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Doctors Without Borders: The Returns to an Occupational License for Soviet Immigrant Physicians in Israel

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November 2002

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
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ABSTRACT

Doctors Without Borders: The Returns to an Occupational License for Soviet Immigrant Physicians in Israel

Re-licensing requirements for professionals that move across borders are widespread. In this paper, we measure the returns to an occupational license using novel data on Soviet trained physicians that immigrated to Israel. An immigrant re-training assignment rule used by the Israel Ministry of Health provides an exogenous source of variation in re-licensing outcomes. Instrumental variables and quantile treatment effects estimates of the returns to an occupational license indicate excess wages due to occupational entry restrictions and negative selection into licensing status. We develop a model of optimal license acquisition which suggests that the wages of high-skilled immigrant physicians in the nonphysician sector outweigh the lower direct costs that these immigrants face in acquiring a medical license. Licensing thus leads to lower average quality of service. However, the positive earnings effect of entry restrictions far outweighs the lower practitioner quality earnings effect that licensing induces.

JEL Classification: D45, J17, J24, J31, J61, J62, L15, L51

Keywords: licensing, occupational mobility, regulation, information and product quality, immigration

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1 Introduction

Restricted entry into an occupation through occupational licensing requirements is a widespread phenomenon. At least 18 percent of the work force in the United States is affected by occupational licensing, exceeding the impact of the minimum wage and of unionization (Kleiner (2000)). Occupational licensing is also widespread in many other countries. In the European Union, for example, occupational entry restrictions are thought to substantially affect incentives for internal migration (see Krueger (2000)).

In the traditional theory of economic regulation, occupational licensing is viewed as a means by which practitioners capture monopoly profits (see Friedman and Kuznets (1945), Stigler (1971) and Posner (1974)). Licensing might be packaged as a means to protect the consumer but is more likely a tool used by practitioners to restrict labor supply and drive up the price of labor. More recent formulations of the theory tend to emphasize the potential benefits of occupational licensing. Licensing may improve the average quality of service offered by practitioners by preventing entry of less-competent practitioners, or by forcing less-competent practitioners to invest in human capital (Leland (1979), Shaked and Sutton (1981) and Shapiro (1986)). The net social benefits of licensing are thus ambiguous, but occupational licensing still leads to excess wages for practitioners.

The existing empirical evidence on the earnings effects of occupational entry restrictions, however, is inconclusive. Previous empirical studies, which mostly use data from the US and Canada, usually find higher mean earnings for individuals in regulated occupations, holding observed human capital levels constant (see, e.g., Benham, Maurizi, and Reder (1968), Muzondo and Pazderka (1980), Pashigian (1980), Kleiner and Kudrle (2000) and Kleiner (2000)). But the data used in these studies generally do not permit identification of the causal effects of entry restrictions on earnings. Entry restrictions and self-selection into the regulated occupation are often confounded.

In this paper, the returns to an occupational license are measured using novel data on the early labor market outcomes of Soviet immigrant physicians in Israel. The data provide a unique opportunity to identify the causal effects of occupational licensing on earnings and empirically assess the hypothesis of excess wages. The opportunity is unique for several reasons. First, Soviet immigrant physicians are a relatively homogeneous group of individuals in terms of previous education and type of work experience. Second, many Soviet immigrant physicians did not get re-licensed and/or obtain employment in their original profession. Third, and most important, the Israel Ministry of Health exogenously placed Soviet immigrant physicians on one of two different re-training tracks with inherently different probabilities of acquiring a license.

The exogenous assignment rule utilized by the Israel Ministry of Health places Soviet immigrant physicians either on a re-training track that requires the passing of a licensing exam (the exam track), or on a re-training track that grants a temporary medical license for six months and allows immigrant physicians to immediately practice medicine under observation (the observation track). At the end of the six month period under observation, immigrant physicians receive a permanent medical license with near certainty. Immigrant physicians with more than a cutoff number of years of previous physician experience are assigned to the observation track. Assigned re-training track is not a function of immigrant unobservables.

Although the Ministry of Health's assignment rule is a near deterministic function of years of previous physician experience and previous physician experience directly affects earnings in the host country, assigned re-training track can be used to construct instrumental variable estimates of the returns to an occupational license, thus correcting for nonrandom selection into licensing status. The discontinuities in the relationship between previous physician experience and licensing status can be matched to the discontinuities in the relationship between previous physician experience and immigrant earnings. The correlation between these discontinuities identifies

the causal effects of being licensed as long as it is the assignment rule and not some other mechanism that is generating the discontinuities in licensing outcomes.[1]

According to OLS estimates, Soviet immigrant physicians that acquire a medical license in Israel have substantially higher mean monthly earnings than their unlicensed counterparts. However, OLS estimates are biased to the extent that licensing status is related to potential outcomes without a license. Instrumental variables estimates that isolate the returns to a license among compliers, i.e., individuals that would not have obtained a license had they not been assigned to the observation track, yield an increase in mean monthly earnings that is considerably higher than that estimated by OLS.[2] The extremely large and significant instrumental variables estimates of the returns to a license, compared to OLS estimates, suggest negative selection and excess wages due to occupational entry restrictions.

The causal effect of an occupational license on the earnings of compliers is also estimated using a quantile treatment effects model. Quantile treatment effects estimates are less sensitive to the inclusion of zero earnings for the unemployed as well as high earnings outliers. Quantile treatment effects estimates indicate that the returns to an occupational license are large at all examined quantiles, but acquisition of a license more substantially increases the upper quantiles of the earnings distribution than the lower quantiles. More highly skilled practitioners thus benefit more from entry restrictions than do less-skilled practitioners.

The quantile treatment effects model is also used to estimate the distribution of earnings without a license among those immigrants that obtained a license. The

[1]The regression discontinuity identification 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 Krueger (2001).

[2]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)).

counterfactual earnings distribution indicates negative selection into licensing status, contrary to the usual hypothesis of positive selection. In order to illustrate how occupational licensing can lead to both excess wages and negative selection, a model of the decision to acquire a license is developed. The model, together with the empirical findings, suggests that the wages that high-skilled immigrant physicians earn as nonphysicians outweigh the lower direct costs that these immigrants face in acquiring a license. Licensing thus leads to lower average quality of service. However, the positive earnings effect of entry restrictions far outweighs the lower practitioner quality earnings effect that licensing induces.

Finally, the rate of median earnings convergence between immigrants and comparable natives is examined using the quantile treatment effects estimates. The large and persistent median earnings gap between licensed immigrants and comparable natives suggests that the excess wages immigrants capture in the regulated occupation may be tempered by consumer and/or employer preferences for native services.

The rest of the paper is organized as follows. The next section briefly describes the recent Soviet immigration wave to Israel and the institutional background of immigration physician re-licensing. Section 3 discusses the data source and descriptive statistics, reports OLS estimates of the returns to a license and presents a graphical analysis of the correlation between discontinuities. Section 4 describes the formal measurement framework. Section 5 reports reduced form, constant-effects instrumental variables estimates and quantile treatment effects estimates of the returns to a license. Section 6 presents the model of optimal license acquisition and interprets the empirical findings. Section 7 examines median earnings convergence between immigrants and comparable natives. Section 8 summarizes and concludes.

