Do Medical Doctors Lose from the Immigration of Doctors?*

by

Per Lundborg
CEIFO, Stockholm university
and
SULCIS, Stockholm university

*I am grateful for comments from participants at the conference on immigration and labor market integration at Rånäs Castle, October 2010 and from a SULCIS workshop.
Introduction

A large body of empirical studies has established that labor demand curves are negatively sloped. Based on this empirical fact and supporting economic theory, one should expect immigration to lower the wages of substitutable labor. However, in studies on wage effects of immigration this adverse wage effect has been difficult to establish with a convincing precision. Studies based on the spatial approach, looking at local effects of immigrants’ penetration, yield zero or very small negative effects and some even find positive effects. A study that stands out with results as more consistent with estimated labor demand curves is Borjas (2003). One distinctive feature of that study is that it, unlike much of the literature, mainly focuses on the national level. In that way the model captures features more in line with the textbook notion of supply and demand. Another feature is its focus on substitution conditions as these are based not only on individuals’ education achievement but also on their experience, as human capital theory suggests. Borjas finds considerably stronger negative effects than other studies do.

If it is the case that the careful definition of the substitutability conditions is crucial for the results, it seems desirable to “refine” this argument further. This is a basic purpose of this paper. While there is some substitutability across large groups of workers like craftsmen, and among clerks of different types, I shall consider a special group of workers for which the domestic labor supply is very well defined and more or less fixed in the short to median term, namely medical doctors. Doctors’ long education, which is a requirement for working as a doctor, can be used to define the national supply. Moreover, we have access to the field of specialization of each individual doctor as well as their year of experience. These facts clearly help in defining the substitutability conditions that apparently are important for the identification of the wage effects of immigration. The domestic supply of doctors is likely to be stable not only in terms of the number of doctors, but also in the sense that few doctors, particularly men, work part time, facilitating the evaluation of the effects of immigration shocks.

---

1 See e.g. Hamermesh (1993).

2 See Card (2009) for a recent review of the literature.
In May 2004, Sweden unconditionally opened its border for immigration from the ten new EU member countries (EU-10) which led to an inflow of a. o. medical doctors. Though some immigration had occurred already before 2004, the accession of the new EU countries drastically facilitated the recruitment of new medical doctors to Sweden. In this paper I shall discuss the earnings effects of this exogenous decision to open up for free immigration.

Besides the approach suggested by Borjas (2003), the dominating approach has been to exploit the spatial clustering of immigrants and the differences in immigration penetration across regions or local labor markets are then used for identifying the wage effects of immigration. Card (1990), Altonji and Card (1991), Pischke and Velling (1997), De Silva et al (2010) are just a few of many studies in this category. But as long as workers move freely across labor markets wage and salary effects will ultimately go away and any negative effect will be difficult to identify. I show that there are major earnings differences among doctors across the Swedish regions; doctors in the remote Northern regions make considerably more money than doctors in e.g. the Stockholm region. This suggests that the regional aspect could be of particular importance in this case. I therefore also proceed to a spatial analysis of the inflow of doctors. I show that the inflow of doctors to some of the Northern regions has been particularly strong and that the regional penetration of EU10 doctors varies considerably. While strong negative effects on doctors’ earnings are found on the national level only small effects and limited to female doctors, are found on the regional level.

Since the regional adjustments tend to hide the wage and salary effects of immigration, I pay special attention to the national level. Such results are interesting as they may capture the effects along a negatively sloped demand curve. The spatial effects are nonetheless of interest since they capture the equilibrating effects as workers move suggesting that inflows directly or indirectly affect any local labor market.

*Descriptive data on the inflow of EU-10 medical doctors.*

As an immigration country, Sweden hosted a fair amount of doctors from other countries, including the new EU members, already before the transition to free immigration in May 2004. Apparently, Sweden would have had an inflow of medical doctors from the new member countries even if the labor market had not opened up and new rules would apply.
Many doctors from the countries that became members in 2004 had arrived in Sweden already before 1990, specifically 748 out of the 1387 that were active in 2004. I shall present the changes of the stock of EU-10 doctors between 2001 and 2007 and relate these to the changes of the stock of native doctors.

It may first be noted that the overall number of EU-10 doctors who arrived in the period 2004-2007 was 409 in 2007. Of these, 237 (58 %) came from Poland, 74 (18%) from Hungary and 54 (13 %) from the Baltic states. Table 1 shows the number of doctors having immigrated to Sweden during the after accession period 2004-2007 along with the total number of doctors in Sweden.

