Demand for International Higher Education and Its Impact on Bilateral Market Integration

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Abstract

We empirically investigate factors affecting demand for higher education from international students as well as the impact of these students on bilateral market integration in the case of Australia. Our estimation results demonstrate that family resource and other pathways such as ELICOS, VET and Secondary School are important determinants of the demand. The direct impact of global financial crisis on higher education is not significant but indirect negative impact through family resource is observed during our sample period of 2002-2011. The results also imply that export of higher education leads to bilateral market integration through exports and imports promotion as well as human capital mobility between Australia and the student's home country.

Key words: Higher education, International students, International trade, Human capital mobility, Australia

1. Introduction

The goals of this paper are to twofold. Firstly, it aims to empirically investigate factors affecting demand for Australian higher education from international students. Secondly, as an extension of the first stage, it examines the impact of this international student on market integration between the student source and hosting countries. We consider exports, imports as well as migration as conduits of this market integration. This paper represents, to the best of our knowledge, the first study to provide systematic empirical evidence on the issue of market integration through international higher education.

Australia provides an excellent case study for the following reasons. The education of international students in Australian universities has grown substantially over recent years. About two-third of international students are enrolled in the four major English-language countries (Choudaha, Chang and Kono, 2013), with Australia, following the USA and UK, the third most popular destination for international students (Choudaha, Chang and Kono, 2013). The portion of international students in total Australian students reached around 28 percent in 2012, which is the highest among the English speaking countries. In particular, the role of higher education has been the most important in terms of both number of students and economic impacts they generate (Australian Education International, 2012). Since the Whitlam government in the early 1970s, Australia has actively pursued globalisation strategies through promoting market integrations and migration policies. Exporting to more than 200 countries generated more than 20 percent of GDP in 2011(Australian Government Department of Foreign Affairs and Trade, 2012). In particular, revenues from export of education has increased substantially, overtaking the tourism industry and became the most important service export item and ranked number three in terms of all export items. Meanwhile, both the structure of trade and the direction of trade have changed. The gravity of

trading partners has changed from the traditional European countries to Asia, withwith the proportion of Asian (7%) becoming the second largest ethnic group in Australia.

This paper adds value on the literature of higher education and on the international business economics, such as bilateral trade of goods and services, and human capital mobility. Our paper explicitly considers endogenously determined international students as a determinant of the trade and human capital mobility. Therefore, the layout of our paper imitates the two stages least squares method. The first part is to examine the demand for international higher education and the second part is the impact of the international students on trade and capital mobility.

Existing studies on higher education are largely focused on estimating the rates of return to education (Ehrenberg, 2004; Mincer, 1976, among others). Galye, Berridge, and Davies (2003) investigate the demand for higher education using survey data in the UK. The survey data include characteristics of the respondents. In contrast with our paper, however, they focus only on domestic students and thus ignore the demand from international students. Existing empirical studies on international trade and market integration are largely based on the gravity model coupled with the comparative advantage theory (see Rose, 2007; Disdier et al., 2008; Anderson, 1979, among others). Combes, Pierre-Philippe, Miren Lafourcade and Thierry Mayer (2005) argue that spatial proximity matters for trade, but in a quite complex way that goes beyond the simple (log linear) impact of geographical distance. They pointed out the effects of business and social networks as a determinant of the trade. Our paper examines the effects of established business and social networks established through international education. In contrast with Gould's (1994) and Girma and Yu (2002) who associate immigrants to bilateral trade, our study directly associates international students with the human capital mobility..

2. Theories and hypotheses

This section provides theoretical arguments for the demand of higher education by international students and the impact of international students on market integration.

Factors affecting demand for higher education

The demand for education in general is explained by the signalling model, coupled with asymmetric information problem, and the human capital model (reference??). Asymmetric information problems often create a market failure and an adverse selection problem in labour market (Akerlof, 1970). Given the asymmetric information between employer and employee, prospective employers are willing to equate wage with market value of marginal productivity of 'average' of all potential employees. As a result, this formula undercuts the productive people's market value and thus low productive people crowd out high productive people. There is no market for high ability people. Spencer's signalling model shows how the privately informed parties' strategies to convey credible information to the uninformed party in labour market (Spence, 1973). The message of this theory is that informed/productive party 'signal' productivity through educational attainment because self-serving claims are not credible. In particular, education in Western countries has been regarded as more reliable signal to the market due partly to its long history of quality assurance programs. Despite these justifications of higher education, studying overseas is not automatically ensured. Firstly, family income is an important determinant factor of higher education. Becker (1975) and Lochner and Monge (2007) illustrated that low income families may face constrained borrowing opportunities inherent in government student loans programs and thus the marginal cost of attending higher education will rise. Higher education itself may also have a consumption or psychic value (Carneiro and Heckman, 2002; Keane, 2002). This proposition

predicts that wealthier families' demand for higher education is more schooling for their children than poorer families when students or their families derive direct utility from schooling. Belley and Lochner (2007) also reports family resources have become more important on educational achievement. This leads to our first hypothesis:

H1: Family resources increases demand for higher education from international students.

