Doctors Without Borders: E¤ects of Professional Licensing on Soviet Immigrant Physicians in Israel

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Abstract

Re-licensing requirements for professionals that move across borders is a widespread phenomenon. Yet, there is very little research that examines the e¤ects of re-licensing requirements on immigrant welfare. This paper measures the importance of professional licensing requirements using unique data on the early labor market outcomes of Soviet immigrant physicians in Israel. Instrumental variables estimates that correct for nonrandom selection into licensing status, in a constant-e¤ects model, yield an increase in monthly earnings due to license acquisition that is signi…cant and considerably higher than indicated by OLS. However, examination of licensing e¤ects on di¤erent quantiles of the distribution of immigrant earnings, using a quantile treatment e¤ects model, indicates a more complex pattern in biases. The estimated quantile treatment e¤ects model is also used to examine convergence in earnings distribution between immigrants and comparable natives. The contribution of license acquisition to convergence in earnings distribution is small, suggesting that licensing requirements do not merely serve as a barrier to entry that protects native professionals from competition.

1 Introduction

Between October 1989 and December 1995, approximately 600;000 Jews from the former Soviet Union immigrated to Israel. By the end of 1995, these immigrants accounted for 11% of the Israeli population. This mass wave of immigration to Israel is not only unprecedented in magnitude, it also stands out in terms of the skill levels of immigrants relative to natives. The average years of completed schooling among the immigrants is 14:5 and over 70 percent worked in high and medium skill occupations in the former Soviet Union. Prior to the start of the immigration wave, Israeli workers had an average of 12:6 years of completed schooling and only 30 percent were employed in high and medium skill occupations in Israel.

A large proportion of the new immigrants from the former Soviet Union entered the Israeli labor market quickly, accepting jobs for which they were clearly over-quali…ed (see Weiss, Sauer and Gotlibovski (2003)). With time in Israel, however, the wages of immigrants grew sharply and the variability in wages across schooling groups and occupations increased (Eckstein and Weiss (1998) and Friedberg (2000)). During the same period, the employment and wages of Israeli natives were not observed to be adversely a¤ected due to increased capital in‡ows and increased exports (see Friedberg (1999) and Eckstein and Weiss (2002)).

Although much is now known about the general character of the labor market absorption of Soviet immigrants in Israel, and the in‡uence of the mass immigration on the labor market outcomes of Israeli natives, little is known about the e¤ects of professional re-licensing requirements on the welfare of these highly educated immigrants.[1] In fact, there is no research at all in the economics of immigration literature that examines the e¤ects of re-licensing requirements on immigrant welfare.[2] Con-

[1] Cohen and Eckstein (2002) study the returns to Israeli government sponsored immigrant retraining programs in general. They do not focus speci…cally on the e¤ects of a professional license.

[2] There is an existing literature on estimating the value of credentials in the labor market but

sidering that re-licensing requirements for professionals that move across borders is a widespread phenomenon, the lack of research in this area must be due to lack of suitable data. In theory, professional re-licensing requirements may exist in order to screen immigrants on the basis of their ability to function in their original profession in a different technological environment. Immigrants that obtain a license thus have the opportunity to take advantage of their specific human capital. Alternatively, professional re-licensing requirements may exist in order to provide immigrants with an opportunity to purchase a signal that reveals higher imported productivity levels, even in alternative professions. It is also possible that professional licensing requirements serve as a barrier to entry that protects native professionals from competition. In either case, acquisition of a license may be important in explaining the variation in earnings among highly educated immigrants as well as their differential rates of economic assimilation.

In this paper, the effects of professional licensing on immigrant welfare are analyzed using novel data on the early labor market outcomes of Soviet immigrant physicians in Israel. Almost all Soviet immigrant physicians that arrived in Israel as part of the mass immigration wave were required to be re-licensed in order to practice medicine. Immigrant physicians that were interested in being re-licensed were assigned by the Israeli Ministry of Health to one of two different re-training tracks. The first re-training track (the exam track) requires the passing of a licensing exam. The second re-training track (the observation track) grants a temporary medical license for six months and allows immigrants to immediately practice medicine under observation. At the end of the six month period, immigrants on the observation track receive a permanent medical license.

Beginning in 1989, immigrants that practiced clinical medicine in the former So-

not in the context of immigrant economic assimilation. See, e.g., Cameron and Heckman (1993) and Tyler, Murnane and Willet (2000) for studies that examine the effect of the GED credential on the earnings of high school dropouts.

viet Union for at least 20 years were assigned to the observation track. Immigrants assigned to the observation track, regardless of years of imported physician experience, are signi…cantly more likely to acquire a medical license than are immigrants assigned to the exam track. The Ministry of Health's assignment rule thus generates an exogenous source of variation in licensing outcomes. Assigned re-training track is not a function of immigrant unobservables. The data also contain an additional source of exogenous variation in licensing outcomes. In November 1992, the Israeli Ministry of Health abruptly lowered the experience requirement for assignment to the observation track to 14 years. The abrupt change in the requirement provides a subset of immigrants with exactly the same number of years of experience and di¤erent assigned re-training tracks.

It is important to note that although the Ministry of Health's assignment rule is a near deterministic function of years of imported physician experience, and imported physician experience directly a¤ects earnings in the host country, assigned re-training track can be used to construct instrumental variable estimates of the increase in earnings attributable to a license, thus correcting for nonrandom selection in licensing status. The discontinuities in the relationship between imported physician experience and licensing status can be matched to the discontinuities in the relationship between imported physician experience and immigrant earnings. The correlation between these discontinuities identi…es the causal e¤ects of being licensed, since it is unlikely that some other mechanism besides the assignment rule is generating the discontinuities.[3] The two di¤erent imported physician experience cuto¤s that determine assignment to the observation track also help identify the causal e¤ects of being licensed under two reasonable assumptions. The …rst assumption is that there are no substantial cohort e¤ects among immigrants that arrived during the …rst three years

[3] This regression discontinuity identi…cation strategy originated with Campbell (1969). More recent applications include van der Klauuw (1996), Angrist and Lavy (1998) and Hahn, Todd and van der Klauuw (1998). See also Angrist and Kreuger (2001).

of the immigration wave. The second assumption is that immigrant physicians were unaware of the impending policy change.

According to OLS estimates, Soviet immigrant physicians that acquire a medical license in Israel have substantially higher monthly earnings than their unlicensed counterparts. However, under the likely assumption that licensing status is related to potential outcomes without a license, OLS estimates are biased. Instrumental variables estimates that correct for nonrandom selection into licensing status, in a constant-effects model, yield an increase in monthly earnings that is considerably higher than that estimated by OLS. The instrumental variables estimates can be interpreted as isolating the increase in monthly earnings among compliers, i.e., individuals that would not have obtained a license had they not been assigned to the observation track.[4]

Examination of licensing effects among compliers on different quantiles of the earnings distribution reveals a more complex pattern in biases when licensing outcomes are treated as exogenous. Quantile treatment effects estimates indicate that the increase in monthly earnings quantiles, with acquistion of a license, is overestimated at lower quantiles and underestimated at upper quantiles when the endogeneity of licensing status is ignored. The results suggest that acquisition of a license is relatively less important for lower skilled immigrants and relatively more important for skilled immigrants than standard quantile regression estimates indicate. The quantile treatment effect estimates also imply negative selection into licensing status at all quantiles of the potential earnings distribution.

The estimated quantile treatment effects model is used to examine convergence in earnings distribution between immigrants and comparable natives and to infer the importance of professional re-licensing requirements as a barrier to entry. Although

[4]Compliers are individuals whose treatment status is affected by the instrument. The effect among compliers in this case is also the local average treatment effect (see Imbens and Angrist (1994) and Angrist, Imbens and Rubin (1996)).

the percentage impact of acquiring a license on immigrant earnings is generally large, the contribution of license acquisition to convergence in distribution is small. This suggests that licensing requirements do not merely serve as a barrier to entry that protects native professionals from competition. The earnings gap between immigrants and comparable natives is more likely due to employer and consumer preferences for native medical services.

The rest of the paper is organized as follows. The next section describes the institutional background of immigrant physician re-licensing in Israel. Section 3 discusses the data and displays descriptive statistics. Section 4 presents a simple graphical analysis of the e¤ects of acquiring a license. Section 5 describes the measurement framework. Section 6 reports OLS estimates, constant-e¤ects instrumental variables estimates and quantile treatment e¤ect estimates of the e¤ects of acquiring a license. Section 7 examines the importance of license acquisition for convergence in earnings distribution between immigrants and comparable natives. Section 8 summarizes and concludes.

2 Institutional Background

Prior to the start of the recent immigration wave from the former Soviet Union, Israel had one of the highest physician to population ratios in the world. The population of Israel, at the end of 1989; was 4:56 million and there were 13; 000 native physicians between the ages of 25 and 64.[5] Between October 1989 and August 1993, approximately 12; 500 Soviet immigrant physicians arrived, nearly doubling the potential supply of physicians in Israel.[6]

According to Israeli immigration law, physicians that were licensed to practice

[5] The number of doctors per 100; 000 Israelis in 1989 was 285. In the same year in the US, there were 216 doctors per 100; 000 Americans.

[6] The population as a whole grew by a substantial 10% during the period.

medicine in a foreign country, and that have their foreign medical credentials recognized by the Israeli Ministry of Health, must pass a re-licensing exam in order to practice medicine. However, immigrant physicians that practiced clinical medicine and that have more than a certain number of years of physician experience are exempt from the exam. Until November 1992, the cuto¤ number of years required for exemption from the re-licensing exam was 20. The cuto¤ was subsequently lowered to 14.[7] Immigrant physicians that meet the imported physician experience requirement and that are granted an exemption must work under observation for six months in designated public hospitals or community clinics.[8] During the six month work under observation period, immigrants receive a salary and income support from the Ministry of Absorption. At the end of the six month period these immigrants receive a permanent license in general medicine.

Immigrant physicians that do not meet the experience requirement and that are assigned to the exam track are eligible, but not required, to participate in a government sponsored examination preparation course.[9] Preparation courses last six months, are o¤ered twice a year and are held in public hospitals throughout the country.[10] Immigrant physicians that are registered for a preparation course also receive income support from the Ministry of Absorption.[11] A permanent license in general medicine

[7] The cuto¤ was lowered in order to increase the proportion of Soviet immigrant physicians with a license. The lowering of the cuto¤ was abrupt and not publicized.

