee's productivity. In contrast, the H-1B program permits employers to observe temporary workers on the job *directly* over a sufficient time period, thereby creating an unprecedented institutional selection of temporary workers: retaining the more productive ones and discontinuing the less productive ones.

These selection mechanisms are compounded by the self selection of many temporary workers. The temporary worker program provides foreign workers a viable option for the goal of a permanent US stay. With the great expansion of tertiary education in the developing world, a growing body of college graduates faces a tough skilled labor market in the home country particularly during unstable economic and political times. Salary differentials, opportunities for career advancement, and intellectual freedom attract high-skilled foreign workers to the US. Options for entering the US, however, are limited. Many of those who intend to migrate are not eligible for permanent residency because it is given based on employment-based preferences, which sets a higher bar such as stature and reputation in the specialty fields than H-1B visa, or

based on family reunification, which does not apply to pioneers. The H-1B program, with a relatively low bar of skills and a temporary status, offers an alternative means to work in the US legally. The temporary worker programs open the door for the motivated skilled workers and those who want to taste migration before making a decision.

Predictions

The above institutional perspective guides us to understand how changes in the policy environment can affect skilled immigrants through institutional adjustments. For skilled immigrants, changes in policy environment appear to be the most important context since the skilled labor market is generally receptive to skilled immigrants and the skilled labor market is national, making the narrow ethnic economy less relevant.

The institutional perspective suggests that the Immigration Act of 1990 may have led to institutional adjustments in the form of EILM and its two institutional selections (at foreign recruitment and at sponsorship for permanent status). These institutional selections then predict higher earnings for temporary-turned permanent skilled workers than any other compatible skilled workers. We expect that, if the institutional selection argument is right, the salary patterns among groups defined by entry visa types, current visa status, and pre- vs. post-policy-shift cohorts should be consistent with the predictions of the institutional selection argument.

Table 1 lays out our predictions. First, to isolate institutional selection from self selection, we need to identify a group of foreign-born skilled workers who are not affected by the policy change in the 1990 Immigration Act and yet possess traits of self selection. Our first prediction about self selection alone states that immigrants arriving with a PR entry visa will earn more than their comparable native-born counterparts in the post-policy cohort (Prediction A1) and this advantage is expected not to differ between the pre- and post-policy cohorts (Prediction A2).

(Table 1 about here)

Second, using Prediction A1 as the baseline, we can form a comparison to identify the initial institutional selection from the subsequent institutional selection for temporary workers. We expect that the current temporary workers who arrived with a temporary worker entry visa after the 1990 Act will earn more than their PR entry visa counterparts because of their foreign recruitment in a close system (Prediction B1).

The next comparisons are to isolate the dual institutional selection. Among those who entered the labor market after 1990, we expect that temporary-turn permanent workers earned more than their permanent entry visa counterparts because of the dual institutional selection. We also expect them to earn more than as their temporary worker visa counterparts who have not obtained the permanent status because of the second institutional selection (Prediction C1). To further confirm this advantage of temporary-turn permanent workers is due to the policy shift, we make a rigorous comparison (Prediction C2) to evaluate whether the higher earnings of temporary-turn permanent workers are greater after 1990 than before 1990.

Finally we examine whether student-turn permanent workers are both self-selected and institutionally selected by comparing them with the native-born counterparts, and institutionally selected by comparing them with their PR entry visa counterparts (Prediction D1). For a more rigorous comparison, we examine whether student-turn permanent workers have a smaller advantage in salary when compared with their PR entry visa counterparts after 1990 than before 1990 because of the lower criterion in institutional selection after the policy shift (Prediction D2).

Data, Design and Methods

Data Source

The analysis draws on data from the National Survey of College Graduates (NSCG) in 2003 by the National Science Foundation. The NSCG provides rich data on education, employment and demographic information for a large probability sample of college graduates enumerated in the decennial census long form 2000. The respondents were aged 75 or younger and living in the US during October 2003. The number of respondents is 100,402. The NSCG is the only survey with a complete coverage of all college graduates, and thus a complete coverage of the college graduate foreign-born stock, including those who received their highest degree in their home country.

Unavailable in other surveys, the NSCG 2003 collected retrospective data on migration and education histories. These histories are relatively reliable because they concern salient life events. The key information includes (1) the entry visa status of the foreign born for a minimum of six-month stay, including permanent resident, temporary worker, student, dependent of temporary worker, and other temporary statuses; (2) the current visa status, including naturalized citizen, permanent resident, temporary worker, student, and other temporary statuses; (3) the year of entry to the US for a minimum of six-month stay; and (4) the year of degree completion up to five highest degrees.

