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Educated in New Zealand and staying on? A parameter simulation analysis

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Abstract

There is a non-trivial probability of students remaining abroad after completion of studies outside their home countries. Departing from typical literature, this paper incorporates simulations of parameters obtained from a multinomial logit model in revealing why international students studying abroad intend to stay abroad or to return home. Micro-level data are obtained from a sample of 623 full-time international students studying at tertiary level programmes in two New Zealand universities. Parameter simulations enable the plotting of the distributions of outcome probabilities, where the distributions would show how distinguishable the effect of an explanatory variable has on the probability of remaining abroad or returning home. Favourable perceptions on the type of lifestyle in one's home country are found to have a positive impact on the probability of returning home. Surprisingly, good perceptions on wage competitiveness do not appear to be a predominant reason behind the probability of remaining abroad or returning home.

Keywords: Brain drain; international student migration; parameter simulation; discrete choice model; destination country.

Introduction

The trend for students to study abroad is expected to continue, and with it the strong likelihood that many will remain in the host country in which they study (Gribble 2008). It is a widely accepted notion that some students who study abroad will subsequently settle there (Angel-Urdinola et al. 2008; Altbach 2004). Many students do not return immediately following the completion of their studies, but stay and work in their country of study (Tansel & Güngör 2003). It is therefore imperative to understand what their motivations are to return home and why there are some who are reluctant to do so.

In the migration literature, this phenomenon has different terms. It is known as student non-return (Bratsberg 1995; Güngör & Tansel 2008a), international student migration (King & Ruiz-Gelices 2003; Li et al. 1996), edu-

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cationally channelled international labour mobility (Liu-Farrer 2009), and indirect immigration of professionals (Huang 1988; Agarwal & Winkler 1985). The issue of international tertiary student staying on in the United States upon completion of their studies is well-documented in the literature. However, these studies do not examine if the students head for other destination countries or head back home. This paper fills the literature gap by examining the student non-return issue in the context of New Zealand and by using a parameter simulation approach.

In 2007, over 2.8 million students were enrolled in tertiary educational institutions outside their home country (UNESCO 2009). This represents 123,400 more students than in 2006, an increase of 4.6%. The global number of mobile students has grown by 53% since 1999 (with an average annual increase of 5.5%) and by 2.5 times since 1975 with an average annual increase of 11.7% throughout this period.

New Zealand's context

New Zealand has recently become an emerging global player as a world class provider of tertiary education to international students; it now has one of the highest percentages of international students, where these students make up more than 10% in tertiary education enrolments and more than 20% in advanced research programmes (OECD 2012). In 2000/2001, there were only 8,210 international students studying at the tertiary level in New Zealand, but the number increased to 33,047 in 2007 (UNESCO 2003; 2009) and increased further to 37,878 in 2010 (UNESCO 2012). New Zealand is among the top five most popular destination countries among students from a number of Asia-Pacific countries (Malaysia, Brunei, Australia) and small Pacific island countries (Fiji, Kiribati, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu) (UNESCO 2012). In 2011/12, 68,980 international students were approved to study in New Zealand (Department of Labour 2012). New Zealand's popularity is due to its deliberate strategy in the internationalization of its higher education system and that it enables immersion in a predominantly English-speaking environment for the students (Kell & Vogl 2010).

In 2007, New Zealand Department of Labour published a report on the staying-on rates of international students in New Zealand. It estimates that 27% of the international students who began their studies in the 1999/00 and 2000/01 cohorts (with a combined total of approximately 47,400 international students, at all levels of education) have continued to stay on in New Zealand after completing their studies, either for work and/or residence purposes. Among the 27% of the 47,400 international students, 15% of them transitioned from study to residence, 6% from study to work, and the remaining 6% from study to work and residence (Merwood 2007). The reported figures include international students from all levels of study. According to a more recent report by New Zealand's Department of Labour, 31% of the interna-

tional students transitioned from study to work in New Zealand, and about a fifth of them gained permanent residence (Wilkinson et al. 2010).

There are only a handful of empirical studies looking at brain drain specifically in New Zealand's context. The studies have examined the migration determinants of professionals from Fiji to New Zealand (Gani & Ward 1995), the migration determinants of doctors and nurses from three small Pacific island countries – Fiji, Samoa, and Tonga – to Australia and New Zealand (Brown & Connell 2004), the brain drain phenomenon of professionals from New Zealand working abroad (Inkson et al. 2004; Jackson et al. 2005; Carr et al. 2005), the determinants of emigration and return migration of New Zealand's top students (Gibson & McKenzie 2011), and the economic consequences of the outflow of the brightest New Zealanders (Gibson & McKenzie 2012). Perhaps with the exception of Gibson and Mckenzie's (2011) study, none of these studies focuses on the determinants of international student migration issue in New Zealand.