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Immigrated first time after accession. Stock</td>
<td></td>
<td></td>
<td></td>
<td>92</td>
<td>165</td>
<td>285</td>
<td>409</td>
</tr>
<tr>
<td>2) Stock of EU10 doctors*</td>
<td>939</td>
<td>1062</td>
<td>1164</td>
<td>1387</td>
<td>1459</td>
<td>1542</td>
<td>1642</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(+223)</td>
<td>(+72)</td>
<td>(+83)</td>
<td>(+100)</td>
</tr>
<tr>
<td>3) Doctors born in Sweden</td>
<td>20695</td>
<td>21289</td>
<td>21768</td>
<td>23921</td>
<td>24181</td>
<td>24604</td>
<td>25139</td>
</tr>
<tr>
<td>4) Total doctors in Sweden</td>
<td>26093</td>
<td>27289</td>
<td>28219</td>
<td>31427</td>
<td>32020</td>
<td>32976</td>
<td>34111</td>
</tr>
</tbody>
</table>

Table 1. Medical doctors born in EU-10 having immigrated after accession and total number of doctors in Sweden, 2004-2007.

*Parentheses show the increase since year before. These figures differ from those in row 1) since some may have immigrated to Sweden before 2004.

Source: Statistics Sweden, (STATIV data set.)

As seen in Table 1, the stock of EU10 doctors in Sweden has increased since 2001. The 2004 decision to open up the labor markets in Sweden for the new EU members

---

3 The figure for 2004 includes those coming in the January-April period.
implied a major simplification for employers to recruit doctors from the accession countries. In particular, work permits, involving a long process of approval from the Migration board, were considered by employers to be an obstacle to recruitment of doctors from outside the EEA and Switzerland. Moreover, the formal language test was abolished, the approval of the foreign degree by the National Board of Health and Welfare was abolished as was the six month probationary and the formal approval that there existed a need for employing a foreign doctor.

Not surprisingly, the largest increase from the year before, took place in the accession year 2004 when the increase was 19 percent. Thereafter the annual increase has been between five and seven percent. There has, however, also been an increase in the domestic supply; while the annual increase has been around two percent it peaked actually in 2004 with a nine percent increase.

![Share EU-10 doctors](image)

Figure 1. EU-10 doctors as a share of native doctors, born in Sweden.

Comparing the number of EU-10 doctors to doctors born in Sweden we see in Figure 1 that this ratio has increased steadily from 4.5 percent in 2001 to 6.5 percent in 2007. This may not seem to be a dramatic change on the national level, particularly noting that the figure could suggest that the increase 2004-2007 is more or less a continuation of a process that already had started in earlier years.
Consider again Table 1. A comparison of figures in row 1 with those in rows 3 or 4, shows that the inflow of doctors immigrating for the first time is small compared to the overall stock of doctors. For instance, the stock of new immigrants in 2007 constituted 1.2 percent of the overall number of doctors. The increase could, though, be of considerable importance to individual regions. Before going into the regional distribution of immigrants, I shall consider a potential reason for an unequal distribution of immigrants across regions, namely regional earnings differentials. Table 2 shows the average annual earnings in the 21 Swedish administrative regions (Län) for the year 2007. The table reveals large regional differences with the highest mean earnings in the very northern regions. For instance, the average earnings of medical doctors in the Stockholm region (Län 1) is SKR 521 810 while the average earnings in the region of Norrbotten (Län 25) is as high as SKR 587 975. Earnings are also considerably higher in the regions of Västmanland (Län 19) 587 664 and Kalmar (Län 8) 580 102.

<table>
<thead>
<tr>
<th>Region (Län)</th>
<th>2007 average earnings of doctors (SKR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Stockholm</td>
<td>521810</td>
</tr>
<tr>
<td>3 Uppsala</td>
<td>537265</td>
</tr>
<tr>
<td>4 Södermanland</td>
<td>568147</td>
</tr>
<tr>
<td>5 Östergötland</td>
<td>560404</td>
</tr>
<tr>
<td>6 Jönköping</td>
<td>570218</td>
</tr>
<tr>
<td>7 Kronoberg</td>
<td>548606</td>
</tr>
<tr>
<td>8 Kalmar</td>
<td>580102</td>
</tr>
<tr>
<td>9 Gotland</td>
<td>549151</td>
</tr>
<tr>
<td>10 Blekinge</td>
<td>582636</td>
</tr>
<tr>
<td>12 Skåne</td>
<td>528423</td>
</tr>
</tbody>
</table>
Table 2. Average annual earnings among doctors in Swedish regions (län) in 2007.

