Estimating differences between migrant and non-migrant dentist treatment intensity in the Scottish National Health Service

Shaolin Wang
University of Dundee

Martin Chalkley
University of Dundee

Colin Tilley
NHS Education of Scotland

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1 Introduction

To address the global crisis in the health workforce, OECD countries have adopted a mix of long-term policies of national self-sufficiency (e.g. increasing domestic training, improving retention, and adapting skill mix), and short or medium-term policies of international recruitment. Immigrant health professionals have proven to be a flexible and low-cost response to shortages and make a significant and escalating contribution to health care labour markets in industrialized countries. In 2000, there were approximately 400,000 migrant doctors and 710,000 migrant nurses working in the OECD area (OECD 2008). The United Kingdom, in particular, has become one of largest recipient countries, with 33% (69813) of the doctors and 10% (65000) of the nurses working in 2006 qualified overseas (WHO 2006).

There are obvious questions regarding the extent to which migrants are perfect substitutes for domestically trained professionals and in the realm of health care, where in the presence of asymmetric information health care professionals have considerable discretion over the type of care they deliver, this raises concerns regarding both the quality and safety of healthcare (OECD, 2008; Simoens and Hurst, 2006). Assessing the extent to which there are differences between internationally recruited and domestically trained health professionals is, therefore, clearly a concern for public policy. Until now, however, there has been little empirical work comparing the services delivered by migrant and indigenously trained health care professionals.

In light of these issues, this paper is concerned with comparing the treatments delivered by migrant and domestically trained individuals from a particular group of health professionals – dentists contracted under the Scottish National Health Service The goal of this paper is to compare the treatment provided by all non-UK qualified dentists who started providing dental services in the GDS after 2006 with the treatment provided by a comparison group consisting of the 2005/06 cohort of Scottish Vocational Trainees (VTs). For this purpose we utilise

administrative data collected for authorising payments for National Health Service (NHS) dental treatment in Scotland.

In contrast with the traditional host countries such as American, UK and Canada, Scotland was not a popular migration destination for health professionals until quite recently. In 2006, the Scottish Executive signed a contract to recruit about 35 dentists directly from Poland. In that year, 92 dentists with non-UK qualification started to provide dental care in the General Dental Services (GDS). This is equivalent to 87% of the annual output of the indigenous dental schools in Scotland.

We estimate a difference-in-differences model to examine how migrant dentists' responses to different case mix and individual circumstances (treatment category, patient type, remuneration, etc.) compare with non-migrant dentists' responses, and whether there is a convergence between the two groups of dentists as migrants assimilate into the host country. Given the longitudinal nature of the data, we control for time-invariant unobserved heterogeneity in dentists using fixed effects method and estimate an auxiliary OLS regression of dentist effects estimated to isolate the fixed effect of migrant status. Our results suggest migrant dentists have different practice styles compared with non-migrants and that the treatments they undertake demonstrate little convergence to the treatments of non-migrants, even after two years of practice.

The paper is organised as follows. The next section describes the administrative data we employ. The empirical model used for examining treatment is presented in Section 3 and regression results are presented in Section 4. The last section discusses the results and concludes the paper.

2 MIDAS data and variables

The anonymised treatment data reported in this paper comes from the Management Information & Dental Accounting System (MIDAS), which is a large-scale administrative database of linked patient-practitioner information maintained by the Practitioner Services Division to process, authorise and store all NHS GDS treatment in Scotland. The NHS payment system allocates a unique identifier for each patient, General Dental Practitioner (GDP), practice and course of treatment (CoT), making it possible to follow patients, GDPs and types of treatment over time. Since Scotland has become an increasingly popular

destination for migrant dentists since 2006, we obtained a sample covering all claims submitted by migrant dentists who arrived in the Scottish GDS and started making claims after 2006. As a comparison group we use the dentists who completed VT in July 2006. By comparing migrant and non-migrant GDPs who entered the Scottish GDS at much the same time, we are able to assess the extent to which there is a trade-off between the relative cost and output of migrant and non-migrant health professionals.

Within each claim the patient usually receives a range of items of service, each with an associated fee. The changes in these fees are informed by Doctors' and Dentists' Review Body but the level of the fees were historically set to make all treatment equally remunerative per unit of time. Thus, the total value of a claim, measured as the sum of fees for the individual items of services contained, reflects the time a dentist has spent treating a particular patient and constitutes a measure of treatment intensity.