Point of departure

This paper contributes to the literature and fills the gap in two ways. First, the paper focuses on international students studying in New Zealand rather than in the US. The paper not only looks at whether the students would continue to stay on in New Zealand (the host country of education), but also examines other destination countries that the students intend to head for, including home. Second, the literature lacks micro-level econometric studies which address the question of which country the students intend to go to upon completing their studies abroad. This is especially so in the context of New Zealand as the host country of study. To date, there are yet to be any migration or brain drain studies examining this specific issue using a parameter simulation approach in a microeconometrics set-up. These are the points of departure of this paper from the pool of existing literature on student migration.

Data and model specification

The target population is all full-time international students currently studying (at the time of survey) at tertiary level programmes in New Zealand's eight universities. Tertiary level students refer to those studying at the levels of Bachelor/Honours, Post-graduate Diploma/Certificate, Masters, and PhD degrees. International short-term exchange students are excluded. The sampling frames used here are the lists of currently enrolled full-time international students maintained by the international offices of the eight universities. However, only Otago University and Canterbury University allowed their international students to participate in the web-based survey conducted from March to May 2008. There were 512 respondents from Otago and 269 from Canterbury, representing response rates of 31.4% and 24.1% each. The final usable sample size totals 623 respondents.

Sample representativeness

Although the sample size appears to be adequate in general, there might still be some reservations about the sample representativeness. Here, the population distributions of the international students' regional origin, age group, level of study, and gender are compared to those of the sample.[1] In terms of regional origin distributions, the population and sample distributions of students who come from the Africa, Central/South America, Middle East, and Northern America regions are quite similar to each other. However, the sample distributions of students who come from the Asia, Europe, and Pacific regions are not similar to the respective population distributions.

In terms of age groups distributions, the population and sample distributions of students in the age groups of less than 18, between 18 and 19, between 20 to 24, and between 25 to 39, are also quite similar to each other, with the exception of the age group of over 40 years old, in which the sample distribution under-represents its population counterpart. In terms of levels of study distributions, the population and sample distributions of students at the Honours/Postgraduate Certificate or Diploma and at the Master's levels are similar to each other. However, the sample distribution of students studying at the Bachelor level under-represents the population distribution, while the sample distribution of doctoral level students is an over-representation of the population distribution. In terms of gender distributions, the sample distribution of female international students over-represents its population distribution, whereas the sample distribution of male international students under-represents its population distribution.

Dependent variable

The dependent variable used in this paper is the intended destination country. In the survey, the students are asked to state their intended destination country upon completion of their current studies. As shown in Table 1, slightly more than half of the students intend to return home, whereas about 28% intend to stay on in New Zealand. The rest either intend to go to (i) Australia or the US, (ii) the UK or others (mostly non-UK European) countries. The four outcomes shown in Table 1 constitute the dependent variable.

Since the dependent variable is clearly nominal and has more than two categories, a multinomial logit (MNL) model is specified. The MNL model is typically used when the outcomes of a polychotomous dependent variable have no clear-cut ordering. The MNL model is derived from random utility maximization theory. According to this theory, an individual (a decision-maker; a student in this case) is assumed to choose the alternative that yields him the highest utility. His utility can be described by a utility function. This function depends on the characteristics of the individual and also the attrib-

[1] These distributions are tabulated in Appendix A.

utes of the alternatives. In this study, however, there are no alternative-specific attributes. The utility function (U) has a deterministic ($\boldsymbol{X\beta}$) and a stochastic component (ε).

Table 1: Outcomes breakdown

Destination	n	%
Home	339	54.41
New Zealand	177	28.41
Australia/US	51	8.19
Others/UK	56	8.99
Total	623	100.00

Note: The Australia/US outcome includes Canada.

MNL Model

Let the utility for a student i faced with J alternatives and choosing alternative m be:

$$U_{im} = \boldsymbol{X}_i\boldsymbol{\beta}_m + \varepsilon_{im} \quad (1)$$

The probability of choosing alternative m over other alternatives is when

$$P(Y_i = m) = P(U_{im} > U_{ij}) \quad \forall j \neq m \quad (2)$$

In order to obtain the MNL model, the error term ε in equation (1) is assumed to be independent and identically distributed (i.i.d) with a Weibull (or type I extreme-value) distribution such that $F(\varepsilon) = exp[-exp(-\varepsilon)]$. This implies that given a set of individual-specific characteristics $\boldsymbol{X}_i$, the probability of student i choosing alternative m is:[2]

$$P(Y_i = m \mid \boldsymbol{X}_i) = \frac{exp(\boldsymbol{X}_i\boldsymbol{\beta}_m)}{\sum_{j=1}^{J} exp(\boldsymbol{X}_i\boldsymbol{\beta}_j)} \quad \text{with } \boldsymbol{\beta}_1 = 0 \text{ and } \forall j \neq m \quad (3)$$

$\boldsymbol{\beta}_1$ is arbitrarily set to zero (i.e. the base outcome in the MNL model) for model identification purpose. The coefficients of the remaining outcomes are interpreted relative to the base outcome. This paper fits an MNL model with a 4-outcome dependent variable, such that,

$$Y = \begin{cases} 1 & \text{if the intended destination is 'Home'} \\ 2 & \text{if intends to stay on in 'New Zealand'} \\ 3 & \text{if intends to go to 'Australia/US'} \\ 4 & \text{if intends to go to 'Others/UK'} \end{cases}$$

Maximum likelihood estimation is used to estimate the outcome probabilities.