The bandwagon effect, coupled with positive externalities, refers to the benefit that a person enjoys as others do the same thing that he or she does. Leibenstein (1950) applies the information economic to explain consumer's herd behaviour. The model of bandwagon effect illustrates that demand for a goods and service will rise when potential consumers' are 'influenced' by existing consumers. It represents the desire of potential consumers to demand goods or services to be in the 'fashion' and/or in order to be confirm with the people they wish to be associated with. Rohlfs (1974) also reports the derived demand caused by positive externalities in a communication service industry. In particular, a consumer may enjoy bandwagon effects as others consume the same product or service that he or she does. Both network externalities and complementarity are important reasons for this bandwagon effect. Availability of information and/or knowledge about new technology from friends (network) creates positive externalities, whereby demand for the goods and service rises further.

These network externalities and complementarity can also be applied to explain the demand for international education. Intensive English learning program, for example, generates complementarity and network externalities to international students from non-English language countries. Intensive English program has become a recruitment pathway. Despite strong academic qualifications, many younger international students are insufficiently prepared to enrol directly in an English-taught degree program. Consequently,

the Intensive English Program, or its equivalent, has been growing at the fastest rate among all other fields of study in recent years. In a similar vein, the number of students in other education sectors such as school and VET is expected to increase the demand for higher education through the bandwagon effects, network externalities and complementarity.[1] We therefore hypothesis the following:

H2: Enrolment/commencement of other education pathways will increase the demand for higher education.

H2a: Demand for higher education from common language countries will be smaller than for others.

The demand for overseas education requires substantial amount of additional costs. International students are usually full-fee paying. In addition to travelling costs between home country and study places, living expenses are also dearer in the four major destinations of the international students than those in other countries. Demand for higher education from international students is typically voluntary basis rather than compulsory. Therefore,

H3: the cost of studying overseas will have an inverse relationship with demand for higher education.

Studying overseas rather than oin the domestic country is harder particularly for low productive people. Therefore, low productive/capable people are often unwilling to or are unable to study overseas (Salop and Salop, 1976). Consequently, study overseas strengthens the credibility of productivity and leads to a better job assignment and higher pay. The Times

[1] Other pathways can also be interpreted as proxy for student ability to study. Successful completion of ELICOS and (secondary) School enhances study capability to study.

Higher Education World Reputation Ranking 2013 report places 43 US universities in the Top 100 list, followed by nine UK universities and six Australian universities (http://www.timeshighereducation.co.uk/world-university-rankings/2013/reputation-ranking). Education in Western countries will be a verifiable signal to the extent the market infers this Western education is equivalent to taking difficult courses in addition to extending years of schooling. Therefore, we predict the following:

H4: Education quality has a positive association with demand from international students.

The impact of higher education on market integration

The networking theory and the theory of human capital externalities provide an analytical framework to analyse the impact of international students on market integration between the host and the source country of the students. Irrespective of the difference in definition of human capital between growth and labour economists, international network facilitates human capital externalities and thus a production capacity. Owing to personal experience in overseas, ceteris paribus, this positive spill-over effect from overseas study will be greater in tradable sector than non-tradable sector. Established international network and local knowledge facilitate international student's advantage to be employed by (multinational) companies and/or start a new international business with the country where they studied.

Studying overseas in the four major hosting countries can be used to create and develop a valuable network of international alumni and variety (Combes, et al., 2005; Trice, 2003; Boissenvain, 1974; Preston, 1989; Borjas, 1995; Broda and Weinstein, 2006; Currie and Moretti, 2003). The high density of the student network may be taken as an index of the large number of transactions that can be exchanged between the student and his network members. Students who form clusters are more closely linked to each other than those who

are with other members of the network, and clusters are often recruited from different activity fields. For international students, the opportunity to share their educational experience with domestic students enriches their learning experience and broadens their networking. It is found that studying in an environment where multi-nationality/cultural diversity exists establishing a network is beneficial both for domestic and international students (Pittaway, Ferguson and Breen, 1998).

Having an established international network will enhance socio-economic interactions between countries. The transaction cost theory (Coase, 1937; Williamson, 1975, 1985) provides two implications for the market integration between two countries. First, the established network and personal experience cut transaction costs, whereby international trade will be promoted. Arm's length transactions, stimulated by reduced transaction costs, encourages specialisation based on individual comparative advantage and thus allows a larger number of economic agents and activities in market. Second, the direction of market integration will be biased toward the country where the international network has been established due to reduced 'searching' costs. Establishing long-term relationship also enhances reliability of implicit contract between parties, which in turn relaxes the constraint of bounded rationality. Absence of negotiation process will reduce 'contracting' costs. Cultural exchange also reduces 'negotiating' costs. Therefore, we predict the following:

H5: Export of education increase bilateral trade between the host and source of student countries.

Further to the positive effect on trade of produced goods and services, having an established international network will also enhance mobility of human capital between countries. Both Rauch (2001) and Wagner et al. (2002) report the having an established network and personal

experience cuts transaction costs for the migration process as well as the initial cost of settling down in the migrated country.