Each claim corresponds to a unique CoT. The NHS payment system allocates a unique identifier for each patient, dentist, practice and claim, and provides a relatively rich set of observable characteristics on each dimension. MIDAS records the claim's value, payment month, and specifies its composition by including an indicator variable for each broad treatment category defined in the SDR (e.g. diagnostic, periodontal, conservative, surgical, prosthetic, etc). On the patient side, MIDAS contains information on the individual's date of birth, age at treatment, gender, and exemption status (exempt or not). The dentist characteristics that are provided include the age at treatment, gender, remuneration structure (self-employed or salaried). Information on the migrant status of dentists in the GDS comes from NHS Education for Scotland. In order to practise NHS dentistry in Scotland, dentists need to be issued with a Vocational Training (VT) number, which indicates they have satisfactorily completed VT in the UK or have equivalent experience or qualifications. These VT numbers are issued by NHS Education for Scotland and identify EEA nationals who hold a recognised European Diploma and are therefore eligible to practise in the GDS. Finally, MIDAS records the NHS Board and the deprivation category of each practice which ranges from 1 (most affluent) to 7 (least affluent).

The initial sample consisted of 199 migrant GDPs with 264,843 claims and 83 non-migrant GDPs with 217,755 claims paid between January 2006 and September 2008. After some data

cleaning the sample size fell to 116,211 claims made by 192 migrant GDPs and 112,394 claims made by 83 non-migrant GDPs[1].

Table 1 reports descriptive statistics on these variables for migrant and non-migrant GDPs and suggest that migrants treat patients slightly more intensively than non-migrants (£38.22 vs. £36.55). However, this could be a consequence of different case mix: migrant GDPs provide more surgical, prosthetic, occasional, and incomplete treatment but less preventive treatment than non-migrants. Individual characteristics of dentists and patients also differ between the two groups. The average age at entry of the migrant GDPs practising in GDS was 34, 9 years older than the Scottish trainees. As mentioned, GDPs can either work as salaried or self-employed in the NHS. With the exception of 28 Polish recruits contracted with the salaried service, the GDPs in the sample are predominately self-employed, of whom only 4 migrants switched contracts during the sample period. Dentists may have different preferences as to whom to provide NHS service on (e.g. exempt or not), at what level (e.g. whether or not include more than just a scale and polish and/or examination, termed as "active treatment") and interval (i.e. visit duration) to serve. While the British Dental Association states that local GDPs who work in the mixed practices demonstrate commitment to the NHS by treating children or those exempt from charges (Macleod 2005), we can see that within the first two years in GDS, non-migrant GDPs treat less exempt patients than migrant GDPs. Moreover, migrant GDPs tend to provide more active treatments and at slightly longer intervals compared with non-migrant GDPs. Finally, distributions between migrant and non-migrant GDPs by deprivation category of the practice and health board are presented in Figure 1 & Figure 2. Migrant dentists work in practices more deprived than Scottish vocational trainees. Given the short sample period, both groups have very low frequencies of switching health board and practice deprivation.

3 Modelling and estimation

Apart from variations in treatment intensity arising from dental conditions of patients being treated and dentist characteristics, healthcare professionals are likely to have developed country-specific skills and practice styles from the training and working experience in their country of origin. The traditional labour literature has highlighted a speedy assimilation process by migrant workers as they learn the local language and institutions, accumulate local

[1] The final sample excludes information on patients who receive treatment only once in the sample (we include duration since last CoT as an explanatory variable) and 9 observations where patient sex changed during the sample.

experience, and adjust skills to suit local labour markets (Eckstein and Yoram, On the Wage Growth of Immigrants: Israel, 1990-2000 2003). Thus, we exploit the longitudinal structure of these data and estimate a difference-in-differences model:

$$y_{ik} = \alpha M_i + \theta Z_{ik} + \lambda Z_{ik} M_i + \gamma F(t_{ik}) + \delta F(t_{ik}) M_i + \mu_i + \varepsilon_{ik} \qquad (1)$$