[8] The average time to …nd a position in a hospital or clinic is 4 months. Approximately 62% found a place within 3 months, another 25% found a place between four and six months.

[9] In our data, 91% of the immigrants that were referred to the licensing exam participated in a preparation course.

[10] Half of those that were referred to the exam track began their studies one month after requesting to participate in the course. Another 24% had to wait less than six months.

[11] There is no available data on the level of support that immigrant physicians received.

is acquired after passing the re-licensing exam.[12]

After successful completion of the re-licensing requirements, immigrant physicians that want to practice medicine in their home country specialty must request to be recognized as specialists by the Israeli Ministry of Health. The overwhelming majority of these requests are denied. Immigrant physicians whose requests are denied must fulfill a post-licensing residency requirement that includes successful completion of two specialty exams. The residency requirement can last a number of years depending upon medical specialty. The status of specialist is not required for performing rounds in hospitals or in residential communities.[13]

3 Data and Descriptive Statistics

The relevant population of immigrant physicians for this study is the subset of immigrants that arrived in Israel from the former USSR between October 1989 and June 1992, that submitted a request to the Israeli Ministry of Health to start the process towards re-licensing, that had their medical credentials in the former USSR recognized, and that were referred to either the exam track or the observation track for re-training. Of the immigrants that declared at the airport, on the day of arrival, that they were physicians in the former USSR, 27% did not submit their credentials to the Ministry of Health.[14] Of the immigrants that submitted their credentials, 3%

[12] Immigrants also have the option of re-training in alternative professions with income support. Approximately 14% of the immigrant physicians chose to re-train in an alternative profession. Many of these latter immigrant physicians re-trained in paramedical professions such as gereontology, emergency medicine and alternative medicine.

[13] Only a small percentage of immigrant physicians were in specialist residency at the time of the survey.

[14] The nonsubmitters are more likely than submitters to be women and over 55 years of age on arrival.

did not have their credentials recognized.[15] Of the immigrants that had their medical credentials recognized, 3% were not referred to one of the two re-training tracks. These latter immigrants were either required to do a one year internship before being eligible for the exam track or were immediately granted recognition as specialists. The total number of immigrant physicians in this restricted population is 6; 754:

Between the months of May and November of 1994, 731 of these 6; 754 immigrant physicians were surveyed, in face-to-face interviews, by Russian-speaking enumerators using a questionnaire written in Russian. The survey was conducted under the auspices of the JDC-Brookdale Institute of Jerusalem, The Israeli Ministry of Health and the Israeli Ministry of Immigrant Absorption. The random sample of 731 immigrant physicians was strati…ed by assigned re-training track and geographical region. The goal was to interview 10% of the restricted population. A reserve list of immigrants was prepared, according to the same strati…cation rules, to substitute for those on the original list that could not be interviewed.[16] In descending order of importance, those on the original list that were not interviewed were either not located, refused to be interviewed, return migrated, or had passed away.

Table 1 displays selected descriptive statistics for the sample by assigned re-training track. Of the 731 immigrant physicians in the sample, only 2 immigrants did not have a re-training track coded. Of the 414 immigrant physicians assigned to the exam track, 73% passed the re-licensing exam. Immigrants that were assigned to the exam track and that did not acquire a license either never took the exam or took the exam and failed.[17] Of the 315 immigrant physicians assigned to the observation track, 89% worked under observation and acquired a permanent license. The 11% among this latter group that are coded as not having acquired a permanent license

[15] Immigrants that did not have their credentials recognized are younger than those that had their credentials recognized.

[16] In total, 1; 002 immigrant physicians were approached for interviewing.

[17] There is no limit to the number of times an immigrant physician can take the exam.

reported that they never looked for a place to begin work under observation.

The …gures in Table 1 show that mean monthly earnings, the employment rate and the rate of employment as a physician, at the time of the survey, are higher among immigrants assigned to the exam track.[18] This is despite the fact that individuals assigned to the exam track are, on average, 18 years younger and have 18 years less physician experience in the former USSR. These immigrants also have more children under the age of 18 in the home at the time of arrival. Note that a considerable proportion of the immigrant physicians that obtained a license on the observation track are not employed as physicians. Immigrants that are licensed but not employed as physicians have slightly higher employment rates in more highly skilled jobs than their unlicensed counterparts. These more highly skilled occupations include higher and post-secondary education teachers, social workers, quali…ed nurses, optometrists, medical technicians and paramedics. The less skilled occupations include unquali…ed nursemaids, cleaners in institutions, security guards, and skilled and unskilled workers in industry.[19]

In terms of gender composition, size of last city of residence in the former USSR (more than 1;000;000 inhabitants), continuation of studies in the former USSR towards an advanced medical degree and the number of months since arrival, the immigrants are quite similar by re-training track. There are, however, di¤erences in marital status, republic of origin, type of medical practice and specialist status in the former USSR. Note that over 95% of the immigrants in the sample arrived during the

[18] There are 330 exam track earnings observations and 186 observation track earnings observations.

[19] Among immigrant physicians employed as physicians, 31% work for the Ministry of Health, 38% for the national HMO's, 7% for public hospitals and 3% for local governments. Private clinics and hospitals employ 11% and 3% work in private Russian-speaking clinics. The self-employed account for 3% and the remaining 7% work for other employers. Only 6% found work as a continuation of the exam preparation course or work under observation.

years 1990 and 1991.[20]

4 Graphical Analysis

The strong relationship between assigned re-training track and license acquisition can be clearly seen in Figure 1. Figure 1 plots the proportion of immigrant physicians assigned to the observation track, the proportion acquiring a medical license and the proportion employed as physicians at the time of the survey against years of physician experience in the former USSR. The proportion assigned to the observation track is zero until 14 years of experience. Between 14 and 19 years of experience the proportion ‡uctuates between 12 and 33 percent. At 20 years of experience the proportion sharply jumps up and ‡uctuates between 92 percent and 100 percent. After 26 years of experience, the proportion remains at 100 percent.[21] Note that the proportion of immigrant physicians acquiring a license starts out quite high but then declines and stabilizes until 14 years of experience. Starting at 14 years of experience, the proportion acquiring a license jumps up together with jumps in the proportion assigned to the observation track. The proportion of immigrant physicians employed as physicians in Israel also starts out quite high and subsequently declines and stabilizes. However, the proportion employed as physicians does not appear to consistently jump together with the proportion assigned to the observation track.

Figure 2 plots mean monthly earnings (including zeros for the nonemployed) at the time of the survey and the proportion acquiring a license against years of physician experience in the former USSR.[22] Note that mean monthly earnings declines sharply

[20] The percentage of immigrant physicians among all immigrants from the former USSR that arrived after 1992 is signi…cantly smaller.

[21] Most immigrant physicians in the sample, 90%, were assigned to the observation track according to the 20 year cuto¤.

[22] Four year experience intervals are used to construct Figures 2 through 6 instead of the single-

with years of imported physician experience. This downward trend in earnings is consistent with a higher rate of depreciation of source country human capital with pre-migration tenure. Notice, however, that mean monthly earnings tends to increase, breaking the downward trend, with sharp increases in the proportion acquiring a license.

Figure 3 plots mean monthly earnings and the proportion employed as physicians against years of physician experience in the former USSR. The proportion employed as physicians also generally declines with pre-migration tenure. However, the increases in mean monthly earnings are not strongly correlated with increases in the proportion employed as physicians. There is only a slight increase in the proportion employed as physicians at the interval midpoint of 21 years of experience and no discernible increase at all at the interval midpoint of 13 years of experience. Figures 1; 2 and 3 indicate a stronger matching of discontinuities between assigned re-training track, licensing outcomes and monthly earnings than between assigned re-training track, employment as a physician and monthly earnings.

The conclusions drawn from Figures 1; 2 and 3 are tentative because they do not take into account the e¤ect of other covariates on licensing, employment and monthly earnings outcomes. It is possible that stronger correlations in discontinuities are being hidden by e¤ects of other covariates. For example, immigrant physicians that pursued an advanced medical degree in the USSR have less imported physician experience and higher monthly earnings in Israel causing the trend in mean monthly earnings as depicted in Figure 2 to be biased downward. Biases due to omitted variables may a¤ect licensing, employment and monthly earnings outcomes di¤erently in magnitude and direction. It is, therefore, important to re-examine the relationship between these outcomes in terms of regression residuals.

value intervals in Figure 1. The four year experience intervals help reduce the greater idiosyncratic variation in the monthly earnings data. The experience axis records the integer value of the interval midpoint.

Figure 4 plots the residuals from separate linear regressions, that have acquisition of a license and employment as a physician as dependent variables. The linear regressions include as covariates the number of months since arrival in Israel, indicators for gender, marital status, profession of spouse (engineer and physician spouse dummies), the number of children under 18 in the home at the time of arrival, an indicator for being older than 40 upon arrival, indicators of region of origin (Russia and Ukraine dummies), an indicator of size of last city of residence in the former USSR (more than 1;000;000 inhabitants), indicators for having pursued an advanced medical degree in the former USSR, an indicator of having achieved specialist status in the former USSR, and indicators for type of medical practice in the former USSR (general medicine, pediatrics and OBGY dummies). The …gures now display sharper discontinuities in the licensing and employment as a physician outcomes. However, the discontinuities in licensing outcomes are sharper within the relevant experience range in which there is variation in assignment to the observation track. In contrast, the discontinuities in employment as a physician outcomes are sharper outside of the relevant experience range.

Figure 5 plots the license regression residuals and residuals from a regression that has monthly earnings as a dependent variable (in levels and including zeros) against imported physician experience. The monthly earnings regression includes the same covariates as in the licensing and employment as a physician regressions but adds controls for having reported after-tax earnings and having reported after-tax and after bene…t deductions earnings. The …gures now display a stronger correlation, both in trend and discontinuities, between monthly earnings and licensing outcomes than in Figure 2. Both monthly earnings and the proportion acquiring a license fall sharply with experience and then either fall less sharply or jump up with changes in the proportion acquiring a license.

Figure 6 re-examines the relationship between monthly earnings, employment as a physician and imported physician experience in terms of regression residuals. The

employment as physician residuals decline more sharply with imported physician experience at low levels of experience and increase with the monthly earnings residuals somewhat more strongly than in Figure 3 at both the 13 and 21 years of experience interval midpoints. However, the correlation in discontinuities between employment as a physician and monthly earnings still appears weaker than between license acquisition and monthly earnings.