A diverse student body provides educational value and benefits for the society of the hosting country, such as the competitive advantage of a diverse workforce and upgrading skills (Carnevale and Fry, 2000; Ortega, 2005). Modern macroeconomists including Lucas (1988) treat human capital as a production input because their main concern is growth (Benhabib and Spiegel 1994; Becker, Murphy and Tamura, 1990). It is natural to assume any government wants a targeted, high-value, demand-driven, skilled migration program that is responsive to the needs of the country's labour market. This demand for imported human capital will rise to the extent that the host country foresees a fast growth given the limited supply of quality labour from domestic market. As these needs change rapidly, the skilled migration program will be adjusted accordingly. Hence,

H6: International student increases human capital mobility from the source to the host country.

3. Data

International student data from 2002 to 2011[2] is obtained from Australian Education International (AEI), which is the international education, science and research arm of the Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE) in Australia. Both enrolment and commencement students in all of the sectors (i.e., Higher Education, ELICOS, School and VET) are scaled by the size of the population (aged between

[2] Previously, the collection was known as the Overseas Student Statistics Collection (OSSC) and was first published in 1993. The OSSC initially focused primarily on international students who came to Australia on a student visa. Later, international students who used other forms of visas were also included.

15 and 64 and in million people) of the student's home country. Data on population is from the World Development Indicator, provided by the World Bank.

Enrolment data is derived from the Commonwealth Provider Registration and International Student Management System (PRISMS) database. Only enrolments that represent students who have actually started studying in Australia are counted in AEI student enrolment data. AEI student enrolment data allocates a student's nationality based on citizenship data. AEI student enrolment data covers onshore international students studying on student visas only. The data does not include overseas students on an Australian funded scholarships or sponsorships or students undertaking study while holding a tourist or other temporary entry visas. New Zealand students are not included in this data as they do not require a student visa to study in Australia. A commencement is a new student enrolment in a particular course at a particular institution.

The exchange rate refers to the bilateral exchange rates expressed as the number Australian dollars per unit of foreign currencies, provided by Pacific Exchange Rate Services, The University of British Columbia (http://fx.sauder.ubc.ca). Australian inflation data, measured by percentage change in CPI index, is from the Australian Bureau of Statistics. Immigration data (in thousand persons) is from Department Immigration and Citizenship, Australia (http://www.immi.gov.au/media/statistics/).

Export and import data are from Australia's Merchandise Exports and Imports published by the Department of Foreign Affairs and Trade (http://www.dfat.gov.au/publications/stats-pubs/pivot-tables.html).

Total exports (of primary and manufactured good) are computed as Australia's total exports to the student's home countries scaled by Australia's total exportto the world in the same year. Total imports are calculated by Australia's total imports \) to the student's home countries scaled by Australia's total imports from the world in the same year.

Comlang, is an indicator variable to show common languages group with Australia, *ldistance*, calculated by log of physical distance from Australia, *lareap*, calculated by log of multiplication of area of two countries are from Rose (2007).

Data on teaching and research-only academic staff and the portion of (senior) lecturer and above are obtained from the Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE) in Australia. All of variables are expressed as a proportion of total academic staff.

Descriptive statistics are shown in Table 1. Both mean and median values of Higher Education, ELICOS, VET and School show that higher education is the most important in terms of enrolment and commencement.

Table1: Summary statistics

Variable	Definitions	Mean	sd	p25	p50	p75	min	max	N
Highereducation	(i)Highereducationenrolment/population(15/64)	1.17	3.77	0.03	0.14	0.58	0	38.89	1005
	(ii)Highereducationcommence/population(15/64)	0.37	1.16	0.01	0.05	0.2	0	14.16	1005
ELICOS	(i)ELICOSenrolment/population(15/64)	0.2	0.52	0	0.03	0.13	0	5.75	990
	(ii)ELICOScomencement/population(15/64)	0.13	0.31	0	0.02	0.09	0	2.96	991
School	(ii)Schoolenrolment/population(15/64)	0.1	0.33	0	0.01	0.03	0	3.72	889
	(ii)Schoolcomencement/population(15/64)	0.04	0.13	0	0	0.01	0	1.48	889
VET	(i)VETenrolment/population(15/64)	0.36	0.86	0.01	0.08	0.33	0	10.32	986
	(ii)VETcommencement/population(15/64)	0.16	0.37	0	0.04	0.16	0	4.55	986
gdppc	GDP per capita (PPP adjusted) in 1,000dollar	15.2	14.8	3.67	9.04	25.3	0.49	88.9	1027
Exchangerate	Bilateral exchange rate	0.61	0.94	0.02	0.23	0.85	0	6.05	616
Inflation	CPI-based Inflation in Australia	2.95	0.67	2.4	2.85	3.4	1.9	4.4	1070
ldistance	Log of physical distance	8.84	0.4	8.72	9	9.12	7.46	9.33	1070
bothin	1 if 2 countries are WTO members and 0 else	0.76	0.43	1	1	1	0	1	1070
lareap	Log of (product of two countries)	27.7	2.27	26.5	28.2	29.3	19.9	31.97	1070
abovesenior	Portion of senior lecturer and above in staff	23.4	1.48	21.9	23.4	24.7	21.6	26.02	1070
teachingonly	Portion of teaching only staff	3.7	0.78	3.26	3.42	3.73	3	5.81	1070
researchonly	Portion of research only staff	30.0	1.88	28.4	30.7	31.6	26.6	32.24	1070
belowlecturer	Portion of lecturer and below staff	19.0	0.77	18.9	19.3	19.5	17.1	19.93	1070
Total exports	Export to country *i* scaled by total exports	1.09	3.34	0	0.05	0.43	0	30.24	916
Primary goods	Portion of primary goods to country *i*	1.21	4.24	0	0.08	0.58	0	38.07	828
Manufactured goods	Portion of manufactured goods exports to country *i* in total manufactured exports	1.21	2.83	0.02	0.11	0.79	0	19.9	828