A Comparative Design

This paper uses a comparative design to test whether the group salary patterns are consistent with the predictions of the individual and institutional selection perspective. First, the cohort effect of the policy environment shift is to distinguish the post-policy cohort from the post-policy cohort according to their initial entry into the skilled labor market. Second, although the 1990 policy shift affects both temporary workers and foreign students, we argue that the foreign recruitment of a group of temporary workers sets up a different institutional process for

temporary workers than for foreign students upon their graduation in the U.S. We separate the temporary entry visa type from the student entry visa type to allow for different predictions from the institutional perspective. Third, to see whether any salary patterns fit the second step of institutional selection, we use the current immigrant status to distinguish those who have obtained permanent residence and those who have not. Taken together, our comparison groups are defined by policy cohorts, entry visa type, and current immigrant status.

Table 2 shows the cross-classification by policy cohorts (before and after the 1990 Immigration Act was implemented in 1992), entry visa types, and current visa types. We specify 10 groups. Virtually all foreign-born workers in the pre-policy cohort have obtained permanent residence or citizenship by 2003 and we eliminated 74 individuals who were currently holding one type of a number of temporary statuses. In the pre-policy cohort, Group 1 consists of native-born citizens (CZ_0 $n=39,471$); Group 2 for naturalized citizens or permanent residents who entered the U.S. with a permanent residence visa (PP_0 $n=3,282$); Group 3 for current naturalized citizens or permanent residents who came with a temporary worker entry visa (TP_0 $n=567$); and Group 4 for current naturalized citizens or permanent residents who came with a student entry visa (SP_0 $n=2,578$). The corresponding groups in the post-policy cohort are: Group 5 (CZ_1 $n=23,572$); Group 6 (PP_1 $n=2,634$), Group 7 (TP_1 $n=990$), and Group 8 (SP_1 $n=2,018$). The post-policy cohort also offers an opportunity to examine temporary entry visa holders who were currently holding a temporary worker visa: Group 9 for temporary worker entry visa type (TT_1 $n=449$) and Group 10 for student entry visa type (ST_1 $n=592$).

(Table 2 about here)

The group salary patterns are estimated by making the comparison groups as comparable as possible, particularly to rule out two major alternative explanations. First, depending on the year of labor market entry, the salary profiles of skilled workers with the same degree start with an initial point that is determined by the economic cycle, and labor demand and supply in that year. Group salary patterns may well reflect these differences owing to different compositions of labor market entry cohorts within comparison groups. To rule out this alternative explanation, we define labor market entry cohorts by the year when (1) natives obtained their highest degree; (2) immigrants obtained their highest degree from a US institutional after they moved to the US; and (3) immigrants came to the US after they obtained their highest degree in their home country. As a result, we have 38 annual labor market entry cohorts for each of the years 1966 to 2003 and a combined cohort covering the years 1962-65 to avoid small cohort size. Second, differential labor demand for different fields may also explain group salary pattern. Science and engineering fields (excluding social sciences) may have greater demand than domestic labor supply, thus raising the salaries in these fields. If immigrants arriving after the 1990 Immigration Act respond to such demand but we do not take into account the specialty areas of immigrants, we could not rule out this alternative explanation. Therefore we compare the group salary patterns controlling for fields of occupation.

The quantile regression models is an appropriate tool for our analysis. Quantile regression, a natural extension of linear regression, provides a full characterization of the whole distribution of the response variable (Koenker 2005; Hao and Naiman 2007). In addition to its capability to model the central and non-central locations of the response distribution, quantile regression models address two limitations of the OLS model. First, the conditional mean from the OLS model is not appropriate to characterize the typical situation of salaries using raw scale.

Figure 2 shows that both pre-policy and post-policy salary distributions are highly right-skewed. The wide practice is to model log salary using OLS. However, the conditional log mean salary is not corresponding to the conditional mean salary through re-transformation. Second, the OLS model treats top-coded salaries as observed. Quantile regression models can overcome these limitations because it can model the median and it is not affected by the top-coded value so long as the quantiles to be modeled are below the top-coded value. See more detailed discussion in Hao and Naiman (2007). Our analysis examines whether the quantile-regression-based group comparisons follow the predictions informed by our institutional and self selection argument.

(Figure 2 about here)

To fully understand group salary patterns we first estimate a median regression, a special case of quantile regression, to capture the typical situation (the median) of a highly skewed salary distribution. We then go beyond median regression to ask whether the policy change impacts differentially on the lower and upper regions of the salary distribution, specifically four other positions to model lower region (P10 and P25) and the upper region of the distribution (P75 and P90). We ask, beyond the effect on the conditional median, whether the policy shift differentially affect the lower and upper tail positions of the salary distribution. Figure 3 shows the empirical quantiles for the pre-policy and post-policy cohorts.