[2] This model includes three sets of explanatory variables, i.e. demographic, education-related, and perception-related variables.

Parameter simulation analysis

Empirical studies using discrete choice models typically report the predicted outcome probabilities, which are the most common quantities of interest. The results hence obtained constitute only one set of outcome probabilities for each outcome, i.e., only a set of actual sample-estimated outcome probabilities. We do not know what the distribution of the outcome probability looks like. A visual of such a distribution would allow an instant grasp of the mean probability, spread around the mean, probability range, and skewness of the distribution. To date, there are no known empirical studies on brain drain and student non-return/migration that follow King et al.'s (2000) recommendation of always doing a post estimation parameter simulation.

The main purpose and primary usefulness of a parameter simulation is to enable the plotting of the distributions of the outcome probabilities. The plots allow a visual inspection of the inherent uncertainty by way of the distributions' spread and overlap. The more a distribution is spread out, the more uncertainty is associated with the outcome probabilities. The distribution plots also reveal how different or how far apart the means of the outcome probabilities are. The further apart the means of the outcome probabilities (less overlap), the more distinguishable the effect a variable has on the outcome probabilities.

A parameter simulation is basically a Monte Carlo simulation exercise. In conducting a parameter simulation, the model, in this case the MNL model, is first estimated. The model estimation gives a vector of parameter estimates. Each of the parameter estimates has a mean and a standard deviation, from which a theoretical distribution can be generated and subsequently plotted. However, the distribution of outcome probabilities cannot be plotted just yet because the estimation from the actual sample has produced only one estimate so far – a point estimate. What a parameter simulation does is, after the model estimation, it randomly draws or simulates a hundred or a thousand or indeed any *M* number of simulations of such parameter estimates from their theoretical distributions.

Say now we let *M=1,000*, then the *1,000* simulated parameter estimates can be used to compute any quantities of interest. Here, the quantities of interest are the outcome probabilities. For each outcome (i.e. Home, New Zealand, Australia/US, and Others/UK), *1,000* thousand simulated outcome probabilities are computed and then a probability distribution for each of the outcome can now be plotted. The outcome probabilities can be computed and then plotted for any values of interest of the explanatory variables.[3] The number of simulations, *M*, can be increased for a more accurate plot of the outcome probability distributions - i.e. the shape, the mean, the standard devi-

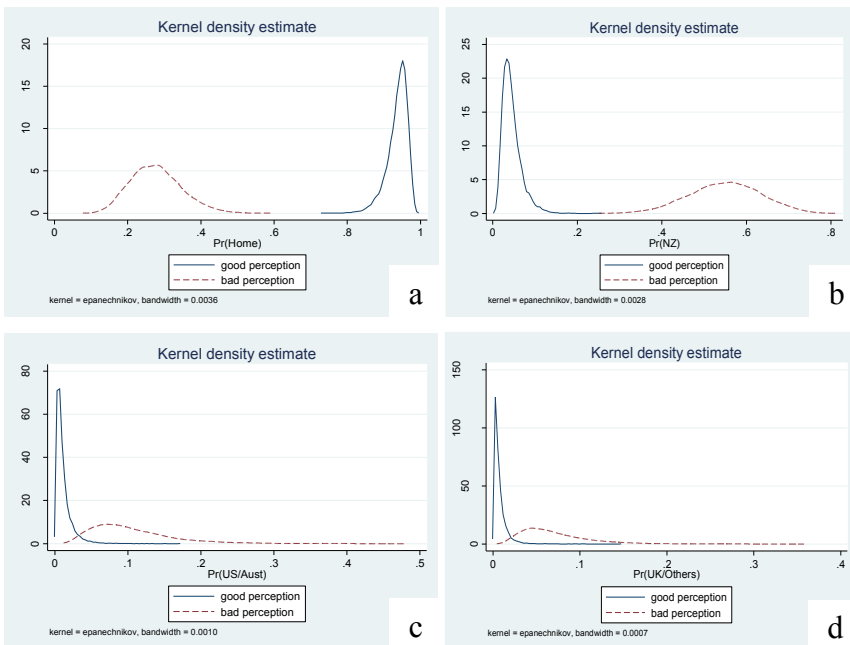
[3] The parameters here are simulated holding other explanatory variables at their representative values while changing the values of the explanatory variable(s) of interest. The representative values refer to the mean values for continuous variables and mode values for dummy variables.

ation, and other statistical features of the distributions. In this paper, all the outcome probability distributions are plotted from 10,000 simulated parameter estimates, i.e. *M=10,000*.