Total imports	Portion of imports from country *i*	1.52	3.25	0.01	0.19	1.11	0	22	660
Primary goods imports	Portion of primary goods imports from country *i*	1.51	3.65	0.03	0.19	1.07	0	29.52	660
Manufactured goods imports	Portion of manufactured goods imports from country *i*	1.52	3.64	0.01	0.15	1.15	0	27.49	660
Immigration	Migration to Australia (thousand people)	404	210	212	398	582	1	776	954

4. Empirical Model

We consider the following two estimation models to estimate demand for higher education from international students and impact of international students on market integration.

Demand for higher education: Structural equation model

Equation (1) shows unrestricted reduced-form model for international students ($Y_{ijt,k}$) from country *j* to Australia (*i*), which we measure as the number of enrolled (k=1) and commencing (k=2) students.

$$Y_{ijt,k} = \text{constant} + \beta_1 Family\,\text{Re}sources_{jt-1} + \sum_{L=2}^{4} \beta_L OtherPathways_{ijt-1} + \sum_{M=5}^{7} \beta_M StudyCosts_{ijt-1}$$

$$+ \beta_8 Commonlang_{ij} + \beta_9\,\text{Re}putation_{it-1} + \lambda\,(\mathbf{I}_j \bullet \mathbf{T}_{jt}) + \gamma\,\mathbf{T}_{jt} + \nu_j + \theta_t + \varepsilon_{ijt} \qquad (1)$$

Where, *FamilyResources* are measured by PPP-adjusted GDP per capita and is expected to have positive sign; *OtherPathways* refers to the number of students enrolled in ELICOS, Secondary School and VET. To address heterogeneity problems, we scale these numbers by the source country'spopulation aged between 15 and 64 (in million persons). Considering the complementarity and positive externalities, we expect the sign of estimated coefficients β_1-β_3 to be positive.

ExchangeRate refers to bilateral (nominal) exchange rate between Australia and the source country, expressed in terms of the number of Australian dollar per unit of foreign currency. We assume the tuition fees (expressed in student's home currency) are linearly associated with this exchange rate. *Distance*, as a proxy for travel costs, is the log value of physical distance between Australia and the source country. The underlying assumption is that distance costs are a linear function of geographical distance, and demand for higher education from international student is inversely proportional to distance costs (Buch, Kleinert, and Toubal, 2004). Hence, lower distance costs are expected to increase the demand

for higher education. Australian inflation, as a proxy for living expenses in Australia, is CPI based annual inflation rate. All of these variables (exchange rate, distance and inflation) are related to the cost of studying in Australia. Thus, the expected sign of their estimated coefficients are expected to be negative.

Commonlang is a binary variable equals to one if student's home country speaks English and 0 otherwise. The expected sign is negative because demand for other pathways particularly ELICOS will be decreased. *Reputation* variable is to capture education quality in Australia. We use the share of research-only staff in total academic staff to proxy reputation of education provider. This is because university's reputation/quality is often proxied by university rankings in terms of research output in high quality academic journals. Considering that international university rankings are biased towards research activities, we expect that universities with a higher portion of research-only staff to have more demand from international students.

The baseline estimation model controls for both time-invariant country-specific factor (v_j) and interaction between country and year variable ($\mathbf{I}_j \bullet \mathbf{T}_{jt}$). The time-invariant country-specific factor is expected to capture a country-specific value on education such as Confucianism-based country and/or religion-based suppressing female education in overseas. Student's ability is largely unobservable although some minimum (English) test score is often used as a prerequisite. We assume student's ability to study overseas (including basic communication skills) is changing depending on education system and is expected to be captured by the interaction between country and year variable. Country-level fixed effects regressions mitigate the effects of omitted variables bias only to the degree that the omitted variables are at the country-level. Thus we include θ_t to capture the effect of omitted variable at the global-level. $\mathbf{T}_{jt}$ is to address for time-trend.

Instrument variable estimation

Equation (2) is the instrument variable estimation model to investigate the impact of international student on the integration ($R_{ijt,k}$) between country *j* and Australia (*i*) through bilateral trade (k=1) and human capital mobility (k=2). In our estimation, bilateral trade refers to bilateral exports and imports between Australia and the student's home country. Hypothesis H4 suggests a positive sign on these trade variables. Human capital mobility is captured by the number of migrant from the student's home country to Australia. Hypothesis H5 implies a positive sign on human capital mobility.