where y_{ik} is the treatment intensity (measured by the natural log of the real fee per claim) provided by dentist i's kth CoT; M_i is a migrant GDP indicator variable; Z_{ik} denotes a set of controls on case mix and individual circumstances that vary across dentists; $F(t_{ik})$ is a polynomial function of dentist experience measured by the number of months elapsed since the first treatment to allow for a non-linear experience-treatment intensity profile; $Z_{ik} M_i$ and $F(t_{ik}) M_i$ denote interaction variables between migrant dummy and different controls; μ_i are dentist-specific effects capturing unobserved heterogeneity in dentists; and ε_{ik} is a pure random error orthogonal to all explanatory variables. In particular, interactions between the migrant dummy and treatment category indicators capture potential different practice styles of delivering particular types of treatment between migrant and non-migrant GDPs. Furthermore, since migrant GDPs are likely to adjust the treatment intensity gradually to become 'local', the function of dentist experience is interacted with migrant dummy to capture the process of assimilation. There is convergence of migrants to local practitioners if $\delta F(exp_{ik})$ is negative and decreasing over time when α is positive; and positive and increasing when α is negative.

Our data allow us to control for unobserved heterogeneity by following multiple treatments provided by the same dentist across time using fixed effects. However, this means that the effect of any variable that is constant within dentists, such as a dummy variable for migrant status, cannot be identified. In order to recover the persistent effect of migrant status so that we can determine how migrant GDPs assimilate into the host country we decompose the estimated dentist fixed effects into two components (following Abowd, Kramarz and Margolis (1999), henceforth AKM):

$$\Theta_i = u_i + P_i \theta \qquad (2)$$

giving a simplified version of Equation (1)

$$y_{ik} = X_{ik} \beta + \Theta_i + \varepsilon_{ik} \qquad (3)$$

where X_{it} is a set of all observable characteristics that vary across dentists and CoTs; Θ_i measures persistent variation in treatment supply among dentists; u_i is the unobservable component of dentist fixed effects; and P_i is a vector of observable characteristics that is invariant or rarely changing for dentists over different CoTs.

The estimates of θ can be recovered using an auxiliary OLS regression by making an additional random effects assumption that v_j and M_j are orthogonal (Abowd, Kramarz, & Margolis, 1999; Andrews, Gill, & Upward, 2006; Andrews, Schank, & Upward, 2006). This is generally a strong assumption in a sense that migrant GDPs may be truly motivated in a different way compared with their native counterparts. However, since this study aims to measure the difference in treatment intensity between migrant and non-migrant GDPs, regardless of whether this is due to M_j or v_j and the extent to which such differential arises from each component is beyond the scope of this paper. Nevertheless, the migrant coefficient could also be biased if the auxiliary regression omits variables that are simultaneously correlated with v_j and migrant dentist dummy (Plümper and Troeger 2004). We make the identification assumption that no observed variable excluded from the auxiliary regression is simultaneously correlated with v_j and the migrant dentist dummy, which is quite reasonable given the rich set of explanatory variables we control for in the auxiliary regression.

4 Regression results

Table 2 presents the results of estimating the treatment intensity function in a dentist fixed effects model. Standard errors are corrected for both heteroskedasticity across dentists and within-dentist correlation using robust cluster variance estimation. The F-test that all regressors are jointly equal to zero is rejected (Prob>F=0.0000).

Dentist effects estimated are significantly different from zero (F(274, 228256) = 12.15, Prob > F = 0.0000) and account for as much as 34% of the variation in treatment intensity (ρ=0.34). The random effects estimation method which produces efficient estimates exploring both within- and between-variance of the data is also employed on the data. The Hausman test suggests that dentist effects are not orthogonal to time-varying explanatory variables, and therefore, should be accounted for in the model ($\chi^2(55)$=296.72, Prob> χ^2=0.0000).

Since fixed effects methods only use time variations within each cross-sectional observation, between-variations for certain variables could also be taken up by the effects (Cornelißen and

Hübler 2007). Thus the auxiliary regression includes time-invariant variables such as dentist migrant status, age at entry and gender,[2] and each contract type, deprivation category of the practice and health board that dentists have worked in. Given the small number of dentists in the sample, we combine deprivation and health board categories containing few dentists together and do not include interact them with the migrant dummy in order to avoid collinearity. Coefficient estimates and robust standard errors are reported in Table 2. These variables are jointly significantly different from zero (Prob>F=0.0000), and explain 26% of the variance of dentist effects obtained from the dentist fixed effects model (R-squared=0.26).