Findings and Discussions

The following Figures 1 to 3 depict the outcome probability distributions. The probability distributions are based on some hypothetical scenarios. Figure 1 shows the distributions of the simulated outcome probabilities for students who perceive all the six aspects of home to be favourable and for students who perceive otherwise. The six aspects of a home country considered in this paper include (i) working environment, (ii) wage competitiveness, (iii) opportunities for use of acquired knowledge, (iv) lifestyle, (v) family ties and network of friends, and (vi) race equality.

Figure 1: Outcome probability distribution based on perceptions of home



The effects of having all good perceptions of home on the probability of choosing home are distinctly separated from the effects of having all bad perceptions. This is shown, in panel a, by the two non-overlapping probability distributions of *Pr(Y=Home)*. Students with good perceptions of all aspects of home have higher probabilities of choosing home and the probabilities are

tightly centred around the mean probability of *Pr(Y=Home)=0.9365*.[4] The relatively spiked distribution suggests that students with such good perceptions would almost certainly have high probabilities of selecting home, with the probability range varying only narrowly from about 0.8 onwards.

Conversely, students with bad perceptions of all the six aspects of home have lower probabilities of choosing home and the flatter probability distribution has a wider spread around the mean probability of *Pr(Y=Home)=0.2778*. This suggests that students with such bad perceptions, besides having lower probabilities of selecting home, are also less certain as to the choice of home as the intended destination.

The distributions of *Pr(Y=NZ)* appear to be mirror images of *Pr(Y=Home)*, although the distributions are not entirely separated (panel b). Students with bad perceptions of home have higher probabilities of choosing New Zealand, i.e. to stay on in New Zealand, but the probabilities are widely spread around the mean of *Pr(Y=NZ)=0.5491*. Students with good perceptions of home have low probabilities of staying on in New Zealand, with a mean value of *Pr(Y=NZ)=0.0449* and a tight distribution around this mean. The probability distributions of *Pr(Y=Aust/US)* and *Pr(Y= Others/UK)* of those with bad perceptions of home overlap the tail portions of the probability distributions of those with good perceptions of home (panel c and d). For students with bad perceptions, their probability distributions spread over almost the entire range of the probability scale. This suggests that such students appear to be indifferent in choosing Aust/US or Others/UK as the intended destination. On the contrary, students with only good perceptions of home have almost negligible probabilities of choosing Aust/US or Others/UK.

The findings here provide further empirical evidence to Lee's (1966) push-pull theory of migration, where the interplay between the 'push' factors in the home countries and the 'pull' factors of the destination countries determines the migration outcome, depending on the strength of those factors. There are however, limitations to the push-pull theory. It is perceived to be too narrow to explain a complex phenomenon such as migration (Hooghe et al .2008), and it assumes that international migration leads to a balancing of the forces of economic growth in different regions (Morawska 2007).

In this paper, the parameter simulations are used on micro-level data on the intention to return home or to stay on abroad. Similar simulations have also been used on macro-level data to examine the brain drain phenomenon, such as the study by Straubhaar and Wolburg (1998). By simulating scenarios with different average and initial stock of human capital, they found that an absolute decrease in the average stock of human capital is relatively robust to different levels of initial average stock of human capital.

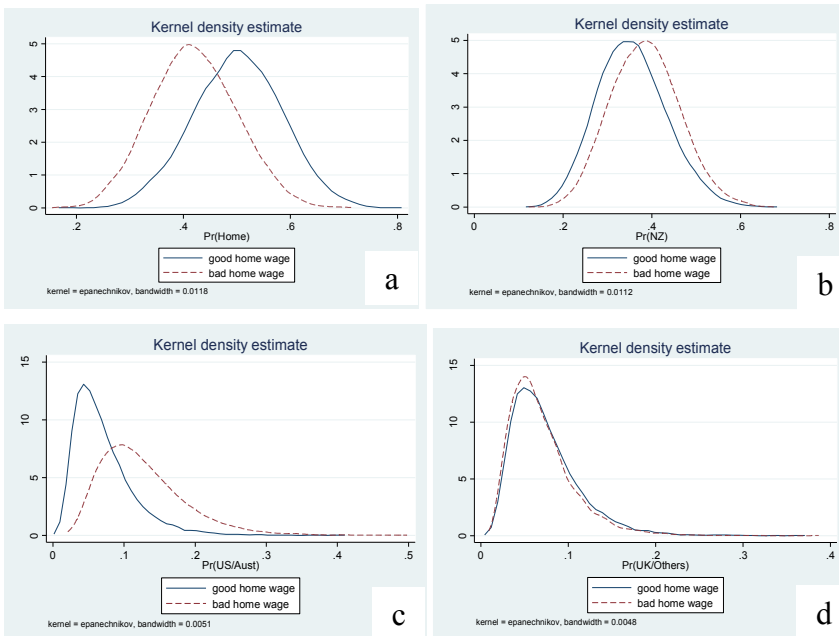
[4] Appendix B provides in details the descriptive statistics of the outcome probabilities discussed in this section.