While we do not directly use the estimated variable from equation (1) as covariate in equation (2), we note that the dependent variable $Y_{ijt,k}$ in equation (1) is a covariate in equation (2). This inclusion of an endogenous variable as a covariate justifies our instrumental variable estimation. Excluded instrument variables are mainly the control variables in the structural equation (1). Others include the remaining control variables, such as physical distance, and the selection is largely based on the theory of international trade and the gravity equation (Rose, 2007; Portes and Rey, 2005; Disdier et al., 2008; Anderson, 1979).

$$R_{ijt,k} = \text{constant} + \beta_1 Y_{ijt,k} + \boldsymbol{\beta_2}\ \mathbf{Others} + \nu_j + \theta_t + \zeta_{ijt} \qquad (2)$$

Where, ***Others*** = {product of log area of two countries (*lareap*), indicator for both WTO membership of trading countries (*bothin*), log of physical distance (*ldistance*), ppp-adjusted GDP per capita (*Income*), bilateral exchange rate (*Exchangerate*)} if k = 1 and {ELICOS, VET, log of physical distance (*ldistance*), dummy for common language (*comlang*)} if k = 2. Country fixed effects ν_j capture omitted variables such as (bilateral) trade resistances and they reflect (unchanging at the yearly frequency) trade costs. Time effects θ_t is expected to capture world-wide (macroeconomic) shocks affecting all countries.

Therefore, equation (2) is to examine whether demand for higher education from international students induces international trade (k=1) or human capital mobility across the border (k=2) through the included covariates in the structural-form equation (1). In estimation, we divided trade (k=1) into exports and imports, which in turn further disaggregated into manufacturing and primary goods.

6. Estimation results

Reduced-form estimates

Table 2 reports our estimation results of the demand for higher education from international students. Dependent variables on Columns (1) - (4) are enrolment and the rest are commencement in thousands. *F.Resources* and *F.Resources2* respectively is the natural logarithm of ppp-adjusted GDP per capita (in thousand dollars) and its squared-term in the beginning of each year. Therefore, the estimated coefficients of *F.Resources* in Columns (1) and (5) respectively indicate semi-elasticity of enrolment and commencement with respect to a representative student's family income/resources. Using Columns (1) and (5) and mean values of lagged GDP per capita, the enrolment (commencement) elasticity with respect to income is 6.8 (2.0). This means that an increase of a ten-dollar per capita income of a (representative) student's family leads to an average of 68 (20) more enrolments (commencements) in higher education in Australia.

Table2: Effects of a representative student's family income on higher education enrolment and commencement in Australia

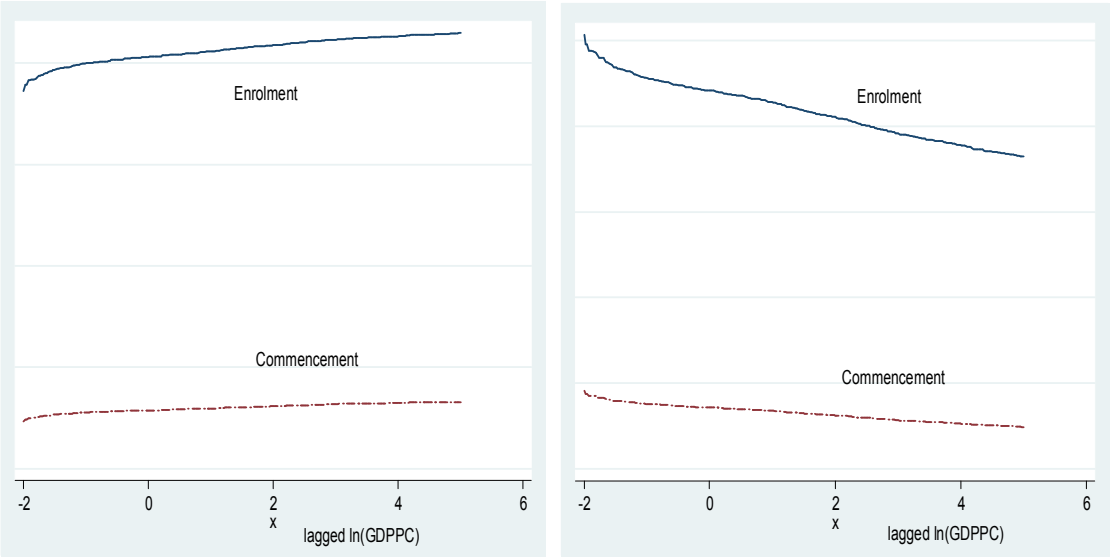
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Higher education enrolment				Higher education commencement			
F.Resources	99.655	118.811	118.811	115.611	30.504	36.108	36.108	35.09
	[0.026]	[0.013]	[0.013]	[0.012]	[0.034]	[0.019]	[0.019]	[0.018]
F.Resources2		-6.593	-6.593	-6.331		-1.929	-1.929	-1.846

		[0.002]	[0.002]	[0.003]		[0.007]	[0.007]	[0.008]
Year			-3.375	-1.606			-1.134	-0.572
			[0.047]	[0.090]			[0.046]	[0.078]
yearXcountry				-0.023				-0.007
				[0.054]				[0.057]
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_cons	56.116	62.981	6819.06	3351.6	17.683	19.689	2290.58	1190.25
	[0.031]	[0.024]	[0.047]	[0.085]	[0.036]	[0.029]	[0.046]	[0.074]
N	993	993	993	993	993	993	993	993
$\overline{R}^2$	0.833	0.834	0.834	0.835	0.854	0.855	0.855	0.856

Dependent variables for models (1)-(4)/(5)-(8) are enrolment/commencement in higher education in thousands students number. Income and Income2 respectively are the logarithm of the ppp-adjusted GDP per capita and its squared. Figures in [ ] show p-values after correcting the heteroscedicity problem. $\overline{R}^2$ refers to adjusted R2.