These regional earnings differentials could imply that the regions have received widely different shares of EU-10 medical doctors. While the overall share of doctors that had immigrated during 2004-2007 in 2007 constituted about 1.2 percent of the total number of doctors, the share in Norrbottens län was 4.6 percent, Kalmar län 6.5 percent and the shares in Värmlands, Örebro and Västmanlands län were around 4.5 percent. Thus, for individual Swedish regions, the inflow of EU-10 doctors implied a substantial increase in the supply of doctors. The inflow was particularly strong to some of the regions where average earnings are high.

Table 3 presents average of some characteristics of the new EU10 immigrated doctors and the total stock of doctors (excluding the EU10 doctors) for the year 2007.
Another variable of interest is the specialization of the immigrated medical doctors. A large share of the immigrated doctors, 74 percent, are not specialized in a particular field though some have passed medical internship (“AT-tjänstgöring”) but no documentation of competence as a specialist. The corresponding figure for native doctors is 32 percent. In general, the EU-10 immigrated doctors are considerably less specialized than

<table>
<thead>
<tr>
<th></th>
<th>Immigrated medical doctors from EU10 after accession.</th>
<th>Total number of medical doctors (excl. EU10 immigrants).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number</td>
<td>409</td>
<td>33 702</td>
</tr>
<tr>
<td>Age</td>
<td>37.1</td>
<td>46.3</td>
</tr>
<tr>
<td>Share men</td>
<td>49.1</td>
<td>54.3</td>
</tr>
<tr>
<td>Real annual earnings</td>
<td>412 193</td>
<td>540 847</td>
</tr>
<tr>
<td>Share in Northern Sweden (&quot;norrlandslän&quot;)</td>
<td>16 %</td>
<td>11 %</td>
</tr>
<tr>
<td>Share unemployed at least 1 day</td>
<td>2.9 %</td>
<td>1.9 %</td>
</tr>
<tr>
<td>Employed outside health sector</td>
<td>8.8 %</td>
<td>9.9 %</td>
</tr>
<tr>
<td>Share “generalists”</td>
<td>74 %</td>
<td>32 %</td>
</tr>
<tr>
<td>Surgeons, incl. specialists in anesthesia</td>
<td>5.7 %</td>
<td>18.0 %</td>
</tr>
<tr>
<td>Internal physician</td>
<td>4.1 %</td>
<td>7.9 %</td>
</tr>
<tr>
<td>Pediatricians</td>
<td>1.6 %</td>
<td>3.4 %</td>
</tr>
<tr>
<td>Geriatricians</td>
<td>0.0 %</td>
<td>1.5 %</td>
</tr>
<tr>
<td>Specialists as general physicians</td>
<td>7.6 %</td>
<td>19.8 %</td>
</tr>
<tr>
<td>Psychiatrists</td>
<td>4.4 %</td>
<td>5.5 %</td>
</tr>
<tr>
<td>Radiologists</td>
<td>0.3 %</td>
<td>3.3 %</td>
</tr>
<tr>
<td>Clinical laboratory specialists</td>
<td>0.0 %</td>
<td>1.2 %</td>
</tr>
<tr>
<td>Other field of specialization</td>
<td>2. %</td>
<td>7.2 %</td>
</tr>
</tbody>
</table>

Table 3. Averages of selected variables.
are native doctors to some extent a consequence of the lower average age of these doctors, 37 as compared to 46.

The differences in annual earnings are large as seen in Table 3, where the earnings of immigrated doctors from the EU10 countries are 76 percent of the overall group, i.e. an earnings gap of 24 percent. However, a regression controlling for age differences, gender, region, specialization etc. gives an adjusted earnings gap of only 3.6 percent.

Some theoretical aspects

Ideally one would like to be able to observe random immigrant penetration of closed labor markets and then relate the inflow to the change in wages of native workers of similar skill and trade. The randomness is necessary in order to avoid spurious correlations that could arise if demand for labor determines the inflow of labor. Closed labor markets are necessary if one wants to avoid the strong effects on earnings that may come about as labor and capital move between open labor markets.