2 Background

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. The large influx of Soviet immigrants to Israel was a direct result of the fall of the Soviet Union and the ensuing political uncertainty.

Despite the unprecedented magnitude of the immigration wave, a large proportion of Soviet immigrants entered the Israeli labor market quickly, accepting jobs for which they were clearly over-qualified (see Weiss, Sauer and Gotlibovski (2003)). With time in Israel, 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 affected due to increased capital inflows and increased exports (see Friedberg (2001) and Eckstein and Weiss (2002)).

The mass immigration wave contained an unusually large number of physicians. Before the arrival of Soviet immigrant physicians, Israel already 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.[3] Between October 1989 and August 1993, approximately 12,500 Soviet immigrant physicians arrived, nearly doubling the potential supply of physicians. The demand for medical services also increased as the population grew by a substantial 10% during the period.

According to Israeli immigration law, physicians that were licensed to practice medicine in a foreign country, and that have their foreign medical credentials recognized by the Israel Ministry of Health, must pass a re-licensing exam in order to

[3] 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.

practice medicine. However, immigrant physicians that practiced clinical medicine and that have substantial previous physician experience are exempt from the exam. Until November 1992, the cutoff number of years required for exemption from the licensing exam was 20. The cutoff was subsequently lowered to 14 in order to increase the proportion of immigrant physicians with a license. The lowering of the cutoff was not publicized beforehand.

Immigrant physicians that are granted an exemption from the licensing exam must work under observation for six months in designated public hospitals or community clinics. During the six month work under observation period, immigrants receive a salary and minimal income support from the Ministry of Absorption. At the end of the six month period these immigrants receive a permanent license in general medicine with near certainty.

Immigrant physicians that are required to pass the licensing exam are eligible, but not required, to participate in a government sponsored examination preparation course. Over 90% of immigrants that are referred to the licensing exam choose to participate in a preparation course. Preparation courses last six months, are offered twice a year and are held in public hospitals throughout the country. Immigrant physicians registered for a preparation course also receive minimal income support from the Ministry of Absorption. A permanent license in general medicine is acquired after passing the exam.[4]

After successful completion of the re-licensing requirements, immigrant physicians must request to be recognized as specialists in order to practice medicine in their former specialty. The Ministry of Health denies an overwhelming majority of these requests. Immigrant physicians whose requests are denied must fulfill a post-licensing residency requirement that includes successful completion of two specialty exams. The

[4]Approximately 14% of the immigrant physicians chose to re-train in alternative professions. Many of these immigrant physicians re-trained in paramedical professions such as gerontology, emergency medicine and alternative medicine.

residency requirement can last a number of years depending upon medical specialty.[5] The status of specialist is not required for performing rounds in hospitals or treating patients in residential communities.

3 Data

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 Israel 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.[6] Of the immigrants that submitted their credentials, 3% did not have their credentials recognized.[7] 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 aus-

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

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

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

pices of the JDC-Brookdale Institute of Jerusalem, The Israel Ministry of Health and the Israel Ministry of Immigrant Absorption. The random sample of 731 immigrant physicians was stratified 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 stratification rules, to substitute for those on the original list that could not be interviewed. In total, $1,002$ immigrant physicians were approached for interviewing. 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.

3.1 Descriptive Statistics

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

The figures in Table 1 show that mean monthly earnings (including zeros for the unemployed), 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. 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 living at home at the time of arrival. Note that a considerable proportion of immigrant physicians on the observation track are not employed as physicians. Immigrants that are employed but not working as physicians

are mostly working as post-secondary education teachers, social workers, qualified nurses, optometrists, medical technicians and paramedics. There are also immigrant physicians working in less skilled occupations as unqualified nursemaids, cleaners in institutions, security guards, and skilled and unskilled workers in industry.[8]

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 only slight differences in marital status upon arrival, republic of origin and type of medical practice in the former USSR. There is a large difference in former specialist status. Note that over 95% of the immigrants in the sample arrived during the years 1990 and 1991.[9]

3.2 OLS Estimates

OLS estimates of the increase in monthly earnings (including zeros for the unemployed) due to acquisition of a license are reported in Table 2. Column (1) does not include any other covariates and yields a precisely estimated coefficient on licensed of 1279 New Israeli Shekel (NIS).[10] In 1994, the year in which earnings are reported, 1 NIS is approximately equal to .33 US dollars. The estimated increase in earnings of 1279 NIS corresponds to a percentage impact of 109%.[11]

[8] Among immigrant physicians employed as physicians, 41% work for the government (local and national). The remainder work for HMO's and other private employers. Only 6% found work as a direct continuation of re-training.

[9] The percentage of immigrant physicians among all immigrants from the former USSR that arrived after 1991 is significantly smaller.

[10] All standard errors are heteroscedasticity robust.

[11] The percentage impact is calculated as the ratio of the coefficient on licensed to the fitted value from the regression with the licensed dummy set to zero and other covariates set to the means among individuals with a license, when other covariates are included.

Column (2) adds covariates to the regression, but excludes previous physician experience. The other regressors include a dummy for age on arrival (older than 50), dummies for year of arrival, months in Israel, gender, marital status, profession of spouse, number of children living at home under 18, size of last city of residence, Republic of origin, pursuit of an advanced medical degree, previous specialist status, previous type of medical practice and type of reported earnings (after-tax and/or after other deductions.) The coefficient on licensed in this latter regression is a precisely estimated 1211, which corresponds to a percentage impact of 98%. Column (3) adds years of physician experience in the USSR and its square. The coefficient on licensed further decreases in strength to 1162 but is still precisely estimated. The percentage impact is 90%.

Column (4) reports the results of adding an indicator for being employed as a physician in the full sample. The coefficient on licensed turns negative, is quite small in magnitude and is not precisely estimated. The coefficient on physician, however, is a substantial 2324 and is precisely estimated. The OLS results do not indicate a significant return to a license when not employed as a practicing physician. A significant coefficient on licensed in this latter specification would have been suggestive of a signalling value to a medical license.

Columns (5) and (6) repeat the specifications in Columns (3) and (4) for the subsample of immigrants that have previous physician experience between 14 and 26 years. This subsample of immigrants is referred to as the "discontinuity" sample. Restricting the analysis to the discontinuity sample helps control for differences in unobservables between immigrants that are affected by the assignment rule and those that are not. The experience levels 14 and 26 are, respectively, the 45th and 75th percentiles in the previous physician experience distribution.[12] The estimated coefficient on licensed in the discontinuity sample is considerably stronger than in

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

the corresponding specification in the full sample. The estimated coefficient without adding a physician employment indicator is 1254 with a standard deviation of 373. The percentage impact is 114%. Column (6) reports the results for the specification which adds the physician employment indicator in the discontinuity sample only. The estimated coefficient on licensed is now positive but is still negligible in magnitude and imprecisely estimated.[13]

3.3 Graphical Discontinuity Analysis

The discontinuities in the data that arise as a result of the re-training assignment rule are illustrated in Figures 1 through 5. In Figure 1, the strong relationship between assigned re-training track and license acquisition can be clearly seen. 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 fluctuates between 12 and 33 percent. At 20 years of experience the proportion sharply jumps up and fluctuates between 92 percent and 100 percent. After 26 years of experience, the proportion remains at 100 percent.[14]

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

[13] The effect of license acquisition on employment probabilities is similar to the effect on physician employment probabilities. The effect on physician employment probabilities will be discussed below.