Columns (2) and (6) in Table 2 also demonstrate a version of diminishing returns to income. To examine the relationship further, we depict in Figure 1 the effect along the increase in income using the estimated coefficients on Columns (2) and (6). The total number of enrolment (commencement) rises (LHS of Figure 1) but marginal effects (RHS of Figure 1) are diminishing in response to an increase in a representative student's family income. For example, a country that belongs to the high quartile of the world income (i.e., richer country) enrol around 171,000 (53,000) more enrolment (commencement) than that from a low quartile (i.e., poorer) country. Figure 1 (RHS) also shows that the diminishing effect on enrolment is slightly greater than that on commencement, although none of these diminishing effects reach the minimum points even when the GDP per capita has maximum values in our sample.

Figure 1: Total (LHS) and Marginal (RHS) effects of family resources increase on enrolment and commencement



A standard model specification for a human capital earnings function indicates a level of schooling is a determinant of (log) wage (Mincer, 1974). Note, however, that family income in our estimation does not directly create this reverse causality due largely because family income is at the time of the student's schooling. A remaining issue is the selection bias, which is associated with sampling bias. Heckman (1979) demonstrates a possible estimation bias in case where researchers can identify student's (purposeful and not random) decision to study in overseas. In an untabulated Table, the Heckman's two-step consistent estimation shows the estimated coefficient of lamda for Column (4) is insignificant, suggesting that selection bias is not a serious concern in our estimations.[3]

Table 3 reports estimation results of the demand for international higher education associated with studies in other pathways. The results suggest the number of students in ELICOS generates a positive effect both on enrolment and commencement. This finding illustrates that English Intensive Program plays an important role as a pathway to higher education. Similarly, both (secondary) School and VET have positive effects on the demand

[3] We used Comlang and ldist for the excluded exogenous variables. The correlation between the model (4) (model (8)) and selection estimation was 0.20 (0.14).

for international higher education, although statistical significance of VET for commencement disappeared in Column (10). Overall, this finding is consistent with our empirical hypothesis H2.

The estimated coefficients in Table 3 indicate that average marginal effect of each pathway. The magnitude of the estimated coefficient of School is greater than for ELICOS or VET. The average marginal effect of School on the enrolment (commencement) ranges from 12.860 (8.804) to 32.266 (19.027), depending on the model specification. This means that an increase of one thousands school enrolment leads to a rise in the higher education enrolment by a minimum (maximum) of 12.86 (32.266)$\times 10^{-6} \times$ number of 15-64 aged population in the student's home country. For example, an increase of one thousand of School enrolments (commencements) from a country with a population of 2 million leads to an increase of the higher education enrolment in between 26-65 and commencement in between 18-38). Results in Column (5) suggest that this marginal effect of School on enrolment (commencement) is 6 (2) percent higher than that of ELICOS. The marginal effect of VET is the smallest, being less than 20 percent of the effect of School.

Table 3: Other Pathways Effect on Demand for International Higher Education

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Higher education enrolment					Higher education commencement				
ELICOS	16.995			11.486	12.179	10.115			8.407	8.643
	[0.000]			[0.000]	[0.000]	[0.000]			[0.000]	[0.000]
School		32.266		18.508	12.860		19.027		9.042	8.804
		[0.000]		[0.000]	[0.000]		[0.000]		[0.000]	[0.001]
VET			7.082		2.426			4.701		1.119
			[0.000]		[0.022]			[0.000]		[0.189]
F.Resources					120.957					37.171
					[0.027]					[0.037]
F.Resources2					-4.615					-1.067
					[0.067]					[0.180]
Year	1.125	1.571	1.118	1.402	-1.633	0.242	0.388	0.272	0.303	-0.678
	[0.141]	[0.066]	[0.146]	[0.098]	[0.139]	[0.312]	[0.145]	[0.260]	[0.249]	[0.072]
yearXcountry					-0.033					-0.008

					[0.041]					[0.110]
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_cons	-2259	-3152	-2245	-2814	3257.4	-485.2	-778.1	-546.8	-608.3	1354.9
	[0.141]	[0.066]	[0.146]	[0.098]	[0.138]	[0.311]	[0.145]	[0.259]	[0.249]	[0.071]
N	898	813	900	813	768	899	813	900	813	768
$\overline{R}^2$	0.868	0.867	0.867	0.868	0.87	0.882	0.879	0.879	0.881	0.882

Dependent variables for models (1)-(5) are enrolment in higher education in thousands students number. ELICOS (English Language Intensive Courses for Overseas Students), School and VET (Vocational Education and Training) are scaled by the population of aged between 15 and 64 in source countries (in million people). Figures in [ ] show p-values after correcting the heteroscedicity problem. $\overline{R}^2$ refers to adjusted R2.