It should be realized that most migrations are not random. The free labor mobility between the EU countries stipulates that, in principle, the individual should have arranged with a job before migration. Thus, the flow of international migrants is determined by domestic demand and one would obtain a spurious correlation between immigration and wages. Basically, the same would hold for most international migrations, including that to the US as studied by e.g. Borjas (2003), where it is unlikely that labor immigrants would be accepted unless a job has been arranged with. The exceptions are the type of exogenous shocks as studied by e.g. Card (1990) or De Silva et al (2010). Sweden’s unconditional opening up for free immigration from the new low wage accession countries facilitated labor migration to such an extent that it could be considered an exogenous shock. However, the regional allocation was much determined by the availability of vacancies.

In the case of Sweden, as in many other countries, one needs to consider that the opening up for labor immigration from low wage countries does not mean that expensive workers can be exchanged for cheap immigrated labor. Job security laws and agreement prevent this to happen and the regional health authority (Landsting) only finds the option to hire doctors from abroad when for some reason a position has become vacant, due to e.g.
retirement, resignation, death, etc. or when the staff of doctors needs to be expanded because of higher demand. Moreover, the small adjusted earnings differentials suggest that low cost is not a major reason for the hiring of foreign doctors.

The fact that the Swedish employer cannot recruit other than at local salary levels could suggest that Landstinget hires immigrated doctors for positions that are hard to fill by native doctors putting the immigrated doctors in a strong bargaining position. Another reason could be that doctors’ unions, for fear of dumping, would not accept that the Landstinget hires doctors at considerably lower salaries. Fair wage arguments could also be put forward as to the relative equalization of salaries of immigrant and native doctors in particular that the immigrated doctors are likely to leave for some other position if salary differences are too large.

In 2004, wage setting according to specified salary tariffs was finally abandoned for doctors with medical internship and individual salary setting became the dominating form. I assume that doctors’ salaries are determined by bargaining between the individual doctor and representatives of the regional landsting. The fact that the Landsting can hire doctors from a considerably larger geographic area would, by itself, constitute a threat to native doctors’ salaries that could have a dampening effect on their wages. To the extent that native doctors see that Landstinget fills the vacancies within their own field of expertise by immigrated doctors, this could exert a downward pressure on wages. The threat of competition from immigrated workers is thus assumed to be manifested only by actual hiring of immigrant doctors.

Assume that the wage rate of doctor $i$ with specialization $j$, $w_{ij}$, is the fraction $F_j \in (0,1]$ of the individual productivity $P_{ij}$:

$$w_{ij} = F_j P_{ij}. \quad (1)$$

The salary is assumed to be determined as the outcome of asymmetric Nash bargaining. In this bargaining, the individual doctor maximizes the difference between the wage and the expected alternative salary, $A_j$. This represents the perceived alternative wage which I assume is the salary obtainable outside the hospital and is assumed identical for all individuals with the same specialization. The landstinget maximizes the positive difference between productivity and pay:
\[ w_{ij} = \arg \max \left[ (w_{ij} - A_j)^\beta (P_{ij} - w_{ij})^{(1-\beta)} \right] \quad (2) \]

which yields the first order condition\(^4\)

\[ w^*_i = \beta P_{ij} + (1 - \beta) A_j \quad (3) \]

\( \beta \) is the parameter representing underlying bargaining power of doctors. The determination of \( A_j \) is of central importance. I assume that the larger the number of competing foreign doctors, the lower is this alternative salary perceived to be. I write this as

\[ A_j = \left( 1 - \frac{M_j}{M_j + N_j} \right) \bar{w}_j = (1 - m_j) \bar{w}_j \quad (4) \]

where \( M_j \) is the number of immigrated doctors of specialization \( j \) and \( N_j \) is the domestic supply of domestic doctors specialized in \( j \). Without any immigration of doctors and given the supply of native doctors, the alternative wage equals \( \bar{w}_j \) which is an average wage for similar doctors with productivity \( P_j \). I assume that there is full employment. However, this outside optional wage is assumed to be affected by immigration in the sense that the larger the number of immigrant doctors, the more competition there will be for any upcoming outside vacancy and the lower will be the native doctor’s expected alternative wage. Thus, \( (1 - m_j) \) is the probability of obtaining a position at wage \( \bar{w}_j \). The immigration of foreign doctors will therefore contain the salary demands for doctors.\(^5\)

One could of course argue that an increase of the supply of native doctors would have the same effect. I assume, though, that since the immigrated doctors come from countries of considerably lower real wages, and hence are assumed to have lower reservation wages, the immigration of doctors exerts a special disciplinary effect on wage setting that deviates from the effects of increases in domestic supply.