5 Measurement Framework

5.1 Constant-E¤ects Model

In order to provide a framework for formal statistical inference of the e¤ects of professional licensing, consider the following linear, constant-e¤ects causal model that connects the earnings of immigrant i at time t, Y_{it}, with the professional licensing status of individual i at time t, L_{it}, plus a vector X_i of immigrant characteristics at the time of arrival and a random error component speci…c to individuals at time t; $²_{it}$:

$$Y_{it} = X_i^{0}— + t± + L_{it}® + ²_{it}: \quad (1)$$

Immigrant characteristics at the time of arrival, included in the vector X_i, are the same as those included in the regressions in the previous section plus imported physician experience. The vector X_i contains polynomials in imported physician experience in order to control for smooth e¤ects of experience on earnings. Note that time (months) in Israel is included as a control variable in (1) and is, like the elements of X_i, widely believed to be exogenous to potential labor market outcomes among those immigrants that arrived in the …rst three years of the immigration wave. All of the physicians in the sample arrived in Israel within this time frame.[23] The time in

[23] Variation in the number of months in Israel is strongly correlated with the size of the last city of residence in the former USSR. Immigrants that arrived earlier came from big cities in which there

Israel variable generically captures changes in language ability, social networks and knowledge of local institutions.[24]

The interpretation of equation (1) is that it describes the earnings of immigrants under alternative assignments of licensing status, controlling for any e¤ects of X_i and t. However, since L_{it} is not randomly assigned and is likely to be correlated with potential earnings, in this case $²_{it}$, OLS estimates of (1) do not have a causal interpretation. Instrumental variables estimates of (1) do have a causal interpretation as long as it is reasonable to assume that, after controlling for X_i and t, the association between assignment to the observation track and monthly earnings is solely due to the association between observation track assignment and licensing status.

Expressed more formally, the "…rst stage" relationship, or the association between licensing status, assignment to the observation track and X_i and t is:

$$L_{it} = X_i^{0}¼_0 + t¼_1 + TR_i¼_2 + »_{it}; \qquad (2)$$

where $TR_i = 1$ indicates assignment to the observation track and $TR_i = 0$ indicates assignment to the exam track. The error term $»_{it}$ is de…ned as the residual from the population regression of L_{it} on X_i and t and the instrument, TR_i. This residual captures other factors that are correlated with licensing status. These other factors are also probably correlated with potential earnings. For example, immigrants that have higher unobserved general skill levels, may be more likely to pass the exam and may also be more likely to have higher earnings without a license. The OLS estimate of ® would thus be biased upward. It is also possible that immigrants that acquire a license have di¤erentially lower earnings potential without a license and a lower opportunity cost of re-training. In this latter case, the OLS estimate of ® would be

was greater access to information, government o¢ces and consulates.

[24] The data include measures of English and Hebrew ability at the time of the survey. However, these variables are strongly endogenous and strongly correlated with time in Israel. They are, therefore, not used in the analysis.

biased downward.[25] In either case, the non-zero correlation between ϵ_{it} and ν_{it} leaves OLS estimates of (1) without a causal interpretation.

The key identifying assumption that underlies estimation using TR_i as an instrument is that any effects of imported physician experience on monthly earnings in Israel are adequately controlled by the smooth functions of imported physician experience included in X_i' and "partialled out" of TR_i by the inclusion of smooth functions of imported physician experience in $X_i'' = 0$. If this assumption is reasonable, then the discontinuities in earnings with imported physician experience, as depicted in the graphical analysis, is likely due to the acquisition of a professional license.[26] The same discussion above carries through for measuring the effect of working as a physician in place of the effect of acquiring a license. However, identification of the effect of working as a physician is doubtful considering the weak partial correlation between assigned re-training track and employment as a physician displayed in the graphical analysis.[27]

5.2 Quantile Treatment Effects Model

The constant-effects model, as specified in (1), does not allow for differential effects of acquiring a license at different points in the monthly earnings distribution. This is especially problematic since the monthly earnings distribution has a mass point at zero. The effect of acquiring a license on participation may be substantially different from the effect of acquiring a license on conditional-on-positive mean earnings. This consideration often justifies separate analyses of participation and conditional-

[25] See Willis and Rosen (1979) and Card (1999) for further discussion of the biases in OLS that can arise using the insights of an optimal schooling model.

[26] Card (1999) surveys evidence supporting the smoothness assumption in the relationship between experience and earnings.

[27] Anecdotal evidence suggests that employers of physicians in Israel are aware of the looser licensing requirements for relatively older physicians.

on-positive e¤ects as well as more inclusive sample-selection models. However, there are alternative estimation strategies that are less demanding than sample-selection models, that incorporate the mass point at zero earnings, that are less sensitive to earnings outliers, and that allow for di¤erential licensing e¤ects at di¤erent points in the earnings distribution (see the discussion in Angrist (2001)). The alternative estimation strategy that is employed in this paper, in addition to separate analyses of participation and conditional-on-positive e¤ects, is the quantile treatment e¤ects procedure recently developed by Abadie, Angrist and Imbens (2002). This procedure modi…es traditional quantile regression for inclusion of an endogenous binary regressor.[28]

The quantile treatment e¤ects procedure speci…es a linear model for conditional quantiles for compliers (suppressing time in Israel for convenience), i.e.,

$$Q_\mu[Y_i|X_i; L_i; L_{1i} > L_{0i}] = X_i'\beta_\mu + L_i\alpha_\mu \tag{3}$$

where L_{1i} denotes licensing status when assigned to the observation track ($Z_i = 1$) and L_{0i} denotes licensing status when assigned to the exam track ($Z_i = 0$). The coef-…cient α_μ has a causal interpretation because L_i is independent of potential earnings outcomes conditional on X_i and being a complier ($L_{1i} > L_{0i}$).[29] The coe¢cient α_μ is the di¤erence in μ quantiles for compliers, i.e.,

$$\alpha_\mu = Q_\mu[Y_{1i}|X_i; L_i; L_{1i} > L_{0i}] - Q_\mu[Y_{0i}|X_i; L_i; L_{1i} > L_{0i}] \tag{4}$$

where Y_{0i} and Y_{1i} denote potential earnings outcomes indexed against licensing status.

The parameters of the quantile treatment e¤ects model are estimated by minimizing the sample analog of

$$E[\cdot_i\rho_\mu(Y_i - X_i'b_\mu - aL_i)] \tag{5}$$

[28] See Chamberlain (1991) and Buchinsky (1991; 1994) for discussion and applications of quantile regression.

[29] See Abadie, Angrist and Imbens (2002) for the proof of this statement.

where ρ_μ is the "check function" (Koenker and Basset (1978)) and the κ_i are weights that transform the conventional quantile regression minimand into a problem for compliers only. For computational reasons κ_i is replaced by an estimate of $E[\kappa_i | X_i; L_i; Y_i]$ where

$$E[\kappa_i | X_i; L_i; Y_i] = 1 - \frac{L_i(1 - E[Z_i | Y_i; L_i; X_i])}{(1 - E[Z_i | X_i])} - \frac{(1 - L_i)E[Z_i | Y_i; L_i; X_i]}{E[Z_i | X_i]}: \quad (6)$$

The first step estimate of $E[\kappa_i | X_i; L_i; Y_i]$ is obtained by separately estimating $E[Z_i | Y_i; L_i; X_i]$ and $E[Z_i | X_i]$.

6 Estimation Results

6.1 OLS Estimates

OLS estimates of the effects of a professional license on mean log earnings are reported in the top panel of Table 2. Column (1) does not include any other regressors and yields a precisely estimated coefficient on licensed of .442. Column (2) adds the exogenous covariates, X_i, and time in Israel, t, and produces a precisely estimated coefficient on licensed of .473.[30] Column (3) adds years of physician experience in the USSR and its square. The coefficient on licensed further increases in strength and precision to .493.

Column (4) of Table 2 reports OLS estimates in the subsample of immigrants that have imported physician experience between 14 and 26 years. This experience range contains all of the variation in assigned re-training track (see Figure 1) and thus all of the discontinuities in licensing, earnings and employment outcomes that are a result of the assignment rule. The experience levels 14 and 26 are the 45th and 75th percentiles, respectively, in the imported physician experience distribution implying that

[30] The monthly earnings regressions with other regressors also include controls for having reported an after-tax income figure and having reported and after-tax, after-benefit deductions income figure. All standard errors are heteroscedasticity robust standard errors.

the "discontinuity sample" contains 30 percent of all observations.[31] The estimated coe¢cient on licensed in the discontinuity sample is :417 with a standard deviation of :156. This latter estimated coe¢cient is somewhat weaker than the corresponding estimated coe¢cient in the full sample, but is still substantial in magnitude and precisely estimated.

Column (5) of Table 2 reports the OLS estimate of the return to working as a licensed physician, controlling for other regressors and imported physician experience and its square. The estimated coe¢cient on physician is :620 with a standard error of :055. This estimated coe¢cient is stronger in magnitude and more precisely estimated than the estimated coe¢cient on licensed in Column (3). Column (6) reports the results of including both the licensed and physician variables in the regression. A signi…cant coe¢cient on licensed in this latter speci…cation would be suggestive of a signalling value to a medical license. The estimated coe¢cient on licensed, however, is only :036 with a standard error of :088. Column (7) repeats this latter speci…cation in the discontinuity sample only. The estimated coe¢cient on licensed substantially increases in magnitude to :121 but still has a relatively large standard error of :167. OLS estimates thus indicate positive returns to a medical license in nonphysician employment but the returns are very imprecisely measured.

Columns (8) through (11) of Table 2 report OLS estimates of the e¤ect of acquiring a license on participation (employed in either a nonphysician or physician job). Employment status at the time of the survey is available for everyone in the sample. Columns (8) through (10) indicate that a license increases the probability of being employed by between 16 and 20 percent depending on the controls that are included in the regression.[32] Column (11) reports the estimated coe¢cient on licensed in the discontinuity sample only. This latter estimated coe¢cient is slightly stronger in mag-

[31] The experience distribution is skewed to the right with a mean of 16, a standard deviation of 11 and a median of 18.

[32] The employment regressions are linear probability models.

nitude than the corresponding full sample estimate but is less precisely estimated.

6.2 Reduced Form Estimates

Reduced form estimates of the effect of being assigned to the observation track are reported in Table 3. Columns (1), (2) and (3) of Table 3 report the effect of being assigned to the observation track on licensing status. In all three specifications, assignment to the observation track increases the probability of acquiring a license. The estimated coefficient on track, without any other regressors, is .159. Including other regressors increases the estimated coefficient to .196. Adding imported physician experience and its square further increases the estimated coefficient on track to .335. The coefficient on track in all three specifications is precisely estimated.