Wage competitiveness

Figure 2 is a slightly different way of showing how perceptions of any one aspect of the home country can have on the outcome probabilities. Here, only the perception of wage competitiveness in the home country is changed while holding other perception variables constant at their mode values.[5] The probability distributions between the two groups of students having different perceptions of their countries' wage competitiveness, have large overlapping portions, especially for *Pr(Y=NZ)* and *Pr(Y=Others/UK)* (panel b and d).

This suggests that perceptions of the home wage may not be a strong determinant in influencing the intended destination country. Empirical findings from Batista et al. (2009) lend some support as they conclude that wage differential only partially explains the positive emigrant selection. A test on the probability means reveals that they are statistically different at the 1% level. Although statistically different, the probability means may not have any practical difference since the absolute values of the means are close to each other (i.e. the relatively close horizontal distance between the distribution peaks).

Figure 2: Outcome probability distribution based on home wage

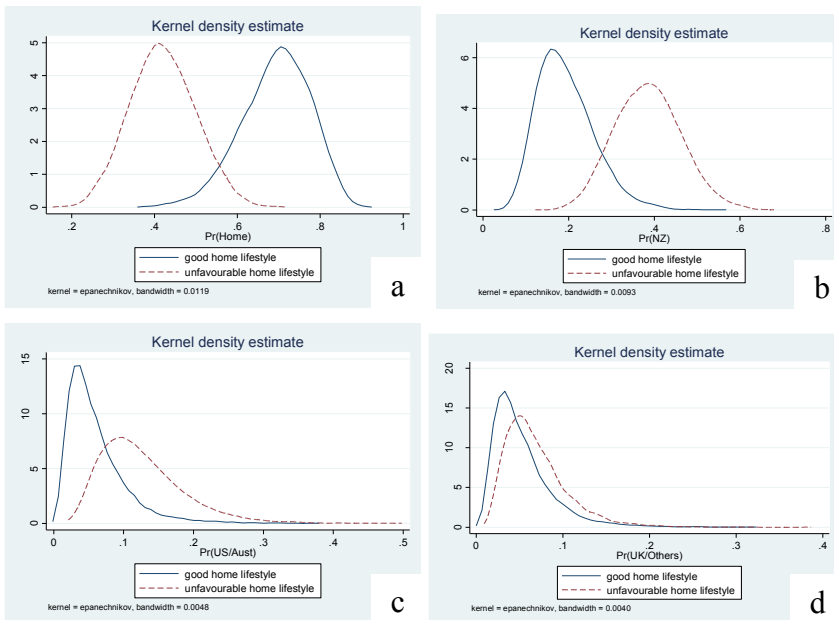


The finding here lends some empirical support to Baláž and Williams (2004) who found Slovakian students' main motivation to study abroad, in the

[5] Respondents are asked to rate whether they perceive wages as more competitive in their home country or abroad. 37% of the respondents agree that wage is more competitive at home.

UK, is not about obtaining higher salaries when they return home after completing their studies abroad, but rather more for their own social advancement. Waters (2006), on the contrary, concluded economic incentive to be the main driver, where middle-class youths from Hong Kong are sent abroad for a western tertiary education with the hope of securing higher salaries when they return home.

Figure 3: Outcome probability distribution based on home lifestyle



Like Waters, Liu-Farrer (2009) came to a similar conclusion that, in the case of Chinese students studying in Japan, their real motive was to work and earn money while there; studying abroad is only as a means of getting easy access into the host country. Gao and Liu's (1998) study on Chinese students going to Australia for English language courses also came to similar conclusions as that of Liu-Farrer's; they too concluded that the students' main agenda is to find work and to stay on in Australia.

It might also be the case that students studying abroad are encouraged to stay for work purposes by the host country, as in the case of Malaysian students studying in Australia; Australia's international education policies and immigration laws welcome graduates with Australian degrees and facilitate their transition to working there (Ziguras & Law 2006). In another study, by Li et al. (1996) however, they concluded that international moves for study purposes do not influence the planning or intention of further migration moves.

Lifestyle

In Figure 3 (panel a and b), the probability distributions of *Pr(Y=Home)* and *Pr(Y=NZ)* for students with different perceptions of home lifestyle, show noticeable differences (less overlap). Here, the probability distributions, and hence the probability means, are more distinct. Students who perceive good home lifestyle have, on average, a higher probability of intending to return to their home countries, compared to students with unfavourable perceptions of that aspect, i.e., *Pr(Y=Home)=0.6930* versus *0.4204*.[6] This finding is consistent with those by Güngör and Tansel (2008a; 2012), who looked at the return intentions of Turkish students studying in the American universities. Using an ordered probit model, they found lifestyle preferences to be one of the strongest variables in determining the probability of student non-return; those who prefer the lifestyle in the host country are less likely to return. Some similar studies by the same authors, Tansel and Güngör (2003), and Güngör and Tansel (2008b), revealed that more than three quarters of their respondents agreed the preference for the lifestyle in the host country to be important in attracting to stay on.