If doctors with identical productivity and characteristics are paid the same wage, the market equilibrium is given by

\[ w^*_j = \bar{w}_j. \quad (5) \]

\(^4\) The payoff in case of disagreement is assumed to be zero for both the employee and the employer.

\(^5\) I do not treat \( A \) as a choice variable of the employers since they are not free to fire native doctors and replace them by immigrated doctors.
Using (4) and (5) in the first order condition (3) yields $w_{ij} = F^*_j P_{ij}$, where

$$β < F^*_j = \frac{β}{1 - (1 - β)(1 - m_j)} ≤ 1. \quad (6)$$

Equation (6) states that with no immigrated doctors ($M_j = m_j = 0$), the native doctors can extract the maximum share $F^* = 1$ implying that the doctors’ salary $w$ would equal productivity $P$. As immigration goes to infinity $\left((M \to \infty) \leftrightarrow (m \to 1)\right)$, $F^*$ will approach $β$ implying that, from (1), $w_j^* \to βP_j$. More immigration can be said to undermine the position of native doctors in the bargaining process and imply a disciplinary effect on salaries. The larger the share of immigrants, the lower will be the fraction of productivity accruing to doctors and thus the lower will be the wage. The relation between wages and the stock of migrants would then look as in Figure 1:

![Figure 1. Relationship between wages and immigration.](image)

With this set-up, one could imagine that the Landstinget, when hiring immigrant doctors, would set an $m$ that is consistent with maximization of (2). However, the fact that native doctors are protected by job security agreements, the opening up for the free labor market does not imply that the Landstinget has the discretion to set an optimal $m$.\(^6\)

\(^6\) Instead, the move to the optimal immigration level would be a gradual one as new positions arise over time. It is beyond the scope of the present paper to explore this possibility.
Empirical results

Having thus established a negative relationship between immigrant stock and wages in a bargaining framework I shall here empirically evaluate the relation. I shall use Swedish register data covering all doctors in Sweden in ages 25 to 64 having been employed within the health sector and fully employed during the year. Data cover the period of immigration of EU doctors after accession i.e. 2004 through 2007. I specifically consider the effects on native doctors’ annual earnings of the share of doctors immigrated from EU10 2004-2007.

Individuals having graduated from medical school are separated into categories of generalists (with or without medical internship (“AT-tjänstgöring”)) and nine categories of specialists (surgeons, internal physical doctors, pediatricians, geriatricians, general physicians, psychiatrists, radiologists, clinical laboratory specialists, and other specialists), a total of ten groups. These are obvious skill groups defining possible substitutability across doctors. Basic human capital theory suggests allowing for experience differences across individual doctors. Work experience is likely to add significantly to the skills, and hence to the earnings, both of generalists and of specialists. A second advantage is that I obtain enough variation in data to examine how supply shocks affect earnings. Skill groups of doctors are thus defined in terms of specialization and of experience. Experience is defined as age minus 25, which is taken to be the year of graduation from medical school. I then define the following experience levels in years: 1-5, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, and 36-40. With the groups of educational specialization and years of experience I am able to capture in great detail the substitution effects between immigrated and native doctors.

I define cells as follows: ten groups of educational specialization $i$, eight experience groups $j$, and seven time periods, $t$. The immigration shock for a skill group is then:

$$m_{ijt} = \frac{M_{ijt}}{M_{ijt} + N_{ijt}}$$

(7)
where $M_{ijt}$ and $N_{ijt}$ is the number of immigrants and natives, respectively, in the $ijt$ cell implying that $m_{ijt}$ is the share of foreign born doctors in the overall stock of doctors of that cell.