[14] Only 32 out of the 729 immigrants in the sample were assigned to the observation track according to the 14 year cutoff.

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 at the time of the survey and the proportion acquiring a license against years of physician experience in the former USSR.[15] Note that mean monthly earnings decline sharply with years of previous 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 tend to increase, breaking the downward trend, with sharp increases in the proportion acquiring a license.

The conclusions drawn from Figures 1 and 2 are tentative because they do not take into account the effect of other covariates on licensing and monthly earnings outcomes. It is possible that stronger correlations in discontinuities are being hidden by effects 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 affect licensing and monthly earnings outcomes differently in magnitude and direction.

Figure 3 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 the same covariates as in the OLS regressions in the previous section, but exclude previous physician experience. The figures 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

[15]Four year experience intervals are used to construct Figures 2 through 5 instead of the single-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.

range in which there is variation in assignment to the observation track. In contrast, the discontinuities in employment as a physician are somewhat sharper outside of the relevant experience range.

Figure 4 plots license residuals and monthly earnings residuals against previous physician experience. The figures 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 5 re-examines the relationship between monthly earnings, employment as a physician and previous physician experience. The employment as physician residuals decline sharply with imported physician experience at low levels of experience and increase with the monthly earnings residuals at both the 13 and 21 years of previous experience interval midpoints. However, the correlation in discontinuities between employment as a physician and monthly earnings appears weaker than between license acquisition and monthly earnings.

4 Measurement Framework

4.1 Constant-Effects Model

The discontinuities in the data, described graphically in the previous section, can be exploited within a formal model of statistical inference to identify the causal effect of an occupational license on earnings. Consider the following linear, constant-effects causal model that connects the earnings of immigrant i at time t, Y_{it}, with the occupational 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 specific to individuals at time t, ϵ_{it}:

$$Y_{it} = X_i'\beta + t\delta + L_{it}\alpha + \epsilon_{it}. \tag{1}$$

Immigrant characteristics at the time of arrival, included in the vector X_i, are the same as those included in the previous OLS regressions. Importantly, the vector X_i contains polynomials in previous physician experience in order to control for smooth effects of experience on earnings. Note that time in Israel, t, is included as a control variable in (1) and is, like the other elements of X_i, widely believed to be exogenous to potential labor market outcomes among those immigrants that arrived in the first three years of the immigration wave. All of the physicians in the sample arrived in Israel within this time frame.[16] The time in Israel variable generically captures changes in language ability, social networks and knowledge of local institutions.[17]

The interpretation of equation (1) is that it describes the earnings of immigrants under alternative assignments of licensing status, controlling for any effects 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 ϵ_{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 "first stage" relationship, or the association between licensing status, assignment to the observation track and X_i and t is:

$$L_{it} = X_i'\pi_0 + t\pi_1 + TR_i\pi_2 + \xi_{it}, \tag{2}$$

where $TR_i = 1$ indicates assignment to the observation track and $TR_i = 0$ indicates assignment to the exam track. The error term ξ_{it} is defined as the residual from

[16] 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 was greater access to information, government offices and consulates.

[17] 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.

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 α would thus be biased upward. It is also possible that immigrants that acquire a license have differentially lower earnings potential without a license and a lower opportunity cost of re-training. In this latter case, the OLS estimate of α would likely be biased downward. In either case, the non-zero correlation between ϵ_{it} and ξ_{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 previous physician experience on monthly earnings in Israel are adequately controlled by the smooth functions of previous physician experience included in $X_i'\beta$ and "partialled out" of TR_i by the inclusion of smooth functions of previous physician experience in $X_i'\pi_0$. 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 an occupational license.[18]

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 weaker partial correlation between assigned re-training track and employment as a physician displayed in the graphical analysis.

4.2 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

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

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. An alternative estimation strategy that is less sensitive to the inclusion of zero earnings, that is less demanding than formal sample-selection models, and that is less sensitive to earnings outliers, is the quantile treatment effects model (Angrist (2001) and Abadie, Angrist and Imbens (2002)). The quantile treatment effects model modifies traditional quantile regression for inclusion of an endogenous binary regressor.[19]

The quantile treatment effects model specifies a linear relationship between earnings and licensing status at each quantile. That is,

$$Q_\theta \left[Y_i | X_i, L_i, L_{1i} > L_{0i} \right] = X_i' \beta_\theta + L_i \alpha_\theta \tag{3}$$

where L_{1i} denotes licensing status when assigned to the observation track ($TR_i = 1$) and L_{0i} denotes licensing status when assigned to the exam track ($TR_i = 0$).[20] The coefficient α_θ has a causal interpretation because L_i is independent of potential earnings outcomes conditional on X_i and being a complier ($L_{1i} > L_{0i}$).[21]

The parameters of the quantile treatment effects model are estimated by minimizing the sample analog of

$$E \left[\kappa_i \rho_\theta \left(Y_i - X_i' b_\theta - L_i a_\theta \right) \right] \tag{4}$$

where ρ_θ 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 $E \left[\kappa_i | X_i, L_i, Y_i \right]$ where

$$E \left[\kappa_i | X_i, L_i, Y_i \right] = 1 - \frac{L_i \left(1 - E \left[TR_i | Y_i, L_i, X_i \right] \right)}{\left(1 - E \left[TR_i | X_i \right] \right)} - \frac{(1 - L_i) E \left[TR_i | Y_i, L_i, X_i \right]}{E \left[TR_i | X_i \right]}. \tag{5}$$

[19] See Chamberlain (1991) and Buchinsky (1991, 1994) for discussion and applications of traditional quantile regression.

[20] Time in Israel is suppressed for convenience.

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

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

5 Estimation Results

5.1 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 monthly earnings in the full sample. Without controls for other regressors and previous 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 experience. The association between being assigned to the observation track and monthly earnings becomes significantly positive with the addition of other regressors and previous physician experience and its square. The coefficient on track in this latter specification is 571 with a standard error of 255. The percentage impact is 14%. Column (4) reports the same specification as in Column (3) in the discontinuity sample only. The coefficient on track is stronger, 628, but somewhat less precisely estimated. The percentage impact increases to 23%.