Columns (4), (5) and (6) of Table 3 report the effect of being assigned to the observation track on employment status as a licensed physician. In all three specifications there is a negative association between track and employment status as a physician. However, in the full specification with other regressors and imported physician experience, the negative association is not statistically different from zero. Since there is a very weak first stage relationship between employment status as a physician and assigned re-training track, it is not possible to consistently estimate the effect of being employed as a physician in Israel on immigrant physician earnings. The strong first stage relationship between acquisition of a license and assigned re-training track allows consistent estimation of the effect of obtaining a license, however, this latter effect includes the returns to a medical license in nonphysician jobs as well.

Columns (7), (8) and (9) of Table 3 report the effect of being assigned to the observation track on mean log earnings. Without controls for imported physician experience, there is a negative association between assignment to the observation track and monthly earnings. The track variable is picking up the downward trend in earnings with greater pre-migration tenure. The association between being assigned to the observation track and monthly earnings becomes strongly positive with the

addition of imported physician experience and its square. The coe¢cient on track in this latter speci…cation is :209 with a standard error of :105.

Columns (10), (11) and (12) of Table 3 report the e¤ect of being assigned to the observation track on employment status. The results are quite similar to the results in Columns (4), (5) and (6) in which the dependent variable is employment status as a physician. That is, there is a negative association between track and employment status that becomes increasingly weaker and insigni…cant as more controls are added to the regressions. For this reason, the e¤ect of professional licensing on employment status alone will not be further explored.

6.3 Instrumental Variables Estimates

Instrumental variables estimates of the e¤ect of acquiring a professional license in a constant-e¤ects model are reported in Table 4. Acquisition of a license is instrumented by assigned re-training track.[33] Columns (1), (2) and (3) of Table 4 report the estimated coe¢cients on licensed without any other regressors, with other regressors excluding imported physician experience, and with other regressors and a quadratic in imported physician experience, respectively. The estimated coe¢cient on licensed with other regressors and a quadratic in imported physician experience is :839 with a standard error of :413: Correcting for nonrandom selection in licensing status in a constant-e¤ects framework yields an estimated coe¢cient on licensed that is 70:3% higher than the corresponding OLS estimate.

Considering that instrumental variables estimates in a regression discontinuity design may be quite sensitive to the way in which the variable generating the discontinuity is controlled, Column (4) of Table 4 reports the results of including a third order polynomial in imported physician experience. The estimated e¤ect of a professional license in this latter speci…cation is :969 with a standard error of :505, still

[33] The instrumental variables estimates deviate somewhat from the ratio of the relevant reduced-form estimates in Table 3 due to di¤erent sample sizes.

indicating a substantial downward bias in OLS estimates. Column (5) of Table 4 reports the results of estimating a quadratic in imported physician experience in the discontinuity sample only. The estimated coe¢cient on licensed remains substantial in magnitude, :915, but is less precisely estimated due to the smaller sample size. The instrumental variables estimate in the discontinuity sample is 138% higher than the corresponding OLS estimate in the discontinuity sample.

In order to check the sensitivity of the results to the exclusion of the nonemployed, Columns (6), (7) and (8) of Table 4 report the e¤ects of acquiring a professional license in levels, rather than in logs, and with monthly earnings set to zero for the nonemployed. Similar to the results in logs, instrumental variables estimates with the nonemployed included indicate substantial downward biases in OLS estimates, although the biases are relatively smaller in magnitude. The OLS estimates corresponding to Columns (6), (7) and (8) in Table 4 are 1177 (138), 1189 (140) and 1246 (373)[34], implying a downward bias in OLS estimates of 17%, 35% and 81%, respectively.

The instrumental variables estimates in Table 4 isolate the increase in mean monthly earnings (both with and without zero earnings), due to acquisition of a license, among compliers in a constant-e¤ects framework. The constant-e¤ects model has a drawback in that it does not allow for di¤erential e¤ects of acquiring a license at di¤erent points in the earnings distribution. In the next subsection, heterogeneity in licensing e¤ects among compliers is examined by applying the more ‡exible quantile treatment e¤ects approach.[35]

[34] Standard errors are in parentheses.

[35] Instrumental variables estimates in the constant-e¤ects framework that interact licensing status with individual characteristics do not yield statistically signi…cant coe¢cients on the interaction terms.

6.4 Quantile Regression and Treatment E¤ect Estimates

The top panel of Table 5 reports quantile regression and quantile treatment e¤ect estimates, in the full sample, of the e¤ect of licensing status on monthly earnings. Licensing e¤ects are measured at the :15, :25, :50, :75 and :85 quantiles of the monthly earnings distribution. Quantile regression estimates treat licensing status as exogenous and produce the largest percentage impact of acquiring a license at the :25 quantile.[36] The percentage impact at the :25 quantile is a substantial 105 percent. The percentage impact steadily declines at higher quantiles, falling to 60 percent at the :85 quantile. At each quantile the coe¢cient on licensed is precisely estimated.

Quantile treatment e¤ect estimates that treat licensing status as endogenous yield substantially di¤erent results. The percentage impact of acquiring a license peaks at the :85 quantile as opposed to the :25 quantile. The percentage impact at the :85 quantile is 120 percent, considerably higher than the percentage impact of 69 percent at the same quantile according to quantile regression. Quantile treatment e¤ect estimates consistently yield larger percentage licensing e¤ects in the upper half of the earnings distribution.

Quantile treatment e¤ect estimates also consistently produce lower percentage licensing e¤ects in the lower half of the earnings distribution. The percentage impact at the :15 quantile is 35 percent according to quantile treatment e¤ect estimates and 82 percent at the same quantile according to quantile regression. The quantile treatment e¤ects in the lower half of the distribution are, however, less precisely estimated.[37]

[36] The percentage impact is calculated as the ratio of the coe¢cient on licensed at a particular quantile to the …tted value at that quantile with the licensed dummy set to zero and other covariates set to the means among individuals with a license.

[37] The …rst step estimate of $E[\cdot_i | X_i; L_i; Y_i]$ is obtained by estimating $E[Z_i | Y_i; L_i; X_i]$ and $E[Z_i | X_i]$ in (5) by probit. Predicted values of $E[\cdot_i | X_i; L_i; Y_i]$ that are negative are set to zero leading to a reduced sample size. Standard errors are computed by a bootstrapping procedure that repeats the …rst and second step estimation procedure 100 times.

The overall pattern in the results in the top panel of Table 5 suggests that the substantially higher constant-effects instrumental variables estimates, in comparison to OLS, are driven by the powerful licensing effects in the upper half of the monthly earnings distribution.

The bottom panel of Table 5 reports licensing effects on median earnings in the discontinuity sample only. Effects at other quantiles are difficult to identify given the reduced variation in earnings and smaller sample size. The results indicate a very large effect on median earnings, 144 percent, when licensing status is treated as exogenous. Treating licensing status as endogenous further increases the percentage impact on median earnings to 194 percent. Both of these large licensing effects are precisely estimated.

Although the percentage impact of acquiring a license, according to quantile treatment effect estimates, is lower than the percentage impact produced by quantile regression in the lower half of the distribution, the results indicate negative selection into licensing status at all quantiles of potential earnings. This is documented in Table 6, which reports the estimated marginal distribution of monthly earnings without a license (Y_0) both for immigrants that acquired a license and immigrants that did not acquire a license. Potential earnings without a license for immigrants that acquired a license are obtained by using the quantile treatment effect coefficients together with the covariate means among those that acquired a license and the licensing status dummy to set to zero.[38] The counterfactual earnings of all immigrants with a license are thus approximated by the counterfactual earnings of compliers.[39] The monthly earnings without a license for immigrants that did not acquire a license are also computed conditional on the mean of the covariates among immigrants that acquired a license with the licensing status dummy set to zero, but use the quantile regression

[38] The same calculation was used for computing the percentage impact of licensing status in Table 5.

[39] The calculation assumes that compliers are a random sample of all immigrants with a license.

coe¢cients.

The …gures in the top panel of Table 6 show that, in the full sample, licensed immigrants earn less without a license than unlicensed immigrants at all quantiles of the monthly earnings distribution. The negative selection bias is largest in the tails of the distribution. The percentage selection bias is 29 percent at the :15 quantile and 27 percent at the :85 quantile. The bottom panel of Table 6 shows that negative selection bias is also present at the median of potential earnings in the discontinuity sample. However, the selection bias is a relatively weaker 9 percent.

7 The Importance of Professional Licensing

Estimates of the constant-e¤ects and quantile treatment e¤ects models indicate that professional licensing status is an important factor in explaining di¤erences in immigrant earnings. An additional way in which the importance of professional licensing status can be assessed in this context is by measuring the extent to which acquisition of a license closes the earnings gap between immigrants and comparable natives. In this section, the monthly earnings of immigrant physicians both with and without a medical license are compared to the monthly earnings of Israeli native physicians at di¤erent points in time and at di¤erent quantiles of the earnings distribution.

The comparison of immigrant and native earnings quantiles over time since migration is equivalent to assessing convergence in earnings distribution rather than convergence in mean earnings.[40] The fanning out of the immigrant earnings distribution over time since migration, even amongst immigrants that acquire a license, is illustrated in Figure 7. Figure 7 plots the distribution of earnings at the :25, :50 and :75 quantiles from the time of immigration until 60 months after arrival. The distri-

[40] The immigration literature usually assesses the economic assimilation of immigrants in terms of mean earnings convergence (Chiswick (1978)) and/or the coe¢cient on time since migration in a mean earnings regression (Lalonde and Topel (1992)). See also Borjas (1999) for further discussion.

bution is simulated by using the estimated coe¢cients from the quantile treatment e¤ects model, the means of the covariates at the time of arrival among those that acquired a license, and by setting the licensing status dummy to one. Earnings at the :25 quantile are 43 percent of earnings at the :75 quantile 12 months after arrival. At 60 months after arrival, earnings at the :25 quantile are 25 percent of earnings at the :75 quantile.