Perceptions of home lifestyle have more distinct probability means than perceptions of the home wage in choosing New Zealand. Compare the *Pr(Y=NZ)* distributions of Figures 2 and 3 (panel b). The two distributions suggest that good perceptions of home lifestyle have a stronger impact than perception of home wage on *Pr(Y=NZ)*. Once again, the evidence here raises doubts over the conventional wisdom of wage being the predominant factor in determining destination choices.

Conclusions

This paper incorporates a different statistical approach to the studies of migration and brain drain. So far, there are yet to be any such studies adopting the parameter simulation analysis. This is even more so in the context of the determinants of migration and brain drain of international students studying in New Zealand. Using a discrete choice model framework and a sample of 623 international students studying in two New Zealand universities, a parameter simulation analysis provides an instant grasp of which determinants having a stronger impact on the outcome probabilities (i.e. the probability to intend to return to one's home country, to stay on in New Zealand, to go to Australia/US, or to go to the UK/other countries). The determinants discussed here are how students studying abroad perceive their home countries in different aspects, i.e. the perceptions of wage competitiveness and the kind of lifestyle in one's home country.

We first look at a parameter simulation on how the outcome probabilities are impacted when all the six aspects of a home country are considered favourable versus when all the aspects are unfavourable. We conclude from

[6] Less than a third of the respondents (27%) agree to better lifestyle in their home countries.

Figure 1 (panel a) that if all aspects of home are favourable, there are very high probabilities that students will intend to return home and that there are less uncertainty associated with these probabilities. On the contrary, the findings suggest that if the students perceive all aspects of their home country to be unfavourable, the probabilities of their staying-on in New Zealand are much higher than to go home, or to another country.

We change the simulation approach slightly in Figure 2 and 3. Here, only one from the six aspects is varied to see the impact of such a change in the perception on the outcome probabilities. Compared to the perception of the lifestyle in one's home country, the perception of wage competitiveness is found to have no meaningful impact on the students' choice of intended destination country. The findings from these two figures challenged the received literature that wage is the predominant factor in influencing migration intentions or decisions.

This paper however, has its limitations. Firstly, the sample here only involves international students from two universities in New Zealand. Future studies should try to get a larger participation, i.e. from all the eight universities. Secondly, due to data constraints, this paper discusses the intention, rather than the actual choice of destination country. It is recommended that similar studies can consider collecting a panel data set of at least two points of time, i.e. the intended destination country before the students graduate and the actual chosen destination country after they have graduated. By combining a larger sample with a panel data set, this can help tease out heterogeneity bias and produce more accurate estimates. Interpretations or generalizations from the findings here should therefore bear these caveats in mind.

References

Agarwal, V. B. & Winkler, D. R. (1985). United States immigration policy and indirect immigration of professionals. *Economics of Education Review,* 4(1): 1-16.

Altbach, P. G. (2004). Higher education crosses borders. *Change*, 36(2): 18-24.

Angel-Urdinola, D. F., Takeno, T. & Wodon, Q. (2008). Student migration to the United States and brain circulation: Issues, empirical results, and programmes in Latin America. In A. Solimano (Ed.), *The international mobility of talent: Types, causes and development impact*. Oxford: Oxford University Press.

Baláž, V. & Williams, A. M. (2004). 'Been there, done that': International student migration and human capital transfers from the UK to Slovakia. *Population, Space and Place*, 10: 217-237.

Bastista, C., Lacuesta, A. & Vicente, P. C. (2009). Testing the 'brain gain' hypothesis: Micro evidence from Cape Verde. *IIIS Discussion Paper*, No. 282, Institute for International Integration Studies.

Bratsberg, B. (1995). The incidence of non-return among foreign students in the United States. *Economics of Education Review,* 14(4): 373-384.

Brown, R. P. C. & Connell, J. (2004). The migration of doctors and nurses from South Pacific island nations. *Social Science & Medicine*, 58: 2193-2210.

Carr, S. C., Inkson, K., Thorn, K. (2005). From global careers to talent flow: Reinterpreting 'brain drain'. *Journal of World Business*, 40: 386-398.

Department of Labour (2012). *Migration Trends Key Indicators Report, June 2012*. Wellington: New Zealand Department of Labour.

Gani, A. & Ward, B. D. (1995). Migration of professionals from Fiji to New Zealand: A reduced form supply-demand model. *World Development*, 23(9): 1633-1637.

Gao, M. C. F. & Liu, X. (1998). From student to citizen: A survey of students from the People's Republic of China (PRC) in Australia. *International Migration*, 36(1): 27-46.

Gibson, J. & McKenzie, D. (2011). The microeconomic determinants of emigration and return migration of the best and brightest: Evidence from the Pacific. *Journal of Development Economics*, 95: 18-29.