In what follows, we focus on difference-in-differences variables to examine how a migrant GDP responds to the various case mix and personal circumstances relative to a comparable GDP, and after adjusting for observed variables, how their treatment intensity differs and varies with time.

Variations in patient dental conditions are captured by indicator variables for the broad treatment categories defined in the SDR and a dummy variable for treatment required arose as a result of trauma. An F-test that interaction variables between migrant dummy and treatment category indicators are jointly equal to zero is rejected (P=0.0335), which suggests migrant and non-migrant GDPs offer different levels of intensity for various treatment categories. Estimates suggest that, other things equal, migrant GDPs provide significantly higher level of intensity for surgical (3.58%) and prosthetic (11.17%) than the non-migrant GDPs.

Dummy variables for a dentist's contract (salaried or self-employed) and each patient's exemption status captures how dentists respond to remuneration structure and demand-side cost-sharing, respectively. The fixed effects model suggests that GDPs provide 23.32% less treatment when switching from self-employed to salaried contracts, and vice versa. This estimate, however, is conditional only upon the 4 (or 1.5% of the sample) of the GDPs who switched contracts during the sample period. Difference-in-differences estimates cannot be identified as all of the GDPs switching contracts are migrants. The auxiliary regression, on the other hand, indicates salaried dentists provide about 35% more treatment than the self-employed, although insignificant. The gap observed is likely a result of aggregation biases of omitted patient effects: the recruited Polish dentists, for example, are employed as salaried dentists in areas seeing the most severe service problems and poorest oral health in Scotland,

[2] Time-invariant variables explain only 5% of the variance of dentist effects estimated.

and therefore, are expected to face patients with higher treatment demands than those treated by self-employed dentists. Furthermore, *ceteris paribus*, non-migrant GDPs treat exempt patients 9.23% intensively than non-exempts. Difference-in-differences estimates are insignificant, suggesting no difference responses to the remuneration by migrant GDPs.

Of the standard dentist and patient controls, only the quadratic in patient ages and patient gender are significantly different between migrant and non-migrant GDPs (P= 0.031 and 0.010 respectively). Both migrant and non-migrant GDPs increase treatment intensity with patient age up to a certain age (29 and 33, respectively), before decreasing; but for each given age migrants provide less intensity than non-migrants. On the other hand, migrant GDPs increase treatment intensity for male patients by 2.75% compared with non-migrant GDPs 1.37%.

The indicator variables for the deprivation category of the practice and NHS Board where the patient receives treatment and their migrant-interactive variables capture the variations in treatment intensity by patients' socioeconomic characteristics and Health Boards. Although we find no obvious patterns for effects of practice deprivation, F-tests suggest migrant GDPs demonstrate significantly different variations in treatment intensity across practice deprivation and NHS Boards compared with non-migrant GDPs.

Figure 3 plots the distributions of estimated dentist effects for migrant and non-migrant GDPs. Migrant GDPs demonstrate less variation of fixed effects than non-migrants. The coefficient estimate of migrant dummy in the auxiliary OLS regression is -0.1896, which suggests that, upon arrival, a foreign GDP provides treatment 18.96% less intensively than a comparable local trainee (P=0.001) after adjusting for observed heterogeneity in patients and dentists and dentist-specific unobserved heterogeneity.

We model the experience profile of GDPs using a cubic specification. An F-test that the migrant interaction terms are jointly equal to zero is rejected (P=0.0010) suggesting that migrant GDPs follow a significantly different time-profile of treatment intensity compared with the non-migrants. The experience profiles for the two groups of dentists are plotted in Figure 4. Non-migrant GDPs increase treatment intensity but at a decreasing rate, while migrant GDPs increase intensity at a higher rate within the first year, before subsequently showing a decrease followed by a small upward tail at the end of the sample period. Although

we see some convergence during the first year of practice there is relatively little convergence during the sample period.

5 Discussion and conclusion

As a flexible and low-cost adjustment to temporary or regional imbalance, overseas qualified health professionals have made a significant and escalating contribution to health workforce in industrialized countries. This work, for the first time to our knowledge, compares the output of migrant and non-migrant health professionals to evaluate the impact of international recruitment on the healthcare provision in the host country.