(Figure 3 about here)

Measurement

The dependent variable is annual salaries, defined as the total pay by the employer including wages/salaries and bonuses. For confidentiality, salaries were top-coded at \$350,000. A key explanatory variable is the 10 groups that describe policy cohorts, entry visa types, and current visa status. Other explanatory variables include a set of occupational fields (ICT, other

engineering, health, business, education, natural sciences, social sciences, other); highest degree (BA, MA, doctoral, professional); whether the highest degree was obtain in the home country; traditional western sending countries; sectors (self-employed, for-profit, not-for-profit, government, other); fulltime work; race/ethnicity (white, black, Hispanic, Asian); gender, age and disability; and 39 annual labor market entry cohorts. See Appendix Table 1 for the descriptive statistics of variables used in analysis.

Results

Table 3 shows the observed group salary patterns for skilled workers following the predictions of individual and institutional selection. First, consistent with the self selection prediction A1, immigrants with a PR entry visa earned more than their native-born counterparts after the 1990 Immigration Act was implemented. This observed advantage, however, is greater than the advantage before the policy shift, which is inconsistent with Prediction A2. Placing it in a multivariate framework will rule out confounding effects and evaluate its statistical significance. Our second prediction concerns the combination of self-selection and the first institutional selection due to the 1990 Act. The observed pattern is consistent with Prediction B. Prediction C considers the composite self-selection and dual institutional selection. The observed patterns are consistent with C1 and C2, with sizable policy shift effects on the positive difference in differences with respect to salary (the difference in the differences between temporary-turn permanent workers and native-born workers or immigrants with PR entry visa). Finally the salary patterns for student-turn permanent workers are also consistent with the positive self and institutional selection (D1) and declined institutional selection (D2). Overall, the observed patterns are largely consistent with the self-selection and institutional selection argument with only one exception.

(Table 3 about here)

These observed patterns could be attributable to different skills such as fields of occupation, levels of degree, country where the highest degree was obtained, employment sectors, full or part time work, demographic characteristics, and labor market entry cohorts. Our next step is to ascertain the net patterns of the group salary patterns using median regression for salary. The full estimates are shown in Appendix Table 2. The coefficient for a covariate is the change in the conditional median salary due to a one-unit increase in the covariate.

Before we examine the group salary patterns at the conditional median, we briefly interpret the coefficients for other covariates. The levels of degree continue play an important role in determining levels of salary and professional degree holders are much more highly paid than doctoral degree holders. Occupational fields result in differential conditional median salary. Compared to social sciences and humanities, ICT and other engineering receive much higher returns whereas non-tertiary educational fields receive a similar level of salary. Working in the private sector for profit, working full time, the highest degree being the most recent degree, white/Asian, older, male, and no disability all increase salary. For immigrants, having the highest degree awarded abroad, later age at arrival, and coming from non-traditional sending countries are all disadvantageous. Finally, the model controls for the fixed effect of annual labor market entry cohorts (39 in total). With this model specification, the group salary patterns under detailed examinations below are made with all other covariates held constant.

The last column of Table 3 presents the group salary patterns obtained from the median regression model and the salary is on the raw scale. We discuss whether group salary patterns are or are not consistent with the predictions from the self-selection and institutional selection argument. First, concerning self-selection after 1991 when the policy was shifted, immigrants

with a PR entry visa earned \$6,426 more than their native-born counterparts ($PP_1 - CZ_1 > 0$), all else being equal. This advantage is significant, supporting the self-selection prediction. We then do a second-order comparison, that is, we take the difference in the post-policy measure ($PP_1 - CZ_1$) and the pre-cohort measure ($PP_0 - CZ_0$) and test whether this difference is 0. Unlike the observed pattern, the difference is indeed not different from 0 after taking into account other determinant factors. Thus the median regression based group salary patterns are consistent with the self-selection prediction (A1).

Did the policy shift in 1990 lead to different institutional selection of immigrant skilled workers? We examine whether the prediction B is consistent with the median regression results. The selection for temporary skilled workers is two-fold: self-selection and institutional selection, which includes an initial selection at recruitment and a selection at PR sponsorship. We can distinguish between the two-step institutional selections by first examining temporary workers who had not adjusted their entry visa status (Prediction B). The results show that, after the policy shift, temporary workers earned \$16,988 more than their comparable native-born counterparts, indicating a combined advantage due to self-selection and initial institutional selection. As expected, temporary workers also earned \$10,562 more than their counterparts with PR entry visa, indicating the initial selection impact.