Gibson, J. & McKenzie, D. (2012). The economic consequences of 'brain drain' of the best and brightest: Microeconomic evidence from five countries. *The Economic Journal*, 122(560): 339-375.

Gribble, C. (2008). Policy options for managing international student migration: the sending country's perspective. *Journal of Higher Education Policy and Management,* 30(1): 25-39.

Güngör, N. D. & Tansel, A. (2008a). Brain drain from Turkey: an investigation of students' return intentions. *Applied Economics*, 40(23): 3069-3087.

Güngör, N. D. & Tansel, A. (2008b). Brain drain from Turkey: the case of professionals abroad. *International Journal of Manpower*, 29(4): 323-347.

Güngör, N. D. & Tansel, A. (2012). Brain Drain from Turkey: Return Intentions of Skilled Migrants. *International Migration*, DOI: 10.1111/imig.12013

Hooghe, M., Trappers, A., Meuleman, B. & Reeskens, T. (2008). Migration to European countries: A structural explanation of patterns, 1980-2004. *International Migration Review*, 42(2): 476-504.

Huang, W.-C. (1988). An empirical analysis of foreign student brain drain to the United States. *Economics of Education Review,* 7(2): 231-243.

Inkson, K., Carr, S., Edwards, M., Hooks, J., Jackson, D., Thorn, R. & Allfree, N. (Spring 2004). From brain drain to talent flow: Views of Kiwi expatriates. *University of Auckland Business Review*, 29-39.

Jackson, D., Carr, S., Edwards, M., Thorn, R., Allfree, N., Hooks, J. & Inkson, K. (2005). Exploring the dynamics of New Zealand's talent flow. *New Zealand Journal of Psychology*, 34(2): 110-116.

Kell, P. & Vogl, G. (2010). (Eds) *Global student mobility in the Asia Pacific: Mobility, migration, security and wellbeing of international students*. Newcastle: Cambridge Scholars Publishing.

King, R. & Ruiz-Gelices, E. (2003). International student migration and the European 'year abroad': effects on European identity and subsequent migration behaviour. *International Journal of Population Geography* 9(3): 229-252.

King, G., Tomz, M. & Wittenberg, J. (2000). Making the most of statistical analyses: Improving interpretation and presentation. *American Journal of Political Science,* 44(2): 341-355.

Lee, E. S. (1966). A theory of migration. *Demography*, 3(1): 47-57.

Li F. L. N., Findlay, A. M., Jowett, A. J. & Skeldon, R. (1996). Migrating to learn and learning to migrate: A study of the experiences and intentions of international student migrants. *International Journal of Population Geography*, 2: 51-67.

Liu-Farrer, G. (2009). Educationally channeled international labor mobility: Contemporary student migration from China to Japan. *International Migration Review*, 43(1): 178-204.

Merwood, P. (2007). *International students: Studying and staying on in New Zealand*. Wellington: New Zealand Department of Labour.

Morawska, E. (2007). International migration: Its various mechanisms and different theories that try to explain it. *Willy Brandt Series of Working Papers in International Migration and Ethnic Relations*, No. 1/07. Sweden: Malmö Institute for Studies of Migration, Diversity and Welfare.

OECD (2012). *Education at a Glance 2012: OECD Indicators,* OECD Publishing. http://dx.doi.org/10.1787/eag-2012-en

Straubhaar, T. & Wolburg, M. (1998). Brain drain and brain gain in Europe: An evaluation of the East-European migration to Germany. *Center for German and European Studies*, Working Paper, Vol. 4, No. 4, http://migration.ucdavis.edu/rs/more.php?id=76_0_3_0

Tansel, A. & Güngör N. D. (2003). "Brain drain" from Turkey: survey evidence of student non-return. *Career Development International*, 8(2): 52-69.

UNESCO (2003). *Global Education Digest 2003: Measuring progress towards universal primary education*. Montreal: UNESCO Institute for Statistics.

UNESCO (2009). *Global Education Digest 2009: Global trends in tertiary education*. Montreal: UNESCO Institute for Statistics.

UNESCO (2012). *Global Education Digest 2012: The impact of grade repetition and early school leaving*. Montreal: UNESCO Institute for Statistics.

Waters, J. L. (2006). Geographies of cultural capital: education, international migration and family strategies between Hong Kong and Canada. *Transactions of the Institute of British Geographers*, 31: 179-192.

Wilkinson, A., Merwood, P. and Masgoret, A.-M. (2010). *Life after study: International students' settlement experiences in New Zealand*. Wellington: New Zealand Department of Labour.

Ziguras, C. & Law, S. F. (2006). Recruiting international students as skilled migrants: the global 'skills race' as viewed from Australia and Malaysia. *Globalisation, Societies and Education*, 4(1): 59-76.