To assess the extent to which there is a trade-off between the relative cost and output of migrant and non-migrant health professionals, we compare the treatment provided by all non-UK qualified dentists who started providing dental services in the service after 2006 with the treatment provided by a comparison group consisting of the 2005/06 cohort of Scottish VTs. A difference-in-differences model is estimated to examine whether migrant GDPs respond differently to case mix and individual circumstances (treatment category, patient type, remuneration, etc.), and how they assimilate into the host country. Given the longitudinal nature of the data, we control for time-invariant unobserved heterogeneity in dentists using fixed effects method. Our results provide evidence that migrant GDPs have different practice styles. Compared with non-migrant GDPs with comparable characteristics, migrant GDPs treat patients more intensively when delivering surgical and prosthetic treatment; they also provide different levels of treatment intensity according to patient age and gender. Controlling for dentist-specific unobserved heterogeneity and estimating an auxiliary OLS regression of dentist effects estimated, we find migrant GDPs treat patients 18.96% less intensively than non-migrant GDPs upon arrival after adjusting observed variables. Although we find some convergence in treatment between migrant and non-migrant GDPs during their first year following entry, the large gap remains much the same by the end of the second year of practise.

These findings suggest that medical education may not be perfectly portable across countries. Migrant health professionals developing different practice styles, therefore, may not provide a perfect substitute for home grown professionals. The quality and safety of healthcare services delivered by foreign qualified professionals is clearly an important issue requiring more attention.

Appendix A

Table 1. Descriptive statistics.

		Non-migrant			Migrant		
Variable	Description	N	Mean	SD	N	Mean	SD
feesdr107	Total value of the claim (constant SDR107 prices)	112394	36.55	57.54	116211	38.22	56.25
diag	Equals 1 if at least one treatment on the claim was a diagnosis item	112394	0.73	0.45	116211	0.70	0.46
prev	Equals 1 if at least one treatment on the claim was a preventive item	112394	0.0006	0.0239	116211	0.0004	0.0188
perio	Equals 1 if at least one treatment on the claim was a periodontal item	112394	0.49	0.50	116211	0.45	0.50
cons	Equals 1 if at least one treatment on the claim was a conservative item	112394	0.36	0.48	116211	0.40	0.49
surg	Equals 1 if at least one treatment on the claim was a surgical item	112394	0.07	0.25	116211	0.08	0.27
prosth	Equals 1 if at least one treatment on the claim was a prosthetic item	112394	0.06	0.23	116211	0.07	0.25
ortho	Equals 1 if at least one treatment on the claim was an orthodontic item	112394	0.0000	0.0052	116211	0.0001	0.0110
other	Equals 1 if at least one treatment on the claim was an ‘other’ item	112394	0.06	0.24	116211	0.07	0.26
occasional	Equals 1 if at least one treatment on the claim was an occasional item	112394	0.005	0.072	116211	0.014	0.117
incomplete	Equals 1 if at least one treatment on the claim was an ‘incomplete’ item	112394	0.005	0.068	116211	0.010	0.099
misc	Equals 1 if at least one treatment on the claim was a ‘miscellaneous’ item	112394	0.19	0.40	116211	0.22	0.42
trauma	Equals 1 if at the claim was characterized by trauma	112394	0.001	0.035	116211	0.001	0.031
exp	Experience of the dentist in the GDS (months)	112394	15.01	6.05	116211	13.51	7.33
enterage	The age of the dentist at the first treatment in the GDS	83	25.29	2.26	192	34.36	8.83
dsex	The sex of the dentist (male=1)	83	0.49	0.50	192	0.48	0.50
sal	Remuneration structure (salaried=1)	83	0.02/2	0.15	192	0.19/37	0.40
se	Remuneration structure (self-employed=1)	83	0.98/81	0.15	192	0.83/159	0.38
exempt	Exemption status (exempt=1)	112394	0.26	0.44	116211	0.29	0.45
page	The age of the patient	112394	45.24	14.52	116211	45.44	14.43
psex	The sex of the patient (male=1)	112394	0.44	0.50	116211	0.45	0.50
visitdur	Duration since last visit (months)	112394	5.58	3.61	116211	5.86	4.12
active	Neither an exam only, nor a scale & polish only nor both	112394	0.62	0.49	116211	0.68	0.47
depcat	The deprivation category of the dentist’s practice (1/7=least/most deprived)						
caid	Health board ID (anonymous)						

Figure 1. Distribution of GDPs by deprivation category of the practice (by 10).