The di¤erences in earnings quantiles between immigrants and comparable natives are shown in Figures 8; 9 and 10. Figure 8 plots the :25 earnings quantiles since migration when ignoring licensing status, for immigrants without a license, for immigrants with a license and for comparable natives. The earnings quantiles when ignoring licensing status are calculated at the means of the covariates in the sample using the coe¢cients from a quantile regression that doesn't include the licensing status dummy. Comparable native earnings quantiles are calculated using the coe¢cients from a quantile regression on Israeli native physician earnings and the means of the covariates among immigrants that acquired a license. The explanatory variables in the native physician quantile regression are age and age squared, an indicator for being male, and an indicator for being married. The quantile regression estimates are reported in Table 7.[41]

Figure 8 shows a very large gap between immigrant and native :25 earnings quantiles. Immigrant earnings without a license at this quantile are 4 percent the earnings of comparable natives 24 months after arrival. Immigrant earnings with a license are 8 percent the earnings of comparable natives in the same month. By month 60; Immigrant earnings are 11 and 14 percent the earnings of comparable natives, with

[41] The data on the earnings of 324 male and female Israeli native physicians (including zeros for the nonemployed) are drawn from the Israel Central Bureau of Statistics Income Surveys of 1988 through 1995. It is important to note that native physician earnings were not observed to be adversely a¤ected by the mass immigration during these years (see Sussman and Zakai (1999)).

and without a license, respectively.[42] Although the percentage impact of acquiring a license at the :25 quantile is 52 percent, acquisition of a license closes the earnings gaps between immigrants and natives by only 3 to 4 percentage points. It is interesting to note, however, that when licensing status is ignored the earnings di¤erential is generally biased towards zero. The ratio of immigrant earnings to comparable native earnings when licensing status is ignored :19 in month 60.

The di¤erences in median earnings between immigrants and comparable natives are illustrated in Figure 9. The median earnings of immigrants without a license are 1 percent and 16 percent the median earnings of comparable natives in months 24 and 60, respectively. The median earnings of immigrants with a license are 10 percent 22 percent the median earnings of comparable natives in those same months. The percentage impact of acquiring a license on median immigrant earnings is 88 percent but acquisition of a license closes the median earnings gap by 6 to 9 percentage points. Ignoring licensing status generally biases the median earnings di¤erential towards zero.

The gap between immigrant and native :75 earnings quantiles are shown in Figure 10. Immigrant earnings without a license at this quantile are 1 percent and 17 percent the earnings of comparable natives in months 24 and 60, respectively. Immigrants with a license earn 12 and 26 percent the earnings of comparable natives in those same months. Acquisition of a license increases the :75 immigrant earnings quantile by 95 percent and closes the earnings gap by 9 to 11 percentage points. Ignoring licensing status biases the earnings di¤erential towards zero at the :75 quantile as well.

The comparison of immigrant and comparable native earnings distributions over time shows that acquisition of a license closes the earnings gap between immigrants and natives most substantially in the upper half of the earnings distribution. How-

[42] Di¤erential growth rates in earnings between immigrants and comparable natives yield di¤erent percentage earnings gaps at di¤erent points in time.

ever, the earnings gap is quite large at all quantiles.[43] The large earnings gap, even amongst immigrants that acquire a license, suggests that professional re-licensing requirements are not serving as a barrier to entry that protects native physicians from competition. Institutional aspects of the physician labor market in Israel, e.g., employer and consumer tastes for native medical services, are probably more important in determining relative earnings.

8 Conclusion

This paper uses novel data on Soviet immigrant physicians in Israel in order to examine the e¤ects of professional licensing requirements on immigrant labor market outcomes. The Israeli Ministry of Health's exogenous assignment of immigrant physicians to one of two di¤erent re-training tracks is used as an instrument for professional licensing status in the host country. Even though the Ministry of Health's assignment rule is a near deterministic function of years of imported physician experience, and imported physician experience directly a¤ects earnings in the host country, the discontinuities in the data and the change in the assignment rule itself identify the causal e¤ect of acquiring a license.

Instrumental variables estimates, in a constant-e¤ects model, yield percentage increases in immigrant earnings, due to acquisition of a license, that are considerably higher than those estimated by OLS. However, examination of licensing e¤ects on di¤erent quantiles of the earnings distribution among compliers, using a quantile treatment e¤ects model, yields a more complex pattern in biases. Percentage increases in earnings are overestimated at lower quantiles of the earnings distribution and are

[43] These results are highly consistent with the …ndings in the dynamic programming occupational choice model of Weiss, Sauer and Gotlibovski (2003). In this latter paper, the mean earnings gap for all immigrants from the former USSR (including physicians) was decomposed into a loss of mean earnings due to job mismatch and a loss of mean earnings due to lower skill prices.

underestimated at upper quantiles of the earnings distribution when licensing status is treated as exogenous. Quantile treatment e¤ect estimates also indicate negative selection bias at all quantiles of the potential earnings distribution.

Although quantile treatment e¤ects estimates indicate large e¤ects of acquiring a license on immigrant earnings, the importance of license acquisition for earnings convergence between immigrants and comparable natives is not substantial. For both immigrants that do not acquire a license and immigrants that do acquire a license, there is a substantial earnings gap between immigrants and comparable natives at all quantiles and months since migration.

The fact that native physician earnings were not adversely a¤ected by the mass immigration (Sussman and Zakai (1998)) and that there is a substantial earnings gap between immigrants that acquire a medical license and comparable natives, up to …ve years after immigration, suggest that professional licensing requirements do not serve as a barrier to entry that protects the earnings of native professionals. It seems more likely that institutional aspects of the physician labor market in Israel, e.g., employer and consumer tastes for native medical services, are decisive in determining relative earnings. There is also only weak evidence that acquisition of a medical license increases earnings outside of the medical profession. It is thus not possible to conclude that acquisition of a medical license at least partially serves as a signal to employers of higher imported productivity levels.

The implications of the results for immigration policy in Israel are rather straightforward. Arbitrarily changing the imported physician experience requirement for entry into the observation re-training track will have a substantial e¤ect on the earnings of immigrants that would be a¤ected by this change. However, the new policy would not substantially a¤ect the extent or rate of economic assimilation.

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Table 1
Descriptive Statistics

Variable	Exam Track	Observation Track
% Licensed	72.71	88.57
% Employed	86.23	65.40
% Physician	68.26	57.84
Monthly Earnings (NIS)	2994 (1589)	2700 (1922)
Months in Israel	44.3 (6.2)	42.7 (7.4)
Age Upon Arrival	34.5 (5.0)	53.1 (7.4)
Physician Experience in USSR	10.3 (4.8)	28.2 (7.6)
% Male	44.44	44.13
% Married Upon Arrival	84.30	79.36
Children Under 18 Upon Arrival	1.23 (0.75)	0.59 (0.76)
% From Russia	46.14	41.59
% From Ukraine	16.67	23.81
% From Big City	52.17	53.33
% Advanced Degree in USSR	26.81	25.40
% Specialist in USSR	40.34	85.10
% General Medicine in USSR	22.95	18.73
% Pediatrics in USSR	16.18	12.70
% OBGY in USSR	7.49	5.71
% Arrived in 1990	77.30	67.62
% Arrived in 1991	20.05	26.03
N	414	315

Note: The table reports means and percentages by assigned re-licensing track. Standard deviations are in parentheses. Monthly earnings are in 1994 New Israeli Shekels (NIS) where 1 NIS equals .33 US dollars. There are 330 exam track earnings observations and 186 observation track earnings observations.

Table 2
OLS Estimates

	Log of Monthly Earnings						
Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Licensed	.4419	.4727	.4926	.4172	-	.0356	.1210
	(.0716)	(.0714)	(.0708)	(.1561)		(.0877)	(.1673)
Physician	-	-	-	-	.6201	.6033	.4281
					(.0548)	(.0710)	(.1040)
Experience	-	-	-.0175	.0330	.0051	.0047	.0429
			(.0160)	(.2226)	(.0161)	(.0160)	(.2150)
Experience^2	-	-	-.0003	-.0009	-.0006	-.0006	-.0012
			(.0004)	(.0054)	(.0004)	(.0004)	(.0052)
Other Regressors	NO	YES	YES	YES	YES	YES	YES
Root MSE	.6650	.5982	.5787	.5344	.5344	.5349	.5078
R^2	.0575	.2626	.3126	.3906	.4138	.4140	.4541
N	516	516	516	148	516	516	148

	Employed			
Regressors	(8)	(9)	(10)	(11)
Licensed	.1778	.2030	.1628	.1728
	(.0428)	(.0415)	(.0394)	(.0927)
Experience			.0084	.0901
			(.0080)	(.1717)
Experience^2			-.0006	-.0024
			(.0002)	(.0042)
Other Regressors	NO	YES	YES	YES
Root MSE	.4138	.4002	.3809	.3648
R^2	.0292	.1105	.1965	.1549
N	729	729	729	203

Note: Robust standard errors are in parentheses. Other regressors include number of months since arrival in Israel, gender, marital status, profession of spouse, number of children under age 18 in the home, age at arrival, Republic of origin, advanced medical degrees, physician specialty, type of medical practice, and type of reported earnings (after-tax, after deductions). The employment regressions are linear probability models. Columns (4), (7) and (11) use the subsample of observations between 14 and 26 years of imported physician experience.

Table 3
Reduced Form Estimates

	Licensed			Physician		
Regressors	(1)	(2)	(3)	(4)	(5)	(6)
Track	.1587	.1955	.3351	-.2155	-.2010	-.0142
	(.0283)	(.0501)	(.0539)	(.0365)	(.0601)	(.0700)
Experience	-	-	-.0030			-.0218
			(.0085)			(.0091)
Experience^2	-	-	-.0002			.0001
			(.0002)			(.0002)
Other Regressors	NO	YES	YES	NO	YES	YES
Root MSE	.3961	.3941	.3860	.4891	.4760	.4667
R^2	.0380	.0671	.1075	.0456	.1146	.1515
N	729	729	729	729	729	729

	Log of Monthly Earnings			Employed		
Regressors	(7)	(8)	(9)	(10)	(11)	(12)
Track	-.2107	-.0910	.2089	-.2084	-.1818	-.0034
	(.0669)	(.0903)	(.1051)	(.0318)	(.0509)	(.0585)
Experience	-	-	-.0274	-	-	.0101
			(.0162)			(.0084)
Experience^2	-	-	-.0002	-	-	-.0006
			(.0004)			(.0002)
Other Regressors	NO	YES	YES	NO	YES	YES
Root MSE	.6775	.6218	.6034	.4070	.4048	.3863
R^2	.0219	.2033	.2526	.0606	.0901	.1736
N	516	516	516	729	729	729

Note: Robust standard errors are in parentheses. Other regressors include number of months since arrival in Israel, gender, marital status, profession of spouse, number of children under age 18 in the home, age at arrival, Republic of origin, advanced medical degrees, physician specialty, type of medical practice, and type of reported earnings (after-tax, after deductions). The licensed, physician and employment regressions are linear probability models.