The next set of results is used to examine the composite effects of self-selection and the two-step institutional selections by focusing on temporary-turn permanent workers (Prediction C). Due to the self-selection and the two-step institutional selections, we expect that the average salary gain for temporary-turn permanent workers is much higher than their native-born counterparts, which is indeed the case (\$22,001). In fact, this gain is the greatest of all median regression estimates in the table. By comparing with PR entry visa holders, we take out the self-

selection effect, the gain is reduced to \$15,575. Further taking out the initial institutional selection effect by comparing with temporary workers who had not adjusted their visa status further reduces the gain to \$5,014. Two more rigorous comparisons are to seek whether the policy shift in the 1990 Act make temporary-turn permanent workers gain more than before the Act (Prediction C2). The results are significantly positive. The gains are \$5,602 and \$6,386, respectively, when compared with the native born or compared with PR entry visa holders.

Concerning Prediction D1 about student-turn permanent workers in the post-policy cohort, positive self selection and positive institutional selection together lead to \$8,037 more in salary for student-turn permanent workers than for native-born counterpart. After the self-selection is taken out, the advantage due to institutional selection is insignificant when compared with PR entry visa holders. Prediction D2 states that the student-turn permanent workers had a smaller advantage for the post-policy cohort than for the pre-policy cohort: the difference in differences between student-turn permanent workers and native-born workers is -\$3,371, and the difference in differences between student-turn permanent workers and PR entry counterparts is -2,587. Overall, the median regression results are consistent with Predictions A to D.

The median regression captures the typical situation of self selection and institutional selection in the population. Are the effects of selection processes on salary more pronounced in the lower and middle regions of the salary distribution? We estimate quantile regression models at four off-median positions: P10, P25, P75, and P90. We organize the results more succinctly according to the selection components for the post-policy and pre-policy cohorts in Table 4. Conditional quantile estimates at P25 are completely consistent with the predictions in terms of sign, magnitude, and significance: (1) positive self selection which does not differ between the post- and pre-policy cohorts; (2) positive selection via recruitment from foreign soil and positive

selection via adjustment to PR in the U.S.; (3) positive dual institutional selection, which is stronger post policy than pre-policy; and (4) positive selection via recruitment on American soil, which is weaker post-policy than pre-policy. Largely the lower and middle regions of the salary distribution exhibit patterns consistent with the predictions, with moderately differential, non-monotonic effects. Patterns at the upper regions of the salary distribution are less consistent with the predications. Specifically, self selection is seen at P75 but not P90; sponsorship for PR is not substantiated and the dual institutional selection does not differ before and after the 1990 Law. These results are not surprising because the policy targets temporary workers and fresh graduates from universities who are new in the labor force. The quantile regression results help us to confirm this policy intention.

(Table 4 about here)

Conclusions

The policy shift encapsulated by the 1990 Immigration Act may lead to institutional adjustment and a possible extended internal labor market that features two institutional selections: a selection at the recruitment of temporary workers from foreign countries and a subsequent selection at converting them to permanent workers. Applying labor market institutionalism to the case of skilled immigrants, we predict that foreign recruitment and sponsorship for U.S. permanent status are positive institutional selections. While the policy shift also affects foreign students upon their graduation, the institutional selection is easier after the shift than before the shift. We expect that the salary patterns among groups of high-skilled workers defined by entry visa types, current immigrant status, and pre- and post-policy cohorts will be consistent with the predictions from our institutional selection argument. Our comparative design distinguishes groups that are differentially affected by the policy shift while making the comparison groups

statistically similar. The analyses simultaneously address our predictions and two alternative explanations. Using the quantile regression model that is appropriate for our analytic tasks, we examine whether the group salary patterns using a model-based approach and the large-scale, nationally representative data from the NSCG 2003.

The most important finding from our analysis is that current permanent residents or naturalized citizens who arrived with a temporary worker entry visa earned substantially more than their statistically similar native- and foreign-born counterparts and this gain is much higher for those who entered the skilled labor market after the 1991 Immigration Act than those who entered the labor market earlier. Before making conclusions, we examine whether alternative explanations can discredit our institutional selection argument. First, was the large salary discrepancy between the temporary-turn permanent skilled workers and native-born skilled workers a byproduct of the greater variations among workers who entered the skilled labor market in the 1990s? With each of the annual labor market entry cohorts being control, in effect the discrepancy is estimated within each labor market entry cohort, ruling out the possibility of larger salary variations within the post-policy cohort. Second, would the large discrepancies reflect the higher pay for higher demand fields where temporary workers cluster? Our analyses control for occupational fields, ruling out the explanation of earning differentials by specialties.