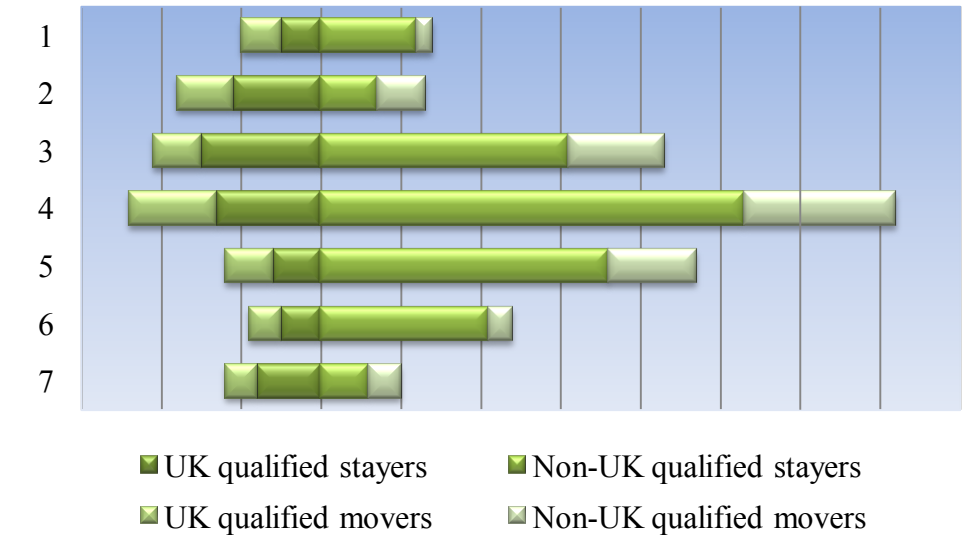


Figure 2. Distribution of GDPs by Health Board (by 10).

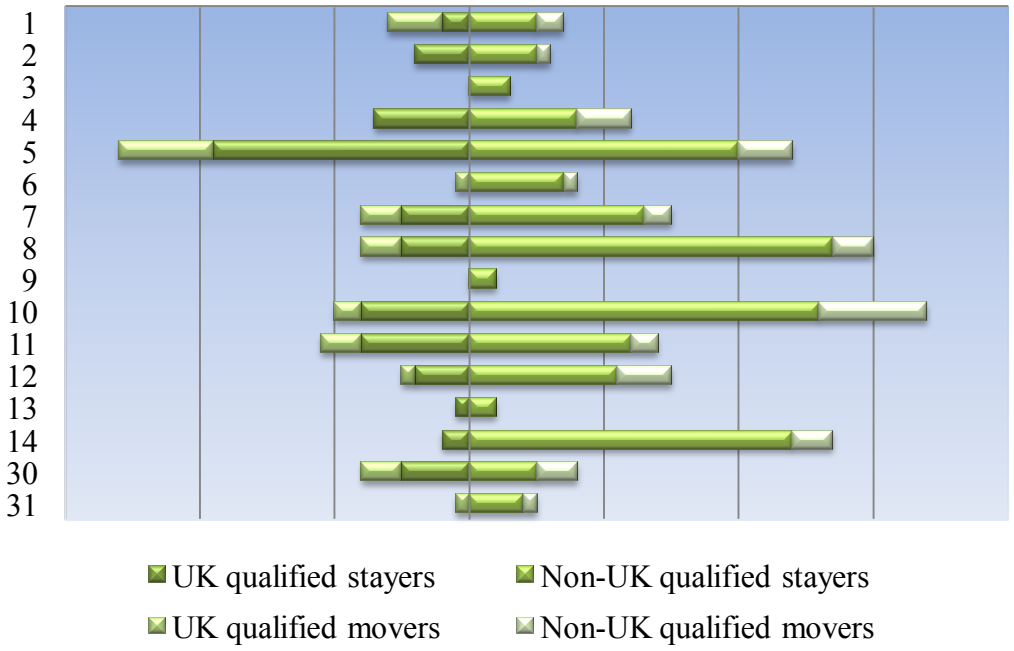


Table 2. Regression results.