Table 4
2SLS Estimates

	Log of Monthly Earnings				
Regressors	(1)	(2)	(3)	(4)	(5)
Licensed	-1.1580	-.4329	.8388	.9690	.9148
	(.4398)	(.4868)	(.4128)	(.5046)	(.7323)
Experience	-	-	-.0153	.0027	.0331
			(.0170)	(.0345)	(.2475)
Experience^2	-	-	-.0004	-.0015	-.0012
			(.0004)	(.0021)	(.0060)
Experience^3=100	-	-	-	.0017	-
				(.0035)	
Other Regressors	NO	YES	YES	YES	YES
Root MSE	.8921	.9550	.5922	.6042	.5601
R^2	.	.	.2802	.2523	.3307
N	516	516	516	516	148

	Monthly Earnings (with Zeros)		
Regressors	(6)	(7)	(8)
Licensed	1377	1603	2250
	(711)	(844)	(1285)
Experience	-32.82	8.79	1066.56
	(30.77)	(64.82)	(741.59)
Experience^2	-.7068	-3.21	-26.50
	(.6129)	(3.5676)	(18.40)
Experience^3=100	-	3.9061	-
		(5.5760)	
Other Regressors	YES	YES	YES
Root MSE	1637	1644	1662
R^2	.3128	.3080	.2787
N	676	676	181

Note: Robust standard errors are in parentheses. Other regressors include number of months since arrival in Israel, gender, marital status, profession of spouse, number of children under age 18 in the home, age at arrival, Republic of origin, advanced medical degrees, physician specialty, type of medical practice, and type of reported earnings (after-tax, after deductions). Licensed is instrumented with assigned re-training track. The OLS estimates corresponding to Columns (6), (7) and (8) are 1177 (138), 1189 (140) and 1246 (373), respectively.

Table 5
Quantile Regression and Treatment E¤ect Estimates

	Quantiles				
	.15	.25	.50	.75	.85
			Full Sample		
Licensed	316.90	606.39	911.96	1332.08	1519.60
Exogenous	(159.37)	(194.75)	(159.81)	(258.22)	(340.63)
% Impact	81.51	104.68	75.42	69.11	59.99
Pseudo R^2	.1628	.2478	.2435	.2152	.2039
N	676	676	676	676	676
Licensed	96.86	262.07	830.59	1451.41	2205.32
Endogenous	(406.58)	(484.21)	(550.52)	(664.44)	(1014.23)
% Impact	35.10	51.67	88.32	95.48	119.76
Pseudo R^2	.1777	.2315	.2555	.1978	.2196
N	569	569	569	569	569
			Discontinuity Sample		
Licensed	-	-	1287.86	-	-
Exogenous			(440.26)		
% Impact	-	-	143.96	-	-
Pseudo R^2	-	-	.2150	-	-
N	-	-	181	-	-
Licensed	-	-	1577.31	-	-
Endogenous			(735.54)		
% Impact	-	-	194.11	-	-
Pseudo R^2	-	-	.2936	-	-
N	-	-	168	-	-

Note: Bootstrapped standard errors are in parentheses. Other regressors include a quadratic in imported physician experience, number of months since arrival in Israel, gender, marital status, profession of spouse, number of children under age 18 in the home, age at arrival, Republic of origin, advanced medical degrees, physician specialty, type of medical practice, and type of reported earnings (after-tax, after deductions). Boostrapped standard errors correct for the …rst step estimation when licensed is treated as endogenous.

Table 6
Earnings Quantiles Without a License

	Quantiles				
	.15	.25	.50	.75	.85
			Full Sample		
Licensed Immigrants	276	507	940	1520	1841
Unlicensed Immigrants	389	579	1209	1928	2533
% Selection Bias	-29.02	-12.44	-22.22	-21.14	-27.31
			Discontinuity Sample		
Licensed Immigrants	-	-	813	-	-
Unlicensed Immigrants	-	-	895	-	-
% Selection Bias	-	-	-9.17	-	-

Note: The table reports monthly earnings quantiles without a license (Y_0) for immigrants that acquired a license and for immigrants that did not acquire a license. Quantiles for immigrants that acquired a license are approximated by quantiles among compliers. These same …gures were used to calculate the percentage impact of being licensed in Table 5. The earnings without a license for immigrants that acquired a license use the quantile treatment e¤ect estimates and the earnings without a license for immigrants

that did not acquire a license use the quantile regression estimates.

Table 7
Quantile Regression Estimates - Natives

	Quantiles		
Regressors	.25	.50	.75
Male	1174.23	1967.61	1507.07
	(411.56)	(625.67)	(863.98)
Married	-373.27	276.70	-540.48
	(658.76)	(1008.10)	(1352.90)
Age	676.25	1053.74	1441.13
	(120.72)	(196.86)	(285.97)
Age^2	-6.99	-10.56	-14.33
	(1.21)	(1.96)	(2.81)
Constant	-11368.75	-19286.50	-24679.06
	(2777.99)	(4667.19)	(6716.14)
Pseudo R^2	.0848	.0974	.1109
N	324	324	324

Note: The earnings data (including zeros for the nonemployed) are drawn from the Israel Central Bureau of Statistics Income Surveys for the years 1988 through 1995. Bootstrapped standard errors are in parentheses.