With the two major alternative explanations ruled out, we are confident in making conclusions from our major findings from model-based comparisons. First, the positive self selection of skilled immigrants is persistent throughout and not affected by the policy shift in the 1990 Immigration Act. Second, foreign recruitment is conducted in a high degree of closure, meeting specific productivity standards and resulting in higher pay. Third, the sponsorship for permanent status further select immigrant skilled workers based on observed productivity during

the years of temporary work status, yielding higher earnings than those who have yet to go through the sponsorship. Third, the 1991 Immigration Act affects foreign students in an opposite way. While still positively self selected and positive institutionally selected in the U.S. external labor market, the standards for institutional selection were relaxed after policy shift, leading to a declined institutional selection for student-burn permanent workers.

Using quantile regression models, our analysis examines not only the typical situation under self selection and institutional selection but also the lower and upper tails of the salary distribution. This enables us to pinpoint which regions of the salary distribution are more affected by the policy shift. Our results suggest that the effects of self selection and institutional selection are on the lower half and middle regions of the salary distribution.

This study is a first step toward testing the institutional selection and self selection hypotheses. Building on this work, a future research direction is to examine differences in entry jobs and career trajectories by entry visa types. Another direction is to inspect the institutional regulations and rules and their changes pertaining to immigrant skilled labor at the firm level.

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Table 1. Predictions of Salary Patterns for Policy Cohorts in NSCG 2003: Pre- and Post-1990 Immigration Act

Types of Selection	Prediction
A. Self-selection	
A1. Positive selection	$PP_1 - CZ_1 > 0$
A2. No difference between policy cohorts	$(PP_1 - CZ_1) - (PP_0 - CZ_0) = 0$
B. Self-selection + institutional selection at foreign recruitment ^a	
B1. Positive selection	$TT_1 - CZ_1 > 0$ $TT_1 - PP_1 > 0$
C. Self-selection + dual institutional selections at foreign recruitment and at sponsorship of permanence	
C1. Positive selection	$TP_1 - CZ_1 > 0$ $TP_1 - PP_1 > 0$ $TP_1 - TT_1 > 0$
C2. Greater selection for post-policy cohort than for pre-policy cohort	$(TP_1 - CZ_1) - (TP_0 - CZ_0) > 0$ $(TP_1 - PP_1) - (TP_0 - PP_0) > 0$
D. Self-selection + institutional selection at domestic recruitment	
D1. Positive selection	$SP_1 - CZ_1 > 0$ $SP_1 - PP_1 > 0$
D2. Weaker selection for post-policy cohort than for pre-policy cohort	$(SP_1 - CZ_1) - (SP_0 - CZ_0) < 0$ $(SP_1 - PP_1) - (SP_0 - PP_0) < 0$

Notes: The subscript 0 indicates the pre-policy cohort and 1 the post-policy cohort.

CZ: native-born U.S. citizens

PP: immigrants who arrived with a PR visa and are currently PR or naturalized citizens

TP: immigrants who arrived with a temporary worker visa and are currently PR or naturalized citizens

SP: immigrants who arrived with a student visa and are currently PR or naturalized citizens

TT: foreign-born persons who arrived with a temporary worker visa and currently are temporary workers

ST: foreign-born persons who arrived with a student visa and currently are temporary workers

^a The small size of current temporary workers in the pre-policy cohort does not allow between-cohort comparisons.

Table 2. Size of Comparison Groups for Policy Cohorts from NSCG 2003: Pre- and Post-1990 Immigration Act

Entry Visa	Current Status		
	Native-born CZ	Naturalized CZ/PR	TW
Pre-policy cohort			
	CZ_0		
Native born	(39,471)		
		PP_0	
PR		(3,282)	
		TP_0	
TW		(567)	
		SP_0	
STU		(2,578)	
Post-policy cohort			
	CZ_1		
Native-born	(23,572)		
		PP_1	
PR		(2,636)	
		TP_1	TT_1
TW		(990)	(449)
		SP_1	ST_1
STU		(2,018)	(592)

Data sources: National Survey of College Graduates, 2003.

Notes: The pre-policy cohort entered the U.S. labor market 1962-1991 and the post-policy cohort entered the labor market 1992-2003. Group sizes are in parantheses.