Appendix A: Sample representativeness[7]

Table A1: Population and sample distribution of regional origin in 2008

Regional origin	Population, p	Pop. ratio, n_p/N_p	Sample, s	Sample ratio, n_s/N_s
Africa	275	0.012	9	0.014
Asia	16,277	0.703	338	0.543
Central/South Am	264	0.011	9	0.014
Europe	2,600	0.112	172	0.276
Middle East	524	0.023	18	0.029
Northern Am	2,222	0.096	63	0.101
Pacific	983	0.042	14	0.022
Total	23,146	1.000	623	1.000

Table A2: Population and sample distribution of age in 2008

Age group	Population, p	Pop. ratio, n_p/N_p	Sample, s	Sample ratio, n_s/N_s
< 18	634	0.016	3	0.005
18-19	4,613	0.116	70	0.112
20-24	20,629	0.519	303	0.486
25-39	12,253	0.308	233	0.374
≥ 40	1,654	0.042	14	0.022
Total	39,783	1.000	623	1.000

Table A3: Population and sample distribution of the levels of study in 2008

Level of study	Population, p	Pop. ratio, n_p/N_p	Sample, s	Sample ratio, n_s/N_s
Bachelor	12,438	0.661	308	0.494
Hons/PG Dip/Cert	2,712	0.144	97	0.156
Master's	1,691	0.090	64	0.103
PhD	1,963	0.104	154	0.247
Total	18,804	1.000	623	1.000

Table A4: Population and sample distribution of gender in 2008

Gender	Population, p	Pop. ratio, n_p/N_p	Sample, s	Sample ratio, n_s/N_s
Female	18,207	0.458	325	0.522
Male	21,576	0.542	298	0.478
Total	39,783	1.000	623	1.000

Note: The figures in Table A2 include international students at all levels of study.

n_p : number of observations per category in the population

N_p : total number of observations in the population

n_s : number of observations per category in the sample

N_s : total number of observations in the sample

[7] Note: All the information in Table A1 to Table A4 are sourced from New Zealand's Ministry of Education webpage – 'Education Counts'.

Appendix B: Descriptive statistics of outcome probabilities obtained from parameter simulations

Scenario	Variables	Outcome Probability	Mean	Std. Dev.	95% c.i.	Min	Max
1	all good perception	Pr(Y=Home)	0.9365	0.0285	[0.8660, 0.9753]	0.7314	0.9915
		Pr(Y=NZ)	0.0449	0.0225	[0.0155, 0.1017]	0.0045	0.2549
		Pr(Y=Aust/US)	0.0113	0.0111	[0.0015, 0.0412]	0.0004	0.1708
		Pr(Y=Others/UK)	0.0073	0.0076	[0.0009, 0.0266]	0.0001	0.1468
	all bad perception	Pr(Y=Home)	0.2778	0.0701	[0.1558, 0.4288]	0.0774	0.5970
		Pr(Y=NZ)	0.5491	0.0851	[0.3784, 0.7108]	0.2508	0.8124
		Pr(Y=Aust/US)	0.1040	0.0553	[0.0311, 0.2434]	0.0120	0.4784
		Pr(Y=Others/UK)	0.0692	0.0385	[0.0197, 0.1649]	0.0043	0.3582
2	good home wage	Pr(Y=Home)	0.5013	0.0826	[0.3378, 0.6605]	0.1792	0.7957
		Pr(Y=NZ)	0.3549	0.0784	[0.2130, 0.5205]	0.1273	0.6714
		Pr(Y=Aust/US)	0.0705	0.0414	[0.0198, 0.1754]	0.0066	0.4050
		Pr(Y=Others/UK)	0.0733	0.0382	[0.0234, 0.1676]	0.0092	0.3661
	bad home wage	Pr(Y=Home)	0.4204	0.0794	[0.2691, 0.5774]	0.1547	0.7147
		Pr(Y=NZ)	0.3851	0.0777	[0.2403, 0.5437]	0.1225	0.6793
		Pr(Y=Aust/US)	0.1254	0.0592	[0.0431, 0.2678]	0.0209	0.4979
		Pr(Y=Others/UK)	0.0691	0.0363	[0.0218, 0.1602]	0.0091	0.3866
3	good home lifestyle	Pr(Y=Home)	0.6930	0.0832	[0.5150, 0.8361]	0.3709	0.9123
		Pr(Y=NZ)	0.1934	0.0663	[0.0893, 0.3452]	0.0346	0.5586
		Pr(Y=Aust/US)	0.0602	0.0420	[0.0125, 0.1729]	0.0035	0.3749
		Pr(Y=Others/UK)	0.0534	0.0350	[0.0130, 0.1469]	0.0041	0.3196
	bad home lifestyle	Pr(Y=Home)	0.4204	0.0794	[0.2691, 0.5774]	0.1547	0.7147
		Pr(Y=NZ)	0.3851	0.0777	[0.2403, 0.5437]	0.1225	0.6793
		Pr(Y=Aust/US)	0.1254	0.0592	[0.0431, 0.2678]	0.0209	0.4979
		Pr(Y=Others/UK)	0.0691	0.0363	[0.0218, 0.1602]	0.0091	0.3866

Note: Number of simulations, M=10,000