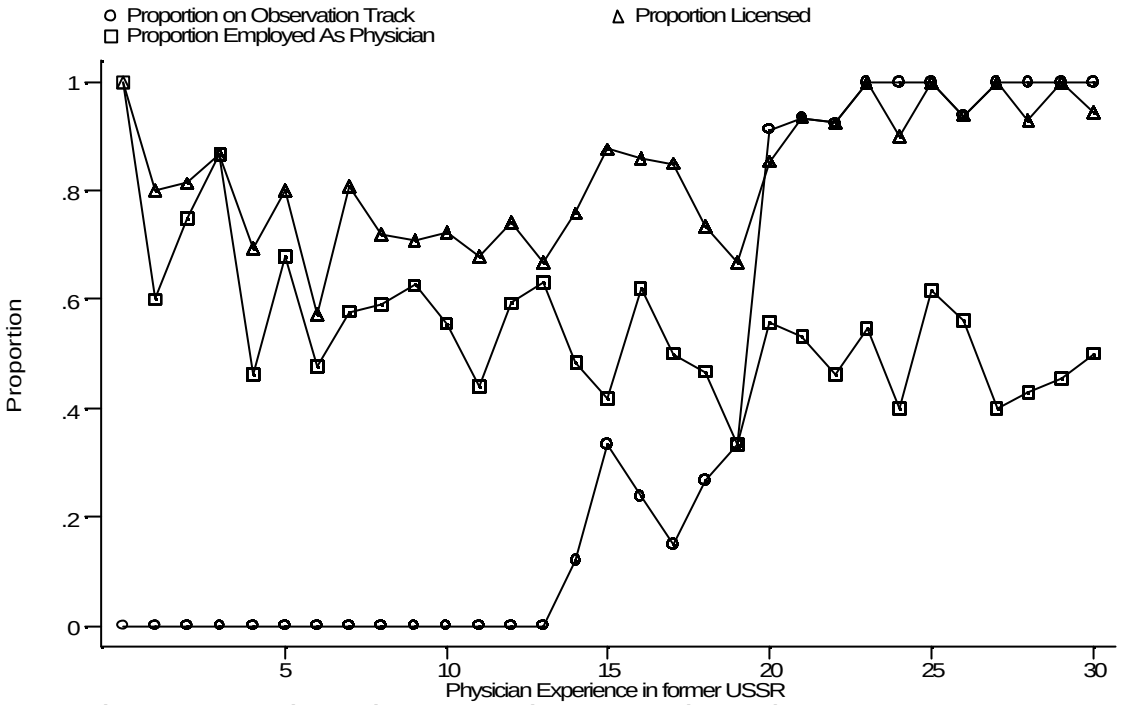

Figure 1: Track Assignment, License and Employment Outcomes

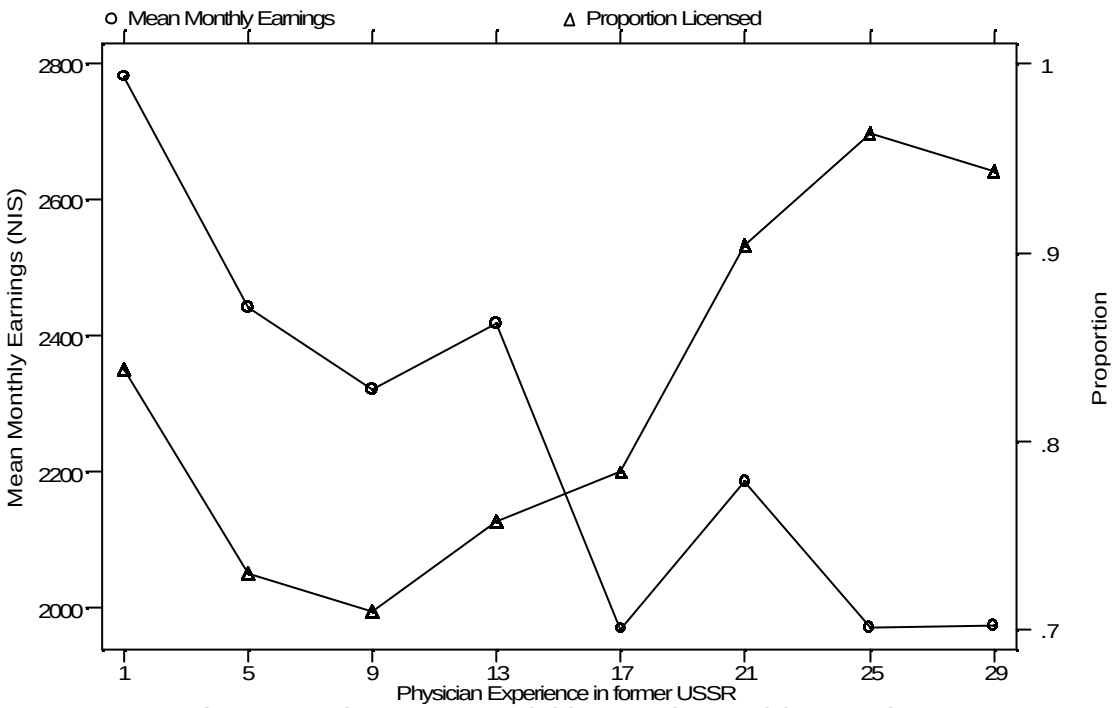

Figure 2: License Acquisition and Monthly Earnings

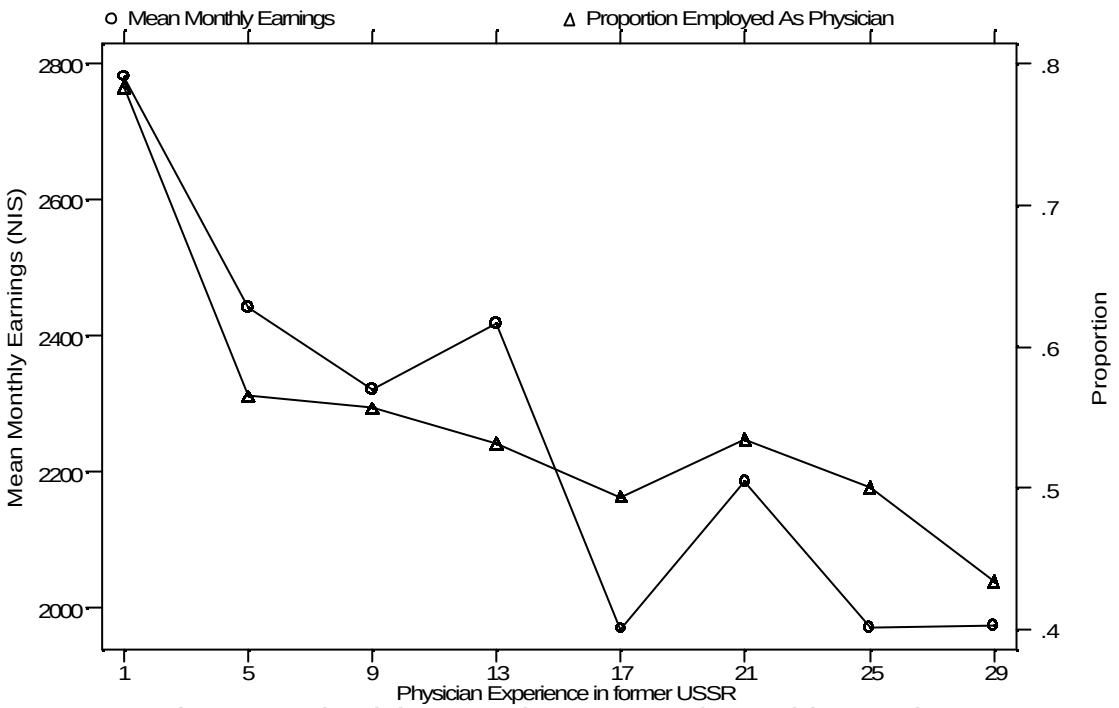

Figure 3: Physician Employment and Monthly Earnings

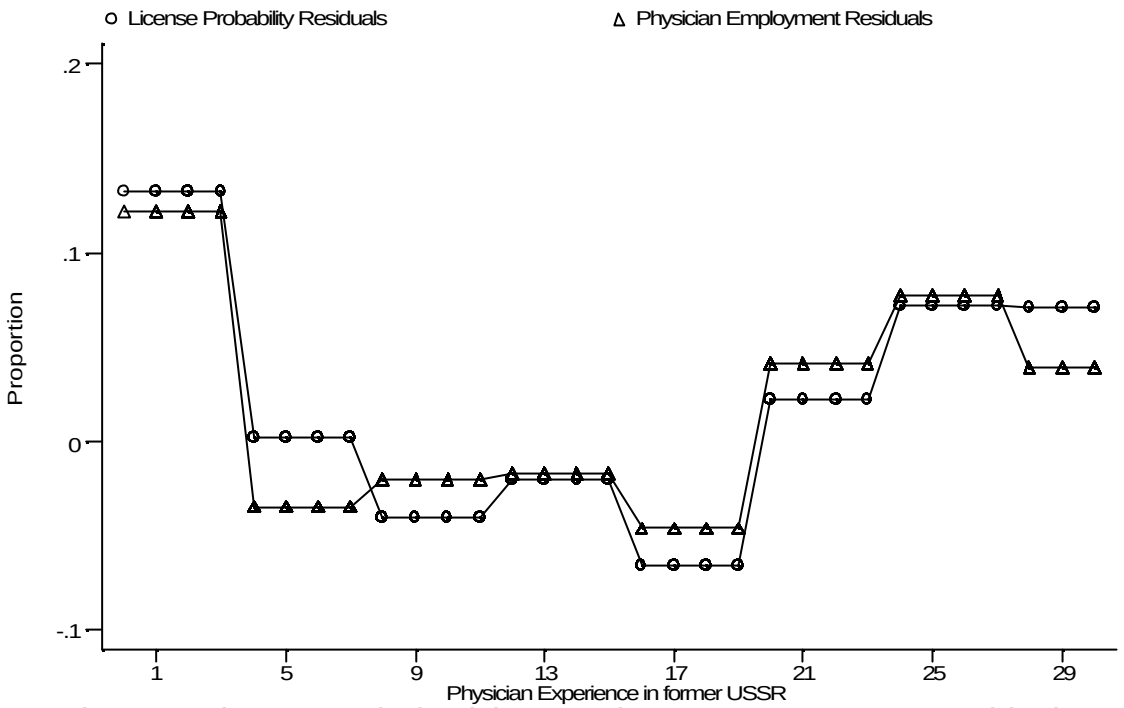

Figure 4: License and Physician Employment Outcomes - Residuals

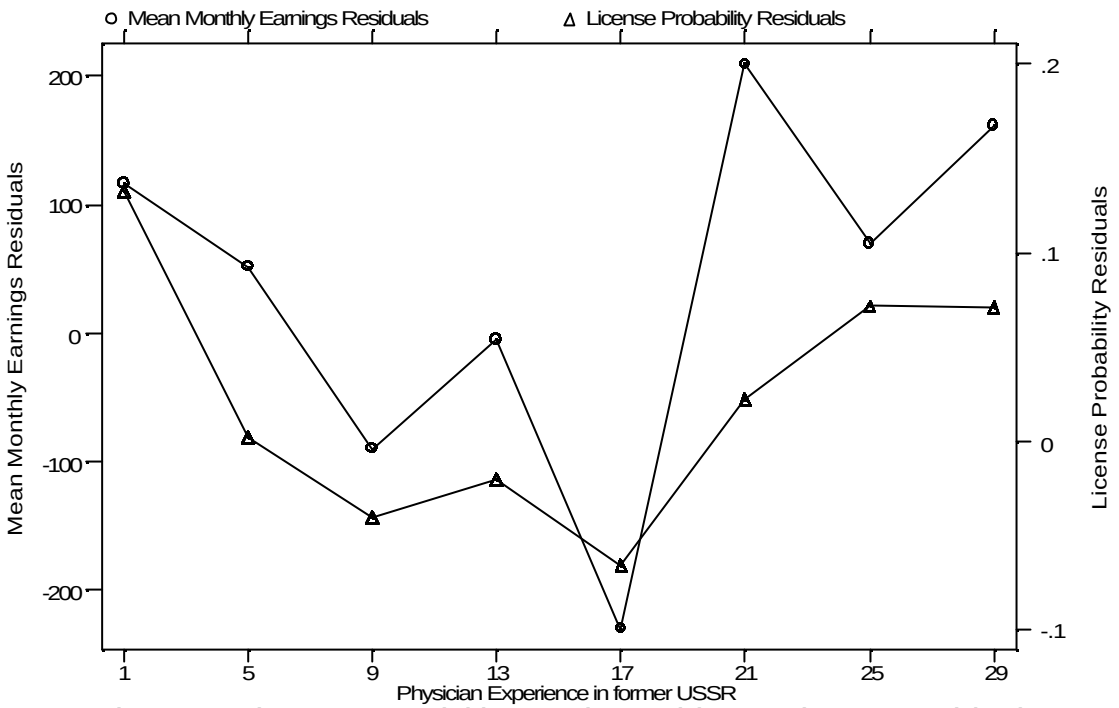

Figure 5: License Acquisition and Monthly Earnings - Residuals