PR: permanent residence visa

TW: temporary worker visa

STU: foreign student visa

CZ: native-born U.S. citizens

PP: immigrants who arrived with a PR visa and are currently naturalized citizens or PR

TP: immigrants who arrived with a temporary worker visa and are currently naturalized citizens or PR

SP: immigrants who arrived with a student visa and are currently naturalized citizens or PR

TT: foreign-born persons who arrived with a temporary worker visa and currently are temporary workers

ST: foreign-born persons who arrived with a student visa and currently are temporary workers

Table 3. Observed and Estimated Salary Patterns From Median Regression for Policy Cohorts in NSCG 2003: Pre- and Post-1990 Immigration Act

Types of Selection	Prediction	Observed	Estimated
A. Self-selection			
A1. Positive selection	$PP_1 - CZ_1 > 0$	6,511	6,426 **
A2. No difference between policy cohorts	$(PP_1 - CZ_1) - (PP_0 - CZ_0) = 0$	4,278	-783
B. Self-selection + institutional selection at foreign recruitment ^a			
B1. Positive selection	$TT_1 - CZ_1 > 0$	23409	16,988 **
	$TT_1 - PP_1 > 0$	16898	10,562 **
C. Self-selection + dual institutional selections at foreign recruitment and at sponsorship of permanence			
C1. Positive selection	$TP_1 - CZ_1 > 0$	28,084	22,001 **
	$TP_1 - PP_1 > 0$	21,573	15,575 **
	$TP_1 - TT_1 > 0$	4,675	5,014 **
C2. Greater selection for post-policy cohort than for pre-policy cohort	$(TP_1 - CZ_1) - (TP_0 - CZ_0) > 0$	14,108	5,602 **
	$(TP_1 - PP_1) - (TP_0 - PP_0) > 0$	9831	6,386 **
D. Self-selection + institutional selection at domestic recruitment			
D1. Positive selection	$SP_1 - CZ_1 > 0$	18,377	8,037 **
	$SP_1 - PP_1 > 0$	11,866	1,611
D2. Weaker selection for post-policy cohort than for pre-policy cohort	$(SP_1 - CZ_1) - (SP_0 - CZ_0) < 0$	-1,400	-3,371 **
	$(SP_1 - PP_1) - (SP_0 - PP_0) < 0$	-5,678	-2,587 **

Data sources: National Survey of College Graduates (NSCG) 2003.

CZ: native-born U.S. citizens

PP: immigrants who arrived with a PR visa and are currently PR or naturalized citizens

TP: immigrants who arrived with a temporary worker visa and are currently PR or naturalized citizens

SP: immigrants who arrived with a student visa and are currently PR or naturalized citizens

TT: foreign-born persons who arrived with a temporary worker visa and currently are temporary workers

ST: foreign-born persons who arrived with a student visa and currently are temporary workers

Table 4. Estimated Effects of Self Selection and Institutional selection on Salary Distribution in NSCG 2003: Pre- and Post-1990 Immigration Act
(quantile regression estimates)

Types of Selection	P10	P25	P50	P75	P90
Self selection					
Post-policy	5,675**	8,841**	6,426**	5,387**	4,091
Pre-policy	5,825**	9,509**	7,209**	5,414**	2,469
Difference	-150	-668	-783	-27	1,622
Institutional selection					
Recruitment on foreign soil					
Post-policy	7,302**	10,805**	10,562**	11,932**	17,327**
Sponsorship for permanent status					
Post-policy	2,864	3,218**	5,014**	2,738	-1,827
Dual: recruitment and adjustment					
Post-policy	10,166**	14,024**	15,575**	14,670**	15,500**
Pre-policy	3,169**	5,964**	9,190**	12,429**	16,362**
Difference	6,997**	8,060**	6,386**	2,241	-862
Recruitment on American soil					
Post-policy	642	1,939**	1,611	781	-939
Pre-policy	3,135**	4,018**	4,198**	7,533**	10,572**
Difference	-2,493**	-2,080*	-2,587**	-6,752**	-11,511**

Data sources: National Survey of College Graduates (NSCG) 2003.

Notes: The quantile regression models include all variables specified in Appendix Table 1.

Appendix Table 1. Descriptive Statistics of Variables used in Analysis

Variable	Mean	Variable	Mean
Salary	69,524	Lmyr62-65	0.01
CZ0	0.52	Lmyr66	0.01
PP0	0.04	Lmyr67	0.01
TP0	0.01	Lmyr68	0.01
SP0	0.03	Lmyr69	0.01
CZ1	0.31	Lmyr70	0.01
PP1	0.03	Lmyr71	0.02
TP1	0.01	Lmyr72	0.02
SP1	0.03	Lmyr73	0.02
TT1	0.01	Lmyr74	0.02
ST1	0.01	Lmyr75	0.02
ICT	0.12	Lmyr76	0.02
Engineer	0.13	Lmyr77	0.02
Health	0.10	Lmyr78	0.03
Business	0.24	Lmyr79	0.02
Education	0.10	Lmyr80	0.03
Natural science	0.07	Lmyr81	0.03
Social science	0.09	Lmyr82	0.03
Other occupational field	0.15	Lmyr83	0.03
Bachelor's	0.54	Lmyr84	0.03
Master's	0.31	Lmyr85	0.03
Doctoral	0.09	Lmyr86	0.03
Professional	0.07	Lmyr87	0.03
Foreign degree	0.07	Lmyr88	0.03
1.5 generation	0.05	Lmyr89	0.03
Age at arrival	24	Lmyr90	0.03
Transitional countries	0.04	Lmyr91	0.03
Self employed	0.16	Lmyr92	0.04
For profit	0.43	Lmyr93	0.04
Not for profit	0.11	Lmyr94	0.04
Government	0.28	Lmyr95	0.04
Other sector	0.01	Lmyr96	0.04
Full time	0.91	Lmyr97	0.04
Lower recent degree	0.01	Lmyr98	0.05
White	0.72	Lmyr99	0.04
Black	0.07	Lmyr00	0.02
Hispanic	0.07	Lmyr01	0.02
Asian	0.11	Lmyr02	0.02
Age	44	Lmyr03	0.01
Age-sqr	2058		
Female	0.41		
Disable	0.20		
n	76,153		