	FE	Auxiliary OLS		FE
Assimilation estimates				
m	[dropped]	-0.1896*		
		[0.0579]		
exp	0.0114+		exp*m	0.0152*
	[0.0060]			[0.0074]
exp^2/100	-0.0635		exp^2/100*m	-0.1270*
	[0.0474]			[0.0567]
exp^3/1000	0.0121		exp^3/1000*m	0.0265*
	[0.0112]			[0.0130]
Case mix				
prev	0.7406*		prev*m	0.0411
	[0.1323]			[0.1924]
perio	0.6895*		perio*m	-0.0098
	[0.0130]			[0.0174]
cons	1.1763*		cons *m	-0.0142
	[0.0190]			[0.0260]
surg	0.6249*		surg*m	0.0358+
	[0.0155]			[0.0214]
prosth	1.4677*		prosth*m	0.1117*
	[0.0264]			[0.0365]
ortho	1.1771		ortho*m	0.6744
	[0.8206]			[0.9398]
other	0.0581*		other*m	-0.0268
	[0.0276]			[0.0361]
occasional	0.6127*		occasional*m	-0.082
	[0.0425]			[0.0571]
incomplete	0.5997*		incomplete *m	-0.1394
	[0.0861]			[0.0969]
misc	-0.0255		misc*m	0.0087
	[0.0190]			[0.0241]
trauma	0.1042		trauma*m	0.0758
	[0.0653]			[0.0887]
Personal circumstances				
Remuneration				
sal	-0.2332*	0.1479	sa1*m	[dropped]
	[0.0826]	[0.1199]		
se		-0.1972		
		[0.1372]		
exempt	0.0923*		exempt*m	0.0151
	[0.0159]			[0.0203]
Dentist characteristics				
enterage	[dropped]	-0.0038	enterage*m	[dropped]
		[0.0033]		

Table 2. Regression results (continued).

	FE	Auxiliary OLS		FE
dsex	[dropped]	0.0006	dsex*m	[dropped]
		[0.0433]		
Patient characteristics				
page	0.0033*		page*m	-0.0018
	[0.0010]			[0.0016]
page^2/100	-0.0050*		page^2/100*m	0.0024
	[0.0010]			[0.0015]
psex	0.0137*		psex*m	0.0138*
	[0.0040]			[0.0053]
visitdur	0.0391*		visitdur*m	-0.0024
	[0.0031]			[0.0036]
visitdur^2/100	-0.1432*		visitdur^2/100*m	0.0161
	[0.0158]			[0.0186]
Practice deprivation				
depcat	Yes		depcat*m	Yes
grouped depcat		Yes		
Health board				
caid	Yes		caid*m	Yes
grouped caid		Yes		
_cons	2.0670*	0.3677*		
	[0.0480]	[0.1842]		
F	4837.17	4.79		
r2	0.61	0.26		
r2_a		0.20		
r2_o	0.53			
r2_w	0.61			
r2_b	0.26			
N	228605	275		
N_g	275			
g_avg	831.29			
sigma_u	0.40			
sigma_e	0.56			
rho	0.34			

Standard errors are in square brackets.

* significant at the 5% level.

+ significant at the 10% level.

Figure 3. Distributions of dentist effects for UK and non-UK qualified dentists estimated for the dentist fixed effects model.