In unreported tables for robustness checks, we fid similar results when we scale the dependent variables using the population in the student's home country aged between15-64. In these estimations, the dependent variables are as a portion of total number of international students in a year.

Multicollinearity among various pathways could be a concern for the estimation in Table 3. A pair-wise correlations among the pathways ranges 0.51-0.59 and is significant at 5 percent level. Factor analysis is a technique to reduce a number of variables by describing linear combinations of the variables that contain most of the information. Assuming a multivariate normal distribution, we run MLE for the factor analysis to extract one factor: pathways. In untabulated results, the estimated coefficients of total student (Column (5)) and new students (Column (10) in Table 3 are 11.263 (p-value=0.000) and 4.087 (p-value=0.000), respectively. Meanwhile, all other regressors' coefficients and statistical significance remain similar to those presented inTable3.

The effect of costs for studying on demand for higher education from international students is presented in Table 4. We consider three proxy variables to capture the tuition fees, travelling costs and living expenses: bilateral exchange rate, physical distance and inflation. The negative coefficient of distance variable on our dependent variable are shown in

Columns(1)-(3) and (5)-(7) and clearly indicate that demand for higher education from a country relatively closer to Australia is greater than that from a country further from Australia. However, the exact interpretation of the coefficients is controversial (Buch, Kleinert, and Toubal, 2004). In contrast to our expectation, depreciation of Australian dollar against the currency of the student's home country is not strongly associated with an increase in the demand although there is some evidence for the enrolment (Columns (1)-(3)). Depreciation of Australian dollar means the tuition fees (and other costs) expressed in foreign currency becomes dearer, whereby living costs rise. CPI-based inflation in Australia neither affects the enrolment nor commencement numbers. Interestingly, all of these cost-related variables are not significant when we control for family resources (*F.Resources*) and its squared term as shown in Columns (4) and (8).

Table4: Costs Effect on Demand for Higher Education from International Student

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Higher education enrolment				Higher education commencement			
ldistance	-59.653	-59.618	-59.118	67.503	-17.642	-17.797	-17.578	20.357
	[0.000]	[0.000]	[0.000]	[0.200]	[0.000]	[0.000]	[0.000]	[0.243]
Inflation	0.012	-0.352	-0.124	-1.233	-0.158	-0.194	-0.145	-0.525
	[0.993]	[0.808]	[0.929]	[0.377]	[0.778]	[0.740]	[0.793]	[0.357]
Exchangerate	14.236	14.67	12.841	12.632	4.263	4.014	3.448	3.851
	[0.048]	[0.045]	[0.072]	[0.157]	[0.066]	[0.080]	[0.126]	[0.165]
ELICOS	18.25			12.681	10.549			7.819
	[0.000]			[0.000]	[0.000]			[0.000]
School		39.408		23.261		28.331		10.630
		[0.000]		[0.006]		[0.000]		[0.077]
VET			11.979	1.191			8.599	-6.016
			[0.000]	[0.505]			[0.000]	[0.142]
F.Resources				282.24				83.565
				[0.009]				[0.022]
F.Resources2				-22.389				-5.817
				[0.007]				[0.048]
Year	2.32	2.93	2.511	-8.195	0.673	0.906	0.751	0.815
	[0.131]	[0.069]	[0.103]	[0.051]	[0.187]	[0.091]	[0.141]	[0.139]
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Country effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_cons	-4105.2	-5329.4	-4493.5	15742	-1187.2	-1652.3	-1344.4	-1471.1
	[0.184]	[0.100]	[0.147]	[0.049]	[0.246]	[0.124]	[0.190]	[0.184]
N	535	513	544	495	535	513	544	495
$\overline{R}^2$	0.864	0.864	0.863	0.882	0.878	0.878	0.877	0.891

Figures in [ ] show p-values after correcting the heteroscedicity problem. $\overline{R}^2$ refers to adjusted R2.

Table 5 examines our hypothesis H2a suggesting a negative effects of common language on the demand for higher education from overseas. Columns (1) and (4) respectively indicate the negative total effect of the common language on enrolment and commencement. In particular, the interactions between *comlang* and ELICOS are consistently significant and negative both in enrolment and commencement. This interaction variable suggests that the negative common language effects attenuate the positive effects of the English Intensive Program on the demand for higher education. Results presented in Columns (2) and (3) suggest that the net negative effects of common language on enrolment remain significant even when we control for the interaction variables, whereas the net effect on commencement is nolonger significant.

Table 5: Common Language Effects on Higher Education from International Student

	(1)	(2)	(3)	(4)	(5)	(6)
	Higher education enrolment			Higher education commencement		
comlang	-72.025	-49.627	-49.627	-21.500	-14.653	-14.653
	[0.012]	[0.056]	[0.056]	[0.053]	[0.163]	[0.163]
comlangXELICOS		-12.532	-12.532		-7.492	-7.492
		[0.002]	[0.002]		[0.000]	[0.000]
ELICOS	9.303	13.39	13.390	7.149	9.509	9.509
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
School	22.698	33.361	33.361	15.474	22.755	22.755
	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]
VET	1.693	2.036	2.036	-0.237	0.598	0.598