Columns (5), (6) and (7) of Table 3 report the effect of being assigned to the observation track on licensing status in the full sample. In all three linear probability models, assignment to the observation track increases the probability of acquiring a license. The estimated coefficient on track, without any other regressors, is 0.159. Including other regressors increases the estimated coefficient to 0.231. Adding previous physician experience and its square further increases the estimated coefficient on track to 0.338. Column (8) reports the same specification as in Column (7) in the discontinuity sample only. The coefficient on track in this latter specification is 0.258. In all four specifications the coefficient on track is precisely estimated.

Columns (9), (10) and (11) of Table 3 report the effect of being assigned to the observation track on employment status as a licensed physician in linear probability models in the full sample. Without controls for previous physician experience, there is a negative association between track and employment status as a physician. Adding previous physician experience yields a positive coefficient on track, but the association is not statistically different from zero. The specification with previous physician experience in the discontinuity sample only, reported in Column (12), produces an imprecise negative association.

Since there is a weak first stage relationship between employment status as a physician and assigned re-training track, in the linear probability models, it is not possible to consistently estimate the effect of being employed as a physician on earnings. The strong first stage linear relationship between acquisition of a license and assigned re-training track does allow consistent estimation of the effect of obtaining a license on earnings and thus inference on the existence of excess wages. The only drawback is that the effect of obtaining a license on earnings will include the returns to a medical license in nonphysician jobs. However, the OLS results in Table 2 suggest that the returns to a license outside of the medical profession are negligible.

5.2 Instrumental Variables Estimates

Instrumental variables estimates of the effect of acquiring a license in a constant-effects model are reported in Table 4. Acquisition of a license is instrumented by assigned re-training track.[22] Columns (1), (2) and (3) of Table 4 report the estimated coefficients on licensed without any other regressors, with other regressors but excluding previous physician experience, and with other regressors and a quadratic in previous physician experience, respectively. The estimated coefficient on licensed with other regressors and a quadratic in previous physician experience is 1638 with a

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

standard error of 706. The percentage impact is 182%. Correcting for nonrandom selection in licensing status in a constant-effects framework yields a percentage impact that is approximately double the corresponding percentage impact produced by OLS (90%).

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 previous physician experience. The estimated effect of a license in this latter specification is 1865 with a standard error of 864. The percentage impact grows to 262%.

Column (5) of Table 4 reports the results of including a quadratic in previous physician experience in the discontinuity sample only. The estimated coefficient on licensed further grows to 1886, but is somewhat less precisely estimated The percentage impact is 342%. The corresponding percentage impact according to OLS in Table 2 is 114%.

There are several additional results to note that are not shown in Table 4 for the sake of brevity.[23] First, there are no significant interactions between licensing status and the other covariates, where licensing status is instrumented by assigned re-training track in the interaction terms as well. Second, difference-in-differences type specifications that control for cohort (subject to 14 year assignment cutoff), having more than 14 years of previous physician experience and an interaction between these latter two dummies do not yield significant coefficients on the interaction terms. The implication is that the small subset of individuals that have between 14 and 19 years of experience and that are assigned to different re-training tracks do not differentially contribute to the identification of the returns to a license.

[23] The additional results are available from the authors upon request.

5.3 Quantile Regression and Treatment Effect Estimates

The top panel of Table 5 reports quantile regression and quantile treatment effect estimates of the effect of licensing status on monthly earnings in the full sample. Licensing effects are measured at the 0.15, 0.25, 0.50, 0.75 and 0.85 quantiles of the monthly earnings distribution. Quantile regression estimates treat licensing status as exogenous and produce the largest percentage impacts of acquiring a license, 93% and 117%, at the 0.15 and 0.25 quantiles, respectively. The percentage impact steadily declines at higher quantiles, falling to 59% percent at the 0.85 quantile. At each quantile the coefficient on licensed is precisely estimated.

Quantile treatment effects estimates that correct for the endogeneity of licensing status yield substantially different results. The percentage impact of acquiring a license at the 0.15 and 0.25 quantiles are both 50%, considerably lower than the quantile regression estimates. The percentage impact at the 0.50, 0.75 and 0.85 quantiles are, on the other hand, considerably higher than the quantile regression estimates. The quantile treatment effects model produces the largest percentage impact, 169%, at the 0.85 quantile. At each quantile the coefficient on licensed is precisely estimated.[24]

Note that the highest percentage impact of 169% at the 0.85 quantile is less than the percentage impact estimated in the corresponding specification in the constant-effects model in Table 4 (182%). This suggests that the licensing effect on mean earnings in the constant-effects model is relatively more sensitive to high earnings outliers than the inclusion of zero earnings.

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

[24]The first step estimate of $E[\kappa_i|X_i, L_i, Y_i]$ in the quantile treatment effects procedure is obtained by estimating $E[TR_i|Y_i, L_i, X_i]$ and $E[TR_i|X_i]$ in (5) by probit. Predicted values of $E[\kappa_i|X_i, L_i, Y_i]$ that are negative are set to zero leading to a reduced sample size. Standard errors are computed by bootstrapping the first and second step estimations 100 times.

reduced variation in earnings and smaller sample size. The results indicate a large effect on median earnings, 239%. The corresponding percentage impact when treating licensed as exogenous is 108%. Both effects are precisely estimated. These percentage impacts stand in sharp contrast to the percentage impact on mean earnings in the discontinuity sample (342%).

The quantile regression and treatment effects estimates reported in Table 5 can be used to estimate the marginal distribution of monthly earnings without a license 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 setting the licensing status dummy to zero. The counterfactual earnings of all immigrants with a license can be approximated by the counterfactual earnings of compliers only, under the assumption that compliers are a random sample of all immigrants with a license. 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, and with the licensing status dummy set to zero, but using the quantile regression coefficients.

The figures in the top panel of Table 6 show that, in the full sample, licensed immigrants have lower potential earnings without a license than unlicensed immigrants at all quantiles of the monthly earnings distribution. The results thus indicate negative selection into licensing status. The negative selection bias is greatest in the tails and at the median of the distribution, varying between 36% and 38%. The bottom panel of Table 6 shows that negative selection bias is also present at the median of potential earnings in the discontinuity sample.

6 Entry Restrictions and Self-Selection

The empirical findings indicate exceedingly large returns to the acquisition of a license as well as negative selection into licensing status. Negative selection is contrary to the usual hypothesis of positive selection in which licensing improves the average quality of service provided by practitioners. In this section, a decision model is developed that illustrates how licensing can lead to both excess wages and lower average quality of service.[25]

The model assumes a continuum of workers of type η, where η is drawn from a distribution $F(\eta)$. Individuals live for two periods and have a discount factor r. In the first period, individuals choose whether to invest in acquiring a license or not. In the second period, all individuals work. Acquisition of a license in the first period involves both direct and indirect costs. The direct costs include the time and effort spent studying for exams and/or meeting other licensing requirements. Indirect costs include the wage the person could earn in the unlicensed occupation in the first period. While direct costs are likely to be lower for more able (higher η) individuals, the opportunity cost of acquiring a license is likely to increase with ability. The existence of direct costs to meeting licensing requirements imply that fewer people will enter the regulated occupation than otherwise. The assumption that costs vary over individuals of different types generates selection into the licensed occupation.