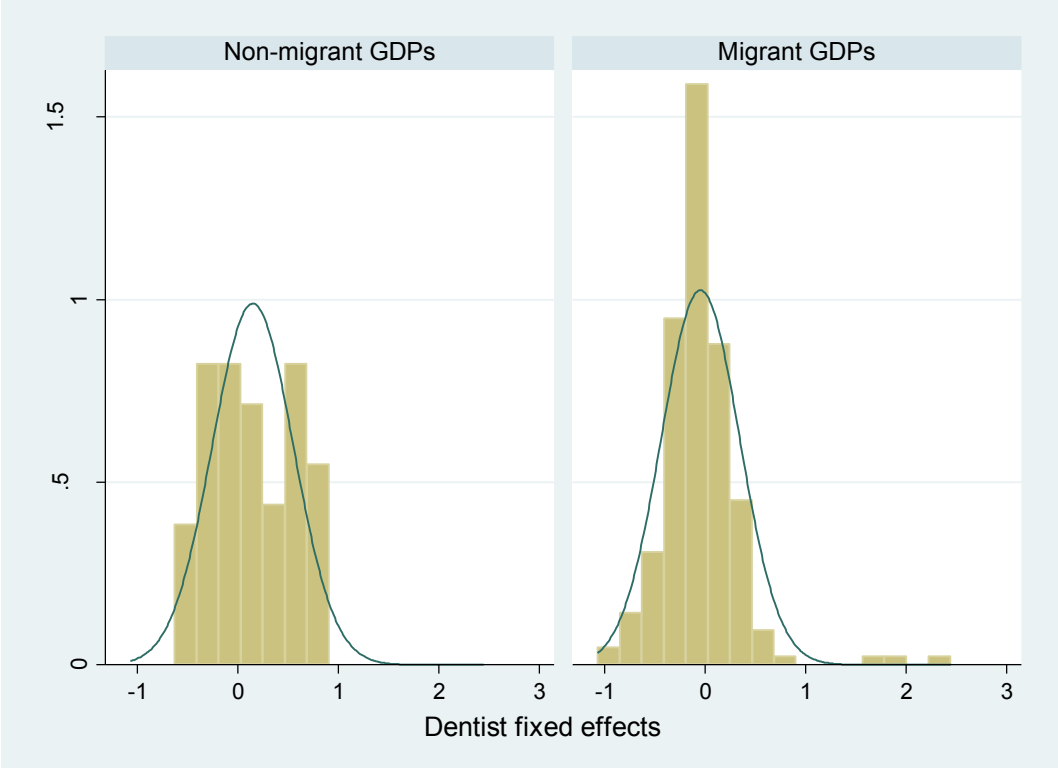
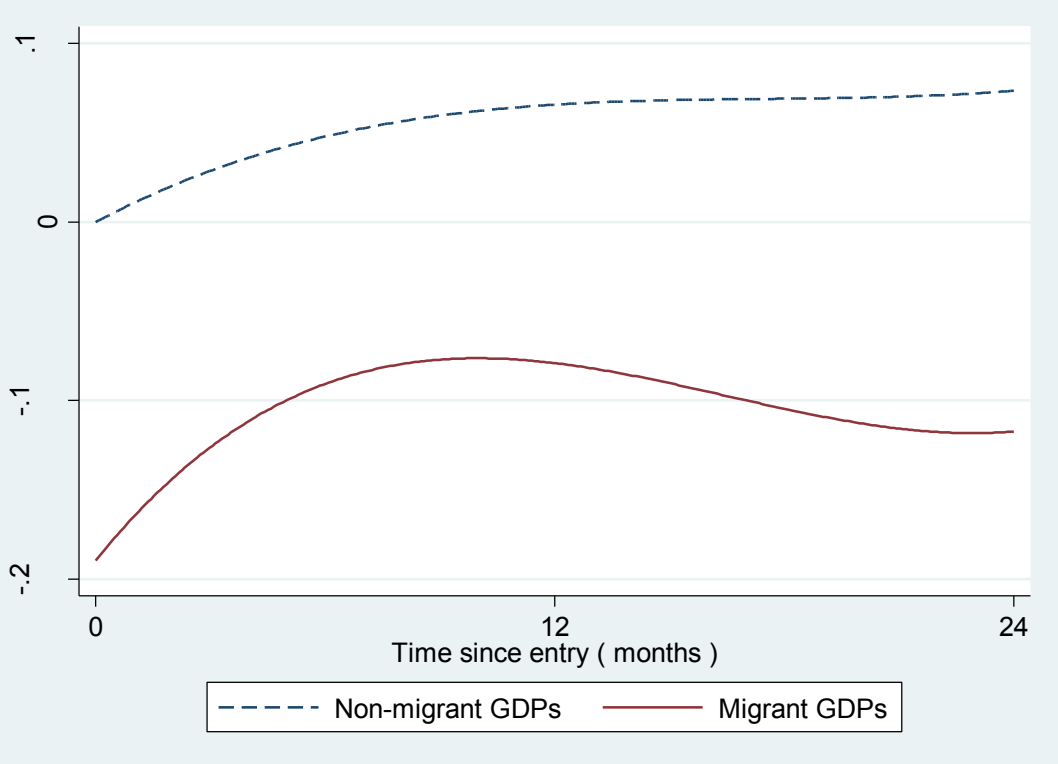


Figure 4. Experience - intensity profiles for UK and non-UK qualified dentists estimated for the dentist fixed effects model.



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