Let the dependent variable $e_{ijt}$ be the log of annual earnings of native doctors of skill specialization $i$, experience $j$ during time period $t$. A basic specification is:

$$
e_{ijt} = \alpha m_{ijt} + \beta Z_{it} + s_i + x_j + \pi_t + (s_i \times x_j) + (s_i \times \pi_t) + (x_j \times \pi_t) + \epsilon_{ijt}
$$

where $Z_{it}$ is a vector of characteristics of individual $i$, time $t$. $s_i$, $x_j$, and $\pi_t$ are fixed effects to control for differences in doctors’ specialization, their experience, and over time, respectively. The first interaction term controls for the possibility that the effects of experience differ across specialization groups, the second that effects of specialization may change over time and the last that the effects of experience may change over time. The fact that the interaction term $(s_i \times x_j)$ is present in (8) means that changes in the immigration share that affect earnings are identified from changes occurring within the specialization-experience cell.

Table 2 shows the results of running the regression specified in (8). In the first regressions, presented in the first three result columns as Model 1, I specify the immigration share for each specialization and experience on the national level after running the model for the full period 2004 through 2007. The regressions are also separated by gender. In parentheses are shown the results obtained after clustering on specialization and country of birth, respectively.

Considering the variation at this level, the estimated effect for men and women together is -0.66 which is the percentage earnings reduction following an increase in the share of immigrated doctors of 1 percent. It could also be of interest to perform regressions on observations with more narrow fields of specialization. For the estimates presented in Row 2, I have excluded doctors lacking medical internship (“AT-tjänstgöring”). The estimate is now slightly higher, -0.80.

Separating the results into male and female doctors, I find that, in general, the estimates are again highly significant, though less so for women. In the regression including

---

$^7$ Cf. Borjas (2003). Using register data allows me, though, to include the vector of personal characteristics.
all doctors irrespective of specialization, the estimate is slightly lower for female doctors, while slightly higher as I exclude doctors lacking medical internship.

These results based on regressions for doctors with well defined fields of specialization show quite strong effects. It is of interest to see how sensitive the results are to one of the novelties of Borjas’ model, i.e. to evaluate the importance of assuming that the variation is over the specialization-experience cells. In the next three columns in Table 2, denoted Model 2, I have assumed that all variation is in the specialization cells only. This allows me to see if earnings are affected by immigration of similarly specialized doctors irrespective of experience.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women</td>
<td>All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women</td>
<td>All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women All Men Women</td>
</tr>
<tr>
<td>1. All</td>
<td>-0.6605 (-2.90)</td>
<td>-0.7912 (-3.16)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-1.35)</td>
</tr>
<tr>
<td>2. Doctors with medical internship.</td>
<td>-0.8046 (-2.99)</td>
<td>-0.7780 (-2.99)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-1.95)</td>
</tr>
</tbody>
</table>

Table 2. Effects on earnings of native doctors of shares of doctors immigrated from EU10, 2004-2007. Results from estimating equation (8).

Note: All regressions include in the vector Z the following variables: gender (if applicable), age, age², age³, regional unemployment rate, doctoral degree, and immigrant. Only doctors with no reported unemployment and employed in the health sector are included. t-ratios in parentheses. The first t-ratio in each cell shows the results when clustering on specialization and the second when clustering on the birth country.
Running the model based on the whole material yields a negative estimated elasticity of -1.68 which is considerably higher than the estimate -0.66 obtained in the previous regression. The variation of data across specialization irrespective of experience level yields a considerably stronger earnings effect than the variation over specialization-experience cells. A possible reason for the lower estimates at the more disaggregated level could be regression dilution caused when immigration shocks are calculated at the highly disaggregated level implied by introducing the experience levels. One more immigrated doctor in a specific specialization-experience cell may cause the immigration share to rise a great deal yielding greater variability and possible measurement errors at this detailed level could therefore yield attenuation bias. One may therefore attribute more reliability to the estimates from running Model 2 than from Model 1. Notable, though, is that the estimates are still significant. Nonetheless, the conclusion is that annual earnings are adversely affected by the immigration of peers irrespective of their years of experience.

Excluding doctors lacking medical internship (“AT-tjänstgöring”) yields a considerably higher estimate, -2.29 suggesting that when focusing in more on “specialists” substitutability is crucial to the quantitative results. This result differs though between the two genders. Going from row 1 to row 2, the estimates are basically unchanged for men but almost double for women doctors. My dependent variable is annual earnings, rather than wages, implying that this gender difference could be the result of changes in labor supply that, generally, is more elastic among women than among men.