Data sources: National Survey of College Graduates (NSCG) 2003.

Note: Lmyr stands for the entry year for a labor market entry cohort.

Appendix Table 2. Median Regression Estimates for Salary

Variable	Coefficient
PPO	7,209 **
TP0	16,399 **
SP0	11,407 **
CZ1	-9,599 ****
PP1	-3,173
TP1	12,402
SP1	-1,563
TT1	7,388 **
ST1	-9,749 **
ICT	22,584 **
Engineer	20,948 **
Health	14,333 **
Business	19,602 **
Education	564
Natural science	6,334 **
Other occ. field	-2,209 **
Master's	11,785 **
Doctoral	23,154 **
Professional	50,383 **
Foreign degree	-4,002 **
1.5 generation	17
Age at arrival	-329 **
Traditional countries	4,953 **
For profit	5,946 **
Not for profit	-4,897 **
Government	-2,763 **
Other sector	5,923 **
Full time	32,106 **
Lower recent degree	-4,312 **
Black	-2,464 **
Hispanic	-2,758 **
Asian	395
Age	1,944 **
Age-squared	-21 **
Female	-8,168 **
Disable	-2,192 **
constant	-19,265 **
n	76,153

Data sources: National Survey of College Graduates (NSCG) 2003.

Note: Median regression is quantile regression at P50. The model includes the fixed effects of 39 labor market entry cohorts.

Figure 1. Extended Internal Labor Market (EILM), Internal Labor Market (ILM), and Temporary-Turn Permanent Skilled Immigration to the US