The direct costs of acquiring a license are specified as $\frac{C}{\eta}$, reflecting that it is easier for more able individuals to study for the licensing exam. Production in the licensed and unlicensed sectors, $Y_L(\eta, N_L)$ and $Y_U(\eta, N_U)$, is assumed to be increasing in η, thus generating higher opportunity costs to acquiring a license for persons with higher ability. It is also assumed that there is diminishing returns with respect to employment, N_L and N_U.

[25] The model is similar in spirit to the model of teacher certification developed in Angrist and Guryan (2002).

Individuals seek to maximize lifetime income by choosing whether or not to acquire a license. Individuals choose to acquire a license and work in the licensed occupation in the second period, rather than work in the unlicensed occupation in both periods, when

$$\frac{w_L - w_U}{(1+r)} \geq \frac{C}{\eta} + w_U. \tag{6}$$

w_L and w_U are the wages in the licensed and unlicensed occupations and are defined as the marginal products of labor in the two occupations, respectively. Equation (6) states that a license will be acquired if the discounted increase in earnings in the second period is greater than or equal to the sum of direct and indirect costs in the first period.

The decision rule can also be expressed in terms of the maximum direct cost component C that individuals are willing to incur to acquire a license. The maximum C is denoted as $C^{\eta}_{\max}$. $C^{\eta}_{\max}$ equates lifetime income in the two sectors and is a function of η,

$$C^{\eta}_{\max} = \frac{\eta[w_L - (2+r)\, w_U]}{(1+r)}. \tag{7}$$

An individual of type η thus chooses to work in the licensed occupation if $C^{\eta}_{\max} \geq C$ and chooses to work in the unlicensed occupation if $C^{\eta}_{\max} < C$.

$C^{\eta}_{\max}$ depends on η in the following way:

$$\begin{aligned} \frac{\partial C^{\eta}_{\max}}{\partial \eta} &= \frac{[w_L - (2+r)\, w_U]}{(1+r)} \\ &\quad - \frac{\eta[\frac{\partial w_L}{\partial \eta} - (2+r)\, \frac{\partial w_U}{\partial \eta}]}{(1+r)}. \end{aligned} \tag{8}$$

If higher ability reduces the direct costs of acquiring a license (the first term in (8)) by more than it increases foregone wages in the unlicensed sector (the second term in (8)) then $\frac{\partial C_{\max}}{\partial \eta} > 0$ and higher ability types are more willing to pay for the license. In this case, individuals with $\eta \in [\tilde{\eta}, \overline{\eta}]$ work in the licensed occupation and individuals

with $\eta \in [\underline{\eta}, \widetilde{\eta}]$ work in the unlicensed occupation, where $\widetilde{\eta}$ is such that $C^{\widetilde{\eta}}_{\max} = C$. This case corresponds to positive selection into the licensed occupation.

When there is positive selection, average wages in the licensed and unlicensed occupations are, respectively,

$$\begin{aligned} E(w_L) &= \int_{\widetilde{\eta}}^{\overline{\eta}} \left[\frac{\partial Y_L(\eta, (1 - F(\widetilde{\eta})))}{\partial N_L} \right] f(\eta) d\eta, \\ E(w_U) &= \int_{\underline{\eta}}^{\widetilde{\eta}} \left[\frac{\partial Y_U(\eta, F(\widetilde{\eta}))}{\partial N_U} \right] f(\eta) d\eta. \end{aligned} \tag{9}$$

Note that licensing, a higher C, unambiguously increases average earnings in the licensed occupation because $\widetilde{\eta}$ increases. A higher $\widetilde{\eta}$ reduces the supply of licensed workers ($N_L = 1 - F(\widetilde{\eta})$) thus raising wages for all types in the licensed occupation. This is the entry restriction effect on earnings. A higher $\widetilde{\eta}$ also raises average wages by increasing the lower bound of the integral $E(w_L)$ in (9). This is the higher average practitioner quality effect on earnings.

If higher ability reduces the direct costs of acquiring a license by less than it increases foregone wages in the unlicensed sector, then $\frac{\partial C_{\max}}{\partial \eta} < 0$ and higher ability types are less willing to pay for the license. In this case, individuals with $\eta \in [\underline{\eta}, \widetilde{\eta}]$ work in the licensed occupation and individuals with $\eta \in [\widetilde{\eta}, \overline{\eta}]$ work in the unlicensed occupation. This is the case of negative selection into the licensed occupation.

When there is negative selection, average wages in the licensed and unlicensed occupations are, respectively,

$$\begin{aligned} E(w_L) &= \int_{\underline{\eta}}^{\widetilde{\eta}} \left[\frac{\partial Y_L(\eta, F(\widetilde{\eta}))}{\partial N_L} \right] f(\eta) d\eta, \\ E(w_U) &= \int_{\widetilde{\eta}}^{\overline{\eta}} \left[\frac{\partial Y_U(\eta, (1 - F(\widetilde{\eta})))}{\partial N_U} \right] f(\eta) d\eta. \end{aligned} \tag{10}$$

Negative selection implies that licensing will have an ambiguous overall effect on average earnings in the licensed occupation. Although a higher C reduces the supply of licensed workers, by reducing $\widetilde{\eta}$ and raising wages for all types in the licensed

occupation, a lower $\widetilde{\eta}$ reduces the upper bound of the integral $E(w_L)$ in (10). Entry restrictions raise average wages in the licensed occupation but reduced average practitioner quality lowers the average wages of practitioners.

The negative selection found in the empirical analysis suggests that the wages that high-skilled immigrant physicians earn as nonphysicians outweigh the lower direct costs that these immigrants face in acquiring a license. Licensing requirements for immigrant physicians thus lead to lower average quality of service. However, the positive earnings effect of entry restrictions far outweighs the lower practitioner quality earnings effect that licensing induces.

7 Earnings Convergence

Occupational entry restrictions and the acquisition of an occupational license may have important implications for the economic assimilation of immigrants. In order to assess the importance in this case, the median monthly earnings of immigrant physicians that acquired a license are compared, at different points in time since arrival, to the median monthly earnings that immigrants would have received as native physicians.[26]

The median monthly earnings of licensed immigrant physicians over time are simulated using the coefficients from the quantile treatment effects model. The median earnings of licensed immigrants as comparable natives are simulated using the coefficients from a native physician median regression and the means of the covariates among the licensed immigrants. The native physician data are drawn from the Israel Central Bureau of Statistics Income Surveys of 1988 through 1995. The sample contains 324 observations on male and female native physician earnings (including

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

zeros for the unemployed). The covariates in the median regression are age and age squared, an indicator for being male, an indicator for being married, an indicator for being older than 46 and a full set of interactions with this latter age dummy. Native physicians that are older than 46 have much stronger wage growth as a high percentage of them are specialists. Immigrant physicians are more comparable with younger native physicians since only 3% of the immigrants are specialists and 15% are in specialist residency at the time of the survey.[27]

The differences in median earnings between immigrants and comparable natives are illustrated in Figure 6. The figures show a large and rather persistent earnings gap over the first 5 years since arrival. The median earnings of immigrants are 25% and 34% the median earnings of comparable natives in months 24 and 60, respectively. Although acquisition of a license has a large percentage impact on the earnings of immigrant physicians, acquisition of a license does not appear to substantially close the earnings gap between licensed immigrants and comparable natives at the general practitioner level. The excess wages that immigrants capture in the regulated occupation may be tempered by consumer and/or employer preferences for native services. It is also possible that the large and persistent gap is due to positive selection of native physicians into the licensed occupation in comparison to the negative selection among immigrants.