In the first year after accession, 2004 and 2005, the number of immigrated doctors was small and the stock of doctors, which we have used in our independent variable, has accumulated over the years. It is therefore of interest to see how the model performs as we consider only the last two years, 2006 and 2007, when the immigration shares have increased to slightly more substantial levels. For these years we could expect less variation in data as the overall number of immigrated doctors has accumulated to higher levels. We therefore estimate the model for 2006 and 2007 based on variation across the specialization-experience cells as in Model 1. If these estimates come out more in line with those obtained in Model 2,

---

8 Aydemir and Borjas (2005) discuss the role of attenuation bias for studies of wage effects of immigration. Their problem is sampling error that may cause an under estimation of the effects on wages. In my case, there is no sampling problem since the whole population is included but some measurement error could, of course, appear that for small immigration shares could play a role for attenuation bias.
this could be a further indication that the results in Model 1 suffer from attenuation bias. The results are presented as Model 3 in Table 2.

Note first that the estimates are highly significant and that they do not vary much between the two genders. The estimates are considerably higher, around the double to those obtained in Model 1 and the regressions only differs with respect to the time period. Given the lower level of variability in 2006-2007 data, it could be an indication of attenuation bias in Model 1. They are, though, generally lower than those obtained in Model 2.

Earnings consist of wages and of hours worked during the year. The results do not reveal whether falling earnings come in terms of real wage drops, reduced work hours, or both. One cannot rule out the possibility that immigration of specialist doctors allow for a reduction of work hours down to a level that is desired by the individual native doctor. Swedish doctors do not work traditional “over time” hours but may earn extra money being “on duty”. To the extent that immigrated doctors compete for work “on duty”, earnings may certainly fall for native doctors.

Effects on regions.

As noted in the introduction, the studies based on estimates of the inflow into different regions have reached only very small negative effects on wages, if any, of immigration inflows. For example, the much cited study by Card (1990) shows basically no effect on domestic wages or unemployment in Miami of the so called Mariel boatlift. Since I focus on doctors with a high level of specialization, it could therefore be of interest to see how the results for doctors come out if a similar spatial approach is applied. The model is specified similarly as equation (8), though with the inclusion of a regional variable and interaction variables. Let index \( r \) denote region (“län”). The first model that is run is specified as follows:

\[
e_{ijtr} = \alpha m_{it} + \beta Z_{it} + s_i + x_j + \pi_t + \chi_r + (\chi_r * \pi_t) + (s_i * \pi_t) + (x_j * \pi_t) + (\chi_r * s_i) + \varepsilon_{ijt} \tag{9}
\]

where \( \chi_r \) is the fixed regional effects, also interacted with the period and specialization fixed effects. Note that I assume all variation (in a given year) to occur across specialization, experience and region. This corresponds to the model that yielded the results in Model 2
above. The reason for doing this is that regressions based on variation across specialization-region-experience, i.e. a specification inspired by Borjas (2003), yield non-significant estimates or unreasonable magnitudes. The reason could again be occurrence of attenuation bias at this extremely disaggregated level.

Allowing for variation across specialization and region yields the results in Model 4, in Table 3.

![Table 3](image)

Table 3. Effects on earnings of native doctors of shares of doctors immigrated from EU10, 2004-2007. Results from estimating equation (9) and (10).

Note: All regressions include in the vector Z the following variables: gender (if applicable), age, age², age³, regional unemployment rate, doctoral degree, and immigrant. Only doctors with no reported unemployment and employed in the health sector are included. t-ratios in parentheses. The first t-ratio in each cell shows the results when clustering on specialization and the second when clustering on the birth country.

The regressions based on equation (9) include personal characteristics, fixed effects for region, specialization, experience and year. To obtain estimates of the change in doctors’ earnings of immigrant doctors’ market penetration I also include interactions of year fixed effects with region, specialization and experience fixed effects, respectively. The results capture the effects on doctors with a particular specialization in a particular region in Sweden. I present again results for all doctors and separated by gender and in separate regressions I exclude doctors with no medical internship.
The results from running equation (9) for men and women together and for all doctors irrespective of specialization is -0.34 and significant. The estimate is higher for men (-0.53) and significant while the lower estimate for female doctors is not significant. When “generalists” are excluded in Row 2, the estimates are in all three cases significant and quantitatively fairly similar. This could be the result of including here only doctors that are closer substitutes. As is to be expected, the estimates of the spatial correlations in Table 3 are considerably lower than those obtained for the national level presented in Table 2. They are, though, considerably higher than the estimates obtained in other migration studies based on the spatial approach and touched upon above where the groups studied are not as close substitutes as in my case.