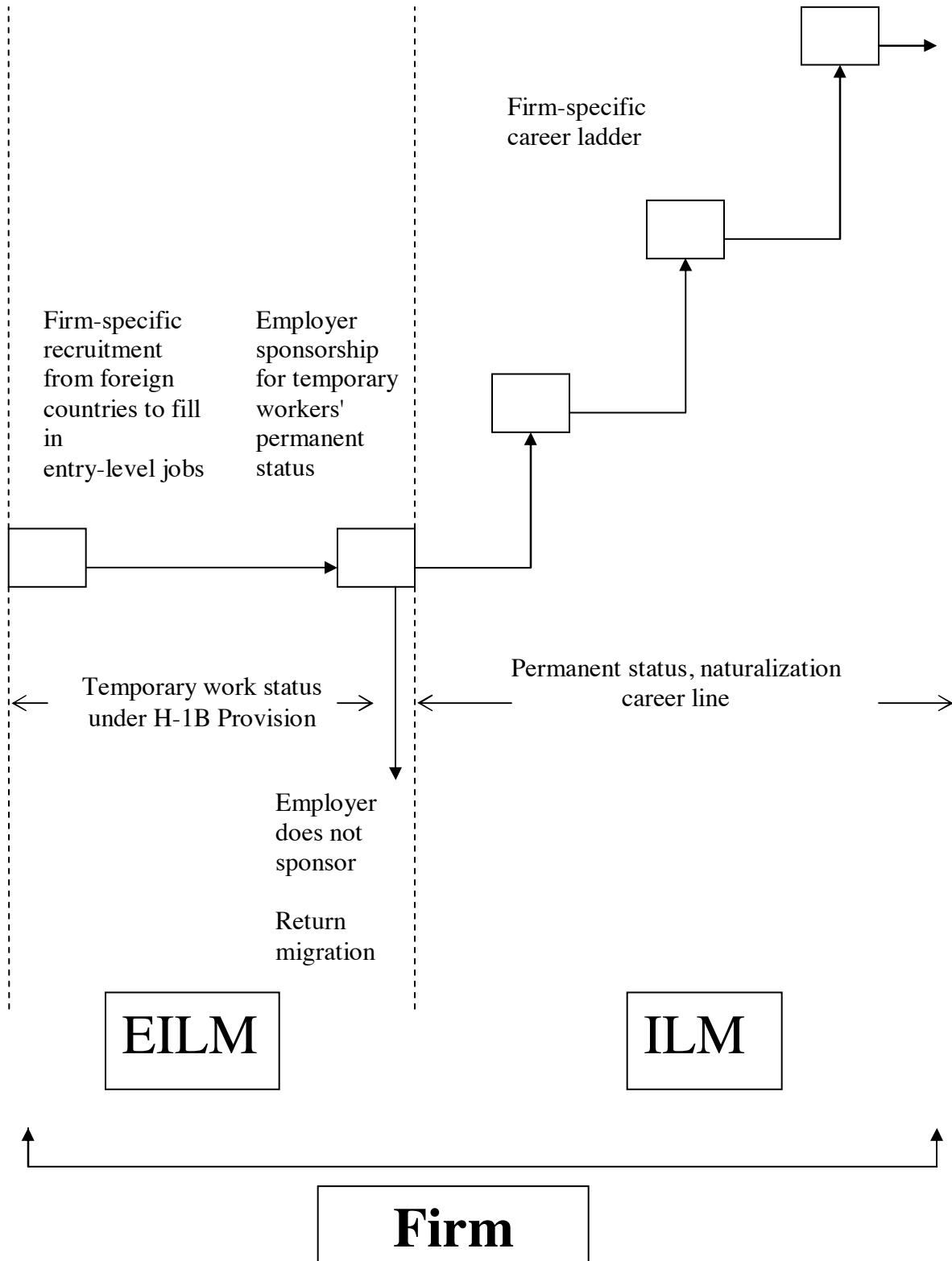


Figure 2. Kernel Density Functions of Salary for Policy Cohorts from NSCG 2003: Pre- and Post 1990 Immigration Act

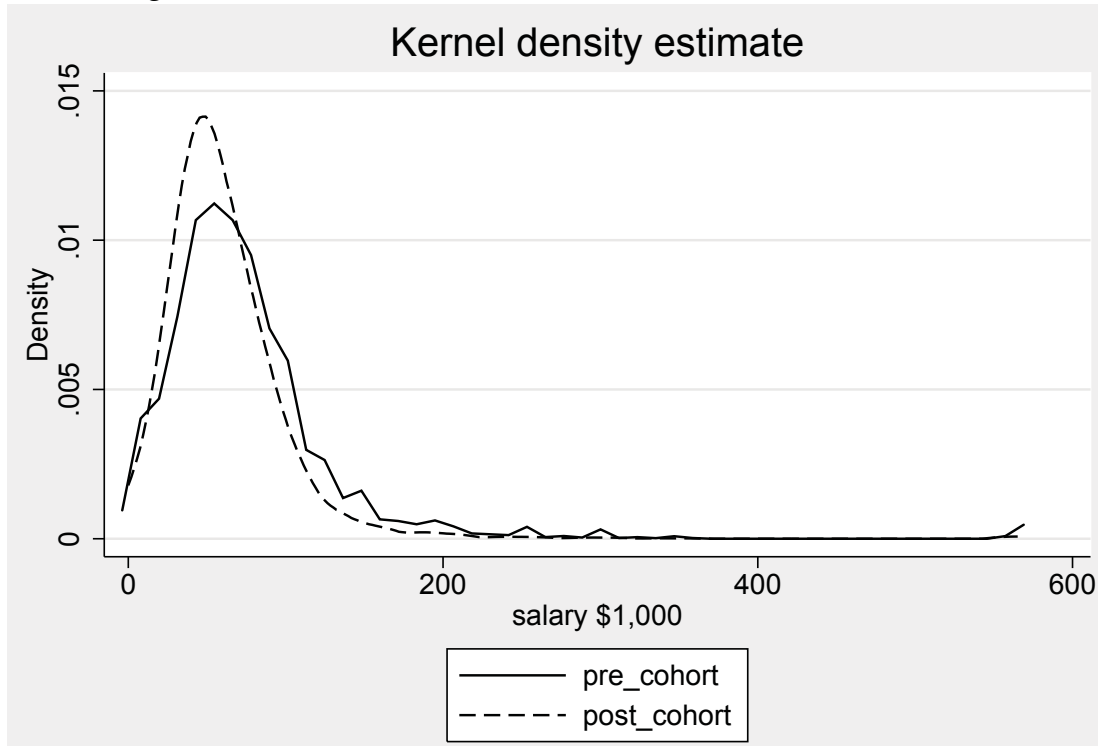


Figure 3. Quantile Functions of Salary for Policy Cohorts from NSCG 2003: Pre- and Post 1990 Immigration Act