	[0.331]	[0.286]	[0.286]	[0.897]	[0.732]	[0.732]
ldistance	-75.361	-84.921	-84.921	-22.870	-24.358	-24.358
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Exchangerate	14.824	13.565	13.565	4.396	3.687	3.687
	[0.042]	[0.057]	[0.057]	[0.059]	[0.101]	[0.101]
Year			2.521			0.592
			[0.117]			[0.241]
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Country effect	Yes	Yes	Yes	Yes	Yes	Yes
_cons	656.119	726.768	-4322.9	199.07	209.951	-975
	[0.000]	[0.000]	[0.177]	[0.000]	[0.000]	[0.336]
N	513	513	513	513	513	513
$\overline{R}^2$	0.864	0.864	0.864	0.878	0.878	0.878

Figures in [ ] show p-values after correcting the heteroscedicity problem. $\overline{R}^2$ refers to adjusted R2.

Table 6 reports the effect of the portion of research intensive staff in total academic staff on higher education from international student. We use individually the portion of research-only staff (Columns 2, 3 and 5, 6) and teaching-only staff (Columns 1, 2 and 4, 5) for comparison purpose. As H3 indicates *research-only* varable is significant at the conventional level. In contrast, the *teaching-only* variable is not significant.

World university ranking announced by agencies have been biased toward university' research activities. The Times Higher Education World Reputation Ranking, for example, is based on survey from academics to list a small number of universities in their field that excel both in research and teaching. Consequently, the ranking is influenced by universities' research network, academic journal publications, and presence of speakers at major academic conferences.[4] Our estimation results imply that potential student's perception about the

[4] There are more limitations of the university rankings in general (Aguillo et al., 2010; Bookstein et. al., 2010; Billaout et al., 2010). The rankings are largely shaped by the limited availability of comparable data. The rankings have a validity problem – the lack of alignment between the evaluative criteria and the measures used – which is most troublesome for comparisons relating to teaching and learning. The data sources for compiling some of the indicators used to derive world university rankings do not capture important outputs of different universities in different fields. The weights assigned to different indicators within the rankings are arbitrary. There is also no correction for redundant measures – the interactions among the variables. There is no

university quality/reputation, which in turn is influenced by research outputs, is a significant determinant of demand of higher education.

Table 6: Research intensive Staff Effects on Higher Education from International Student

	(1)	(2)	(3)	(4)	(5)	(6)
	Highereducation enrolment			Highereducation commencement		
Researchonly		3.427	3.007		0.948	0.865
		[0.017]	[0.036]		[0.029]	[0.050]
Techingonly	4.130		2.379	0.975		0.473
	[0.195]		[0.467]	[0.328]		[0.659]
ELICOS	9.303	9.886	9.104	4.634	4.504	4.502
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
School	22.700	19.510	23.050	16.300	14.940	15.820
	[0.000]	[0.003]	[0.000]	[0.001]	[0.002]	[0.001]
VET	1.693	2.624	1.689	2.485	3.110	2.740
	[0.331]	[0.167]	[0.344]	[0.135]	[0.043]	[0.086]
Exchangerate	14.820	10.780	12.270	3.625	3.147	3.280
	[0.042]	[0.011]	[0.017]	[0.034]	[0.012]	[0.015]
ldistance	-75.400	-72.200	-74.800	-24.100	-23.700	-24.100
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Time effect	Yes	No	No	Yes	No	No
Country effect	Yes	Yes	Yes	Yes	Yes	Yes
_cons	652.8	539.7	563	209.3	180.9	184.9
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
N	513	513	513	569	569	569
$\overline{R}^2$	0.864	0.866	0.866	0.845	0.847	0.847

Figures in [ ] show p-values after correcting the heteroscedicity problem. $\overline{R}^2$ refers to adjusted R2.

For robustness,but in an unreported table, we find the portion of above senior lecturer in total academic is positive and significant but the portion of below lecturer is not significant.

standardisation of the distribution of scores. Several of the indicators in some of the rankings are prone to subjectivity and manipulation. The processes by which the survey data are collected and reported are opaque. The volatility of the rankings reflects their lack of statistical reliability, arising from poor aggregation, without prior standardisation, of different performance indicators for the rankings. An important implication of these methodological concerns is that shifts up or down in institutional positions do not necessarily reveal substantive changes in institutional performance.

Indeed, correlation between our *research-only* variable and above senior lecturer is 0.92 and significant at conventional level.

Additional Analysis for the structural equation model

The effects of the GFC and family resources effect on higher education from international student are presented in Table 7. GFC is a binary variable equals to one if year belongs to 2007-2011 and zero otherwise. Results in Columns (1), (2) and (6), (7) indicate that total effects of GFC on demand for higher education from international students are not significant both for enrolment and commencement. This finding is somewhat unexpected. Thus, we investigate further using interaction variables. Firstly, we interact GFC with different levels of family resources: *uppermidresources, lowermidresources* and *highresources.* High (uppermid/lowermid) resources is a binary variable which equals one if a representative family in a country belongs to the high (third/second) quartile of (PPP-adjusted) GDP per capita. This is based on our assumption that the effect of GFC differs between different levels of family resources. Estimated coefficient of an interaction with a binary variable is easy to interpret. Our results in Columns (3) - (5) illustrate that the magnitude of the