Adding the interaction term between region, specialization and experience \((X_r \times s_i \times x_j)\), as in equation (10), below implies that we capture the change in earnings of doctors with a representative specialization and experience and in a representative region:

\[
e_{ijtr} = \alpha m_{itr} + \beta Z_{it} + s_i + x_j + \pi_t + X_r + (X_r \times \pi_t) + (s_i \times \pi_t) + (x_j \times \pi_t) + (X_r \times s_i) + (X_r \times x_j) + \epsilon_{ijtr}
\]

(10)

The results are presented as Model 5 in Table 3 in the three final columns. As we include all doctors the resulting estimate is slightly lower than those obtained by equation (9), as they are for men while for women I do not obtain a significant estimate. As for the results from equation (9), excluding doctors with no medical internship in equation (10) again yields a significant and (in absolute terms) higher estimate for women.

Adding more three-way interactions to allow for period effects to vary across specialization-experience cells turns out to yield estimates with considerably higher variances. My interpretation is that this is due to the collinearity with other regressors. I therefore refrain from presenting results from these regressions.

One may compare these results obtained at the regional level to those obtained at the national level and presented in Table 2. The results in Table 2 can be argued to better represent the closed labor market that would facilitate the identification of the effects along the labor demand curve. We may first note the similarity that in both cases the effects are stronger for female doctors on the national level. This could reflect the fact that female labor supply in general is more elastic than male labor supply.
In general the effects are considerably stronger on the national level, which one could argue better represents adjustment along a labor demand curve. The fact that effects are stronger on the national level than on the regional level suggests that immigration to a certain region has effects on other regions as well, e.g. due to doctors moving across regions. Comparing Model 2 with Model 9 shows that the estimates on the regional level are generally about one fourth or one fifth of the estimates on the national level. Thus, while there is a strong negative effect on doctors’ earnings, the effects are counteracted by regional mobility and the interactions across regions.

Conclusions

One of the merits of the highly detailed data I have used is that they allow for the estimation of immigration of workers that are very close substitutes to native workers. Using data on medical doctors with specific specializations and experience, facilitates the identification of earnings effects as the supply of native doctors is more or less fixed on the national level. I find, however, that the results appear less trustworthy as I allow for variation on a highly detailed level. Focusing in on variation across specialization or on time periods with less variability in data seems to reduce regression dilution that otherwise is likely to afflict data.

A second feature of the paper is that I explore the effects of an exogenous shock, i.e. the opening up for unconditional free immigration to Sweden from the new EU member countries. This implied a transition to a system of drastically simplified the hiring of medical doctors from countries like Poland or the Baltic states and as such implied a supply shock. However, a simple supply and demand approach does not seem highly appropriate in the case of Sweden. A bargaining framework is a more relevant framework for the setting of Swedish doctors’ salaries and I show how an increased immigration of doctors from low wage countries having low reservation wages, reduces native doctors’ alternative wage and as such contains real wages, and thus also real earnings.

I find clear evidence that immigration of doctors reduces earnings at a substantial rate. The effects are stronger the more I limit the data to cover specialized medical

---

9 This overall result is broadly in line with those found by Borjas (2003) for the total US labor market for men. His estimate for the regional (state) level is about one third of the estimate on the national level.
doctors, i.e. for which the substitution conditions are expected to yield strong effects. To the extent that this reflects lower costs of medical services, the lower costs represent welfare gains for patients and for tax payers.

I find also that the effects generally are considerably stronger on the national level than on the regional level. This should not come as a surprise since the results for the regional level are affected by the adjustments taking place as labor flows across the different regions.

While the elasticities may be surprisingly large in light of much of the previous literature, the actual effects are low due to the modest immigration rates. The influx of medical doctors is approximately 1.2 percent of the stock of native doctors. With the estimated elasticity in Model 3, -1.33, I obtain an effect on earnings by -1.6 percent suggesting that average earnings drop from SKR 540 847 to SKR 532 215. With the elasticity obtained in Model 2, -1.68, the earnings effect is -2.0 percent, reducing earnings to SKR 529 943.
REFERENCES