8 Conclusion

This paper uses novel data on the early labor market outcomes of Soviet immigrant physicians in Israel, and an exogenous immigrant re-training assignment rule, to identify the returns to an occupational license. Instrumental variables estimates of the

[27] The earnings of younger native physicians were not observed to be adversely affected by the mass immigration (see Sussman and Zakai (1999)). The coefficients of the native physician median regression are available upon request from the authors.

returns are large and considerably higher than those estimated by OLS. The large returns to an occupational license are highly suggestive of excess wages due to occupational entry restrictions.

The returns to an occupational license are also measured using a quantile treatment effects model. The quantile treatment effects model is less sensitive to the inclusion of zero earnings for the unemployed as well as high earnings outliers. The quantile treatment effects estimates also yield large returns to a license, especially in the upper quantiles of the complier earnings distribution. More highly skilled practitioners thus benefit more from license acquisition than do less skilled practitioners. The quantile treatment effects estimates also reveal negative selection into licensing status, contrary to the usual hypothesis of positive selection.

In order to illustrate how occupational licensing can lead to both excess wages and negative selection, a model of the decision to acquire a license is developed. The model, together with the empirical findings, suggests that the wages that high-skilled immigrant physicians earn as nonphysicians outweigh the lower direct costs that these immigrants face in acquiring a license. Licensing thus leads to lower average quality of service. However, the positive earnings effect of entry restrictions far outweighs the lower practitioner quality earnings effect that licensing induces.

Lastly, the analysis of median earnings convergence between licensed immigrant physicians and comparable natives shows that the importance of license acquisition for the economic assimilation of immigrants is not substantial. There is a large and persistent median earnings gap between immigrants and comparable natives. Employer and/or consumer preferences for native services may temper the excess wages that immigrants capture in the regulated occupation.

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Table 1: Descriptive Statistics

Variable	Exam Track	Observation Track
% Licensed	72.71	88.57
% Employed	86.23	65.4
% Physician	58.7	37.14
Monthly Earnings (NIS)	2,552	1,703
	(1,811)	(2,011)
Months in Israel	44.3	42.7
	(6.2)	(7.4)
Age Upon Arrival	34.5	53.1
	(5.0)	(7.4)
Previous Physician Experience	10.3	28.2
	(4.8)	(7.6)
% Male	44.44	44.13
% Married Upon Arrival	84.3	79.36
No. of Children under 18 Upon	1.23	0.59
Arrival	(0.75)	(0.76)
% from Russia	46.14	41.59
% from Ukraine	16.67	23.81
% from City > 1,000,000	52.17	53.33
% Advanced Medical Degree	26.81	25.4
% Former Specialist	40.34	85.1
% Former General Practitioner	22.95	18.73
% Former Pediatrician	16.18	12.7
% Former OBGY	7.49	5.71
% Arrived in 1990	77.3	67.62
% Arrived in 1991	20.05	26.03
N	414	315

Notes: The Table reports means and percentages by assigned re-training track. Standard deviations are in parentheses. Monthly earnings are in 1994 New Israeli Shekels (NIS) where 1 NIS equals 0.33 US dollars. There are 382 exam track earnings observations and 294 observation track earnings observations (including zeros for the unemployed).

Table 2: OLS Estimates of the Returns to a Medical License

	Full Sample				Discontinuity Sample	
Regressors	(1)	(2)	(3)	(4)	(5)	(6)
Licensed	1,279	1,211	1,162	-175	1,254	169
	(140)	(140)	(141)	(138)	(373)	(358)
% Impact	1.0948	0.9786	0.904	1.1366	1.1366	0.0772
Physician	–	–	–	2,324	–	1,885
				(158)		(301)
Experience	–	–	5	56	1,111	928
			(25)	(23)	(547)	(462)
Experience²	–	–	-2	-2	-27	-23
			(1)	(1)	(14)	(12)
Other Regressors	NO	YES	YES	YES	YES	YES
Root MSE	1,876	1,672	1,648	1,390	1,631	1,447
R^2	0.0711	0.2847	0.3073	0.5086	0.3227	0.4702
N	676	676	676	676	181	181

Notes: Robust standard errors are in parentheses. Other regressors include dummies for age upon arrival, year of arrival months in Israel, gender, marital status, profession of spouse, number of children, size of last city of residence, Republic of origin, advanced medical degrees, previous specialist status, previous type of medical practice and type of reported earnings (after-tax and/or after other deductions). The discontinuity sample in columns (5) and (6) uses the subsample of observations between 14 and 26 years of previous physician experience.

Table 3: Reduced Form Estimates of the Effect of Track on Monthly Earnings, License Acquisition and Physician Employment

	Monthly Earnings				Licensed				Physician Employment			
	Full Sample			Disc. Sample	Full Sample			Disc. Sample	Full Sample			Disc. Sample
Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Track	-849	42	571	628	0.1587	0.2305	0.3383	0.2853	-0.2155	-0.0939	0.0404	-0.0978
	(149)	(207)	(255)	(371)	(0.0283)	(0.0308)	(0.049)	(0.0679)	(0.0365)	(0.0529)	(0.069)	(0.1008)
% Impact	-0.3325	0.0094	0.1409	0.2262	–	–	–	–	–	–	–	–
Experience	–	–	-14	765	–	–	-0.0053	-0.2198	–	–	-0.0161	-0.0218
			(28)	(530)			(0.008)	(0.1009)			(0.008)	(0.1515)
Experience²	–	–	-1	-19	–	–	-0.0002	0.0052	–	–	0.0001	0.0011
			(1)	(14)			(0.0)	(0.0025)			(0.0)	(0.0038)
Other Regressors	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES
Root MSE	1,900	1,740	1,705	1,675	0.3961	0.3908	0.3854	0.3269	0.4891	0.4676	0.4639	0.4821
R^2	0.0469	0.2257	0.2589	0.2857	0.038	0.0879	0.1153	0.226	0.0456	0.1506	0.1664	0.1755
N	676	676	676	181	729	729	729	203	729	729	729	203

Notes: Robust standard errors are in parentheses. Other regressors include dummies for age of arrival, year of arrival, months in Israel, gender, marital status, profession of spouse, number of children, size of last city of residence, Republic of origin, advanced medical degrees, previous specialist status, previous type of medical practice and type of reported earnings (after-tax and/or after other deductions). The discontinuity sample in Columns (4), (8), and (12) uses the subsample of observations between 12 and 26 years of previous physician experience. The licensed and physician regressions are linear probability models.

Table 4: 2SLS Estimates of the Returns to a Medical License

	Full Sample				Disc. Sample
Regressors	(1)	(2)	(3)	(4)	(5)
Licensed	-5,244	178	1,638	1,865	1,886
	(1,516)	(863)	(706)	(864)	(1,043)
% Impact	-0.827	0.0857	1.8185	2.6171	3.4221
Experience	–	–	-1	45	1,210
			(25)	(77)	(619)
Experience²	–	–	-1	-4	-30
			(1)	(4)	(16)
Experience³	–	–	–	4	–
				(6)	
Other Regressors	NO	YES	YES	YES	YES
Root MSE	3,245	1,722	1,659	1,672	1,646
R^2	–	0.2417	0.2982	0.2883	0.3099
N	676	676	676	676	181

Notes: Robust standard errors are in parentheses. Licensed is instrumented with Track. Other regressors include dummies for age upon arrival, year of arrival, months in Israel, gender, marital status, profession of spouse, number of children, size of last city of residence, Republic of origin, advanced medical degrees, previous specialist status, previous type of medical practice and type of reported earnings (after-tax and/or after other deductions). The discontinuity sample in Column (5) uses the subsample of observations between 14 and 26 years of previous physician experience.

Table 5: Quantile Regression and Treatment Effects Estimates

	Quantile Regression Estimates					Treatment Effects Estimates				
	0.15	0.25	0.5	0.75	0.85	0.15	0.25	0.5	0.75	0.85
					A. Full Sample					
Licensed	359	644	997	1,455	1,507	119	257	1,115	1,589	2,774
	(130)	(163)	(143)	(178)	(320)	(4)	(63)	(65)	(267)	(212)
% Impact	0.9316	1.1748	0.8316	0.7825	0.588	0.4959	0.4992	1.4664	1.0764	1.6884
Pseudo R^2	0.1626	0.2467	0.2397	0.2116	0.2055	0.119	0.1744	0.2315	0.1579	0.1748
N	676	676	676	676	676	548	548	548	548	548
					B. Discontinuity Sample					
Licensed	–	–	1,093	–	–	–	–	1,793	–	–
			(520)					(310)		
% Impact	–	–	1.0761	–	–	–	–	2.3863	–	–
Pseudo R^2	–	–	0.1897	–	–	–	–	0.2413	–	–
N	–	–	181	–	–	–	–	164	–	–

Notes: Other regressors include a quadratic in previous physician experience, dummies for age upon arrival, year of arrival, months in Israel, Republic of origin, advanced medical degrees, previous specialist status, previous type of medical practice and type of reported earnings (after-tax and/or after other deductions). The discontinuity sample is the subsample of observations between 14 and 26 years of previous physician experience. Bootstrapped standard errors are in parentheses. The bootstrapped standard errors when licensed are treated as endogenous and adjusted for the first step estimation.

Table 6: Earnings Quantiles without a License

	Quantiles				
	0.15	0.25	0.5	0.75	0.85
	A. Full Sample				
Licensed Immigrants	239	515	760	1,476	1,643
Unlicensed Immigrants	385	548	1,199	1,859	2,563
% Selection Bias	-0.379	-0.0597	-0.3656	-0.2059	-0.359
	B. Discontinuity Sample				
Licensed Immigrants	–	–	751	–	–
Unlicensed Immigrants	–	–	1,016	–	–
% Selection Bias	–	–	-0.2606	–	–

Notes: The table reports monthly earnings quantiles without a license for immigrants that acquired a license and for immigrants that did not acquire a license. Earnings without a license for immigrants that acquired a license are calculated using quantile treatment effect estimates. Earnings without a license for immigrants that did not acquire a license are calculated using quantile regression estimates. The discontinuity sample is the subsample of observations between 14 and 26 years of previous physician experience.

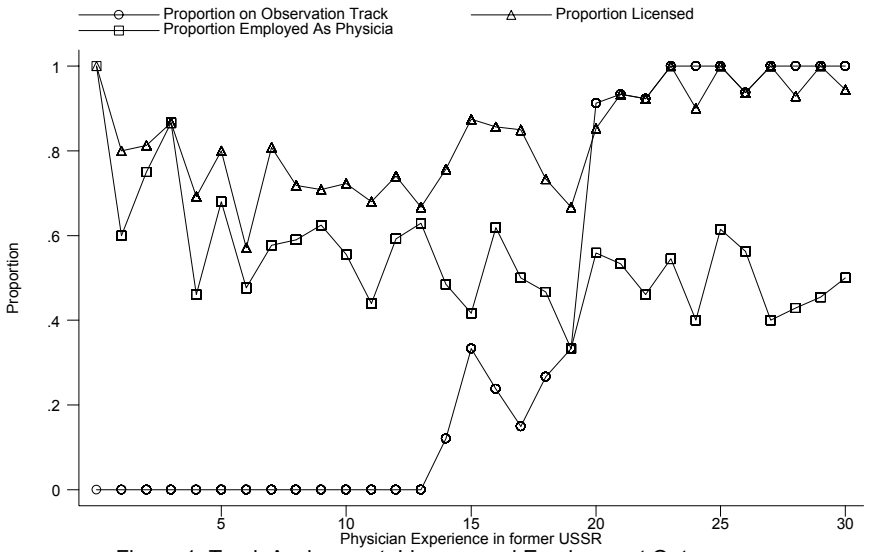

Figure 1: Track Assignment, License and Employment Outcomes

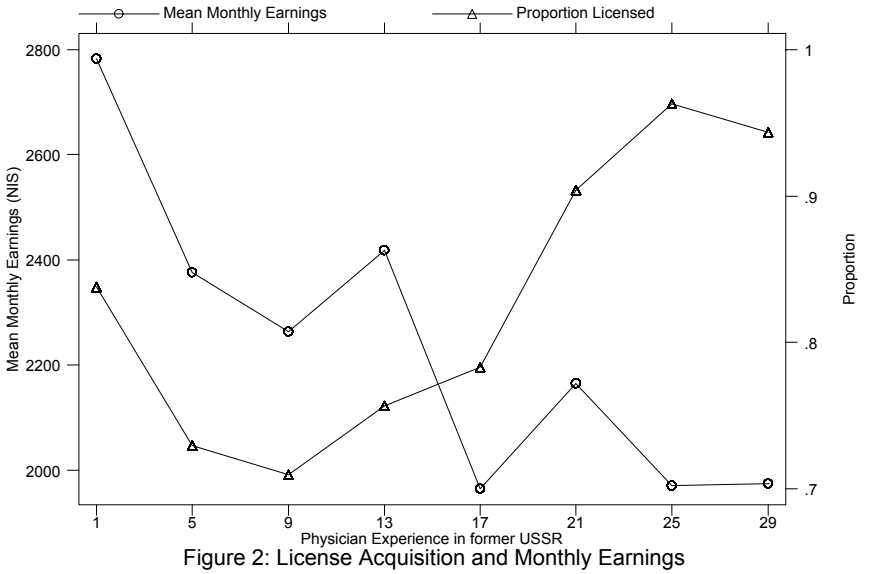

Figure 2: License Acquisition and Monthly Earnings

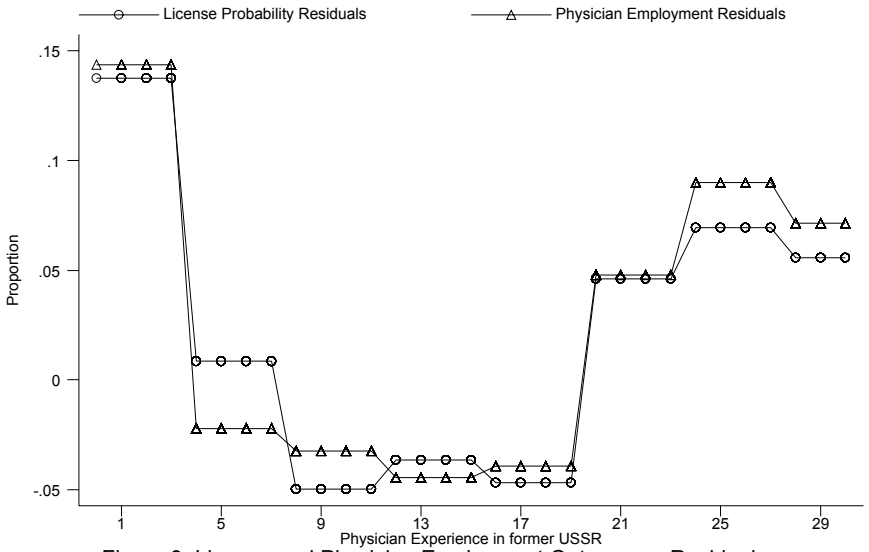

Figure 3: License and Physician Employment Outcomes - Residuals

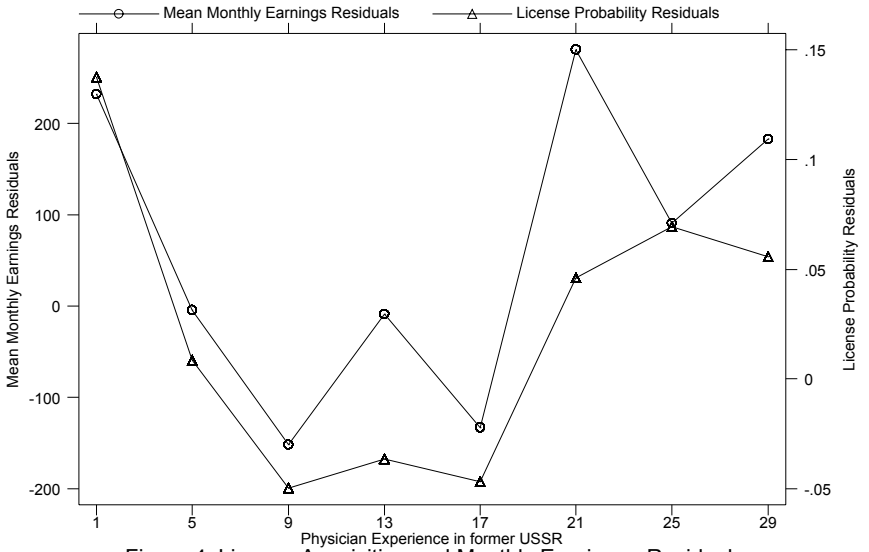

Figure 4: License Acquisition and Monthly Earnings - Residuals

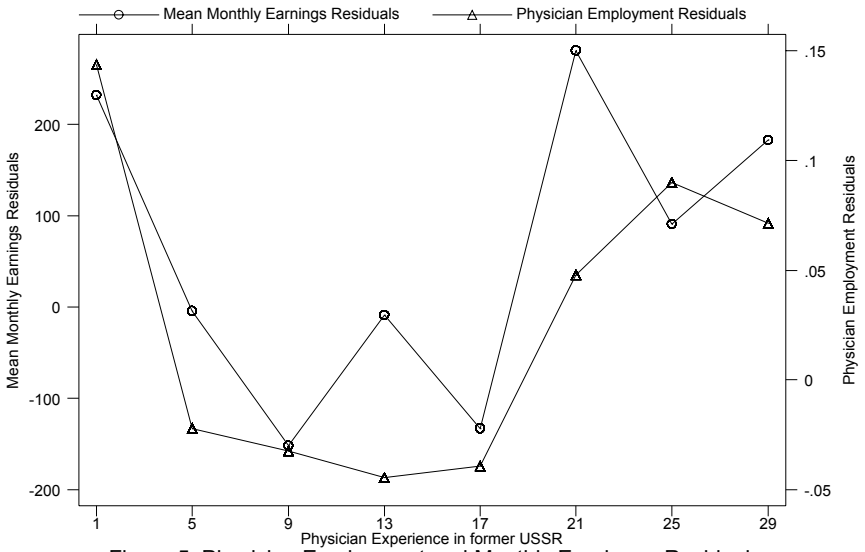

Figure 5: Physician Employment and Monthly Earnings - Residuals

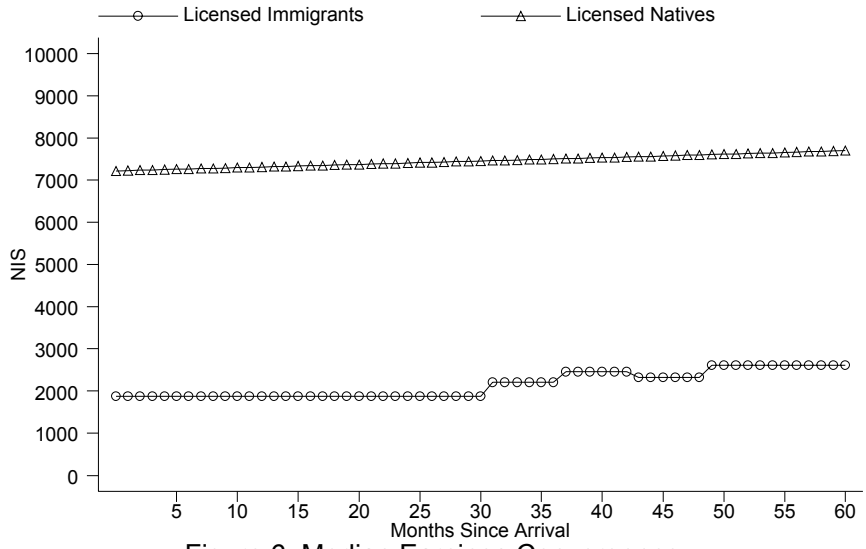

Figure 6: Median Earnings Convergence

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