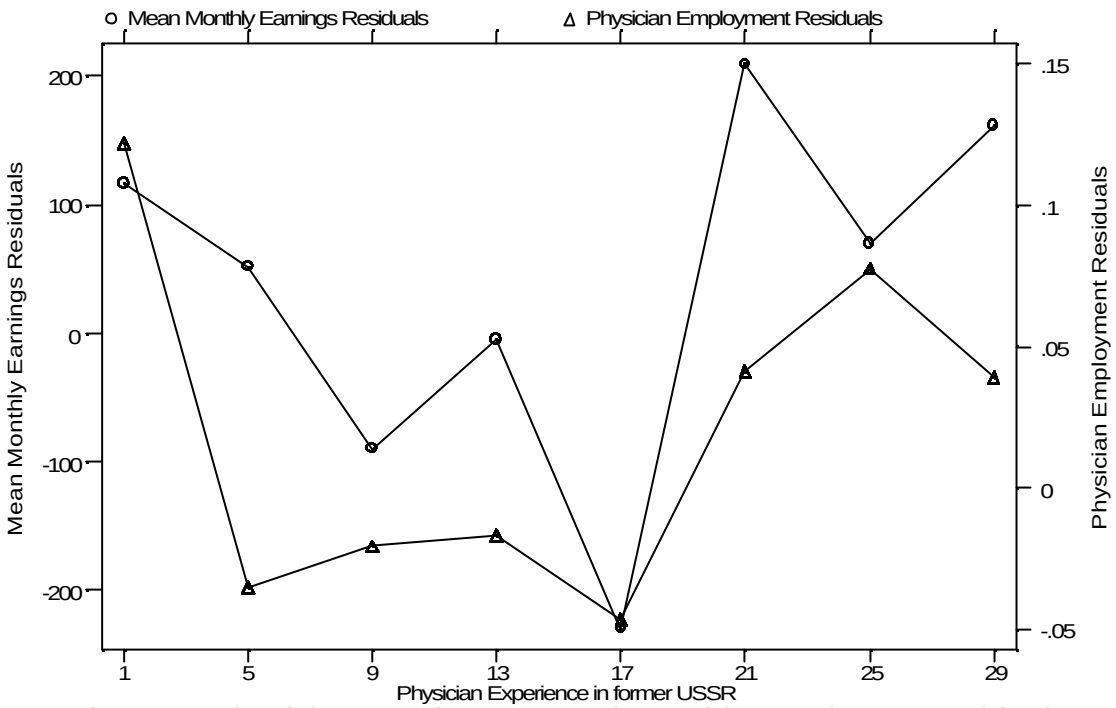

Figure 6: Physician Employment and Monthly Earnings - Residuals

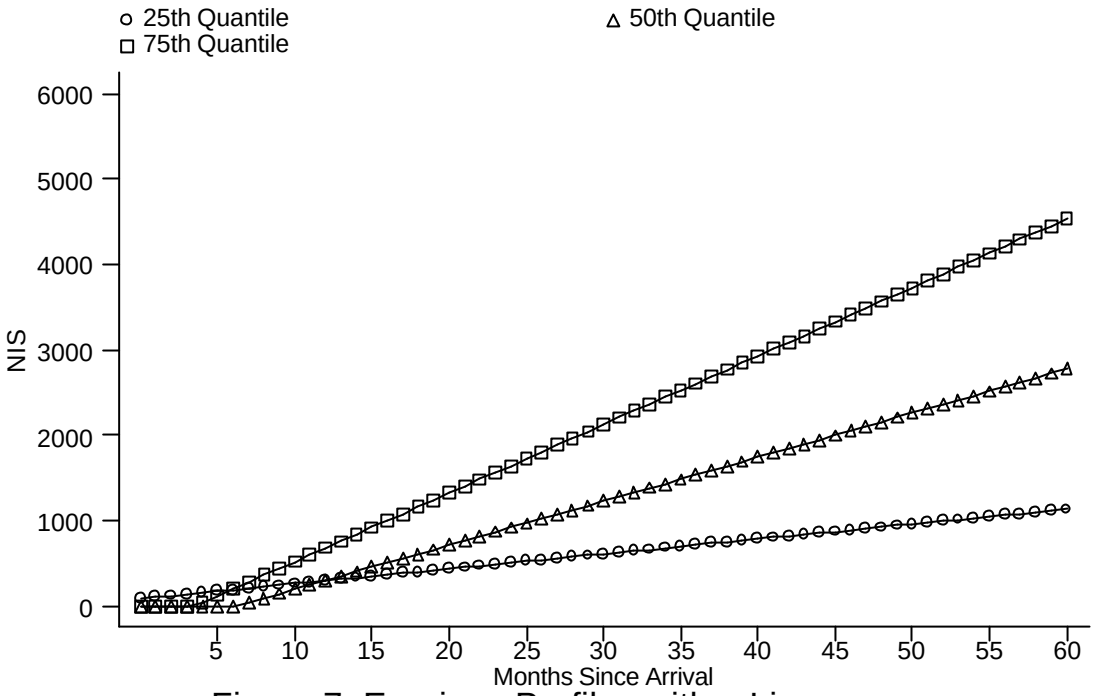

Figure 7: Earnings Profiles with a License

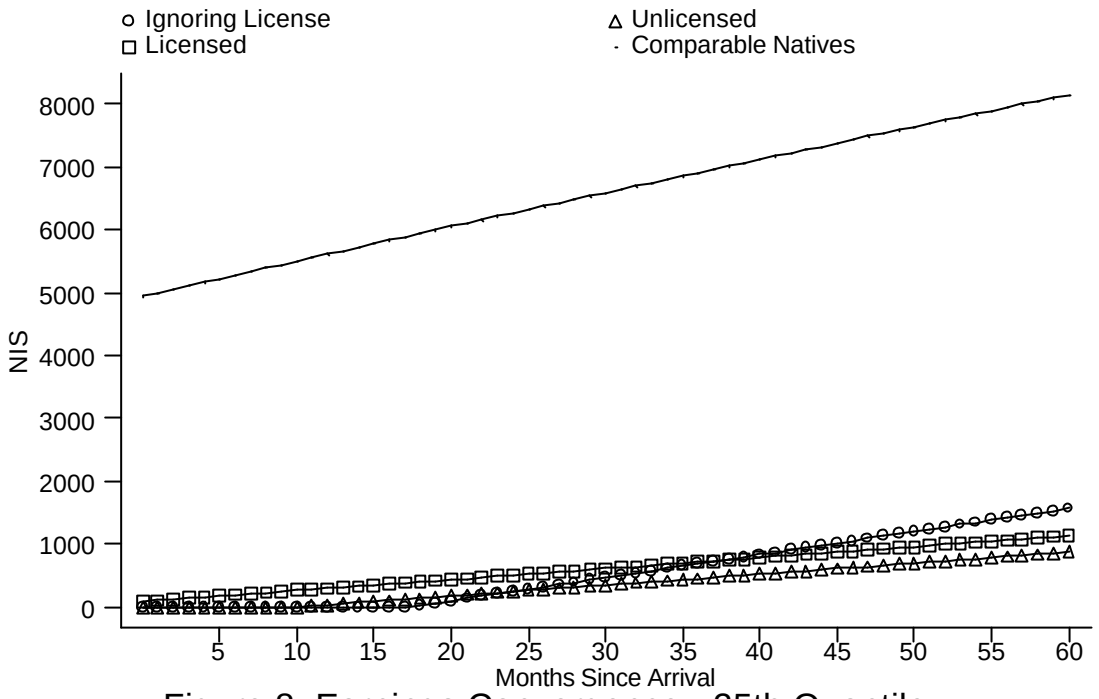

Figure 8: Earnings Convergence - 25th Quantile

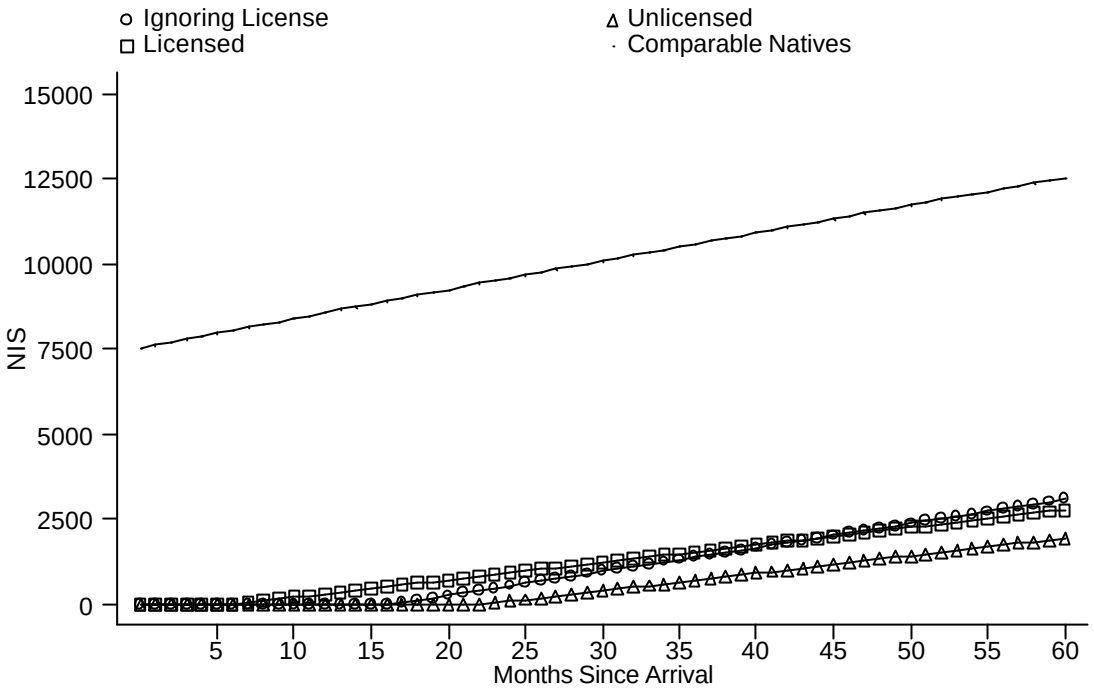

Figure 9: Earnings Convergence - 50th Quantile

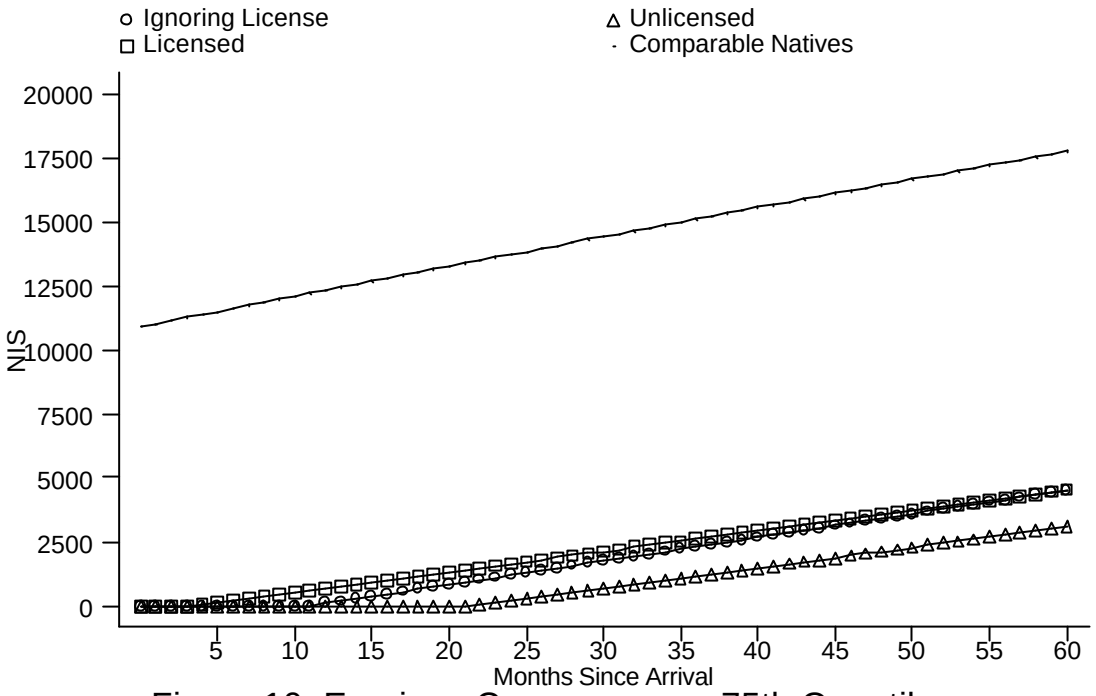

Figure 10: Earnings Convergence - 75th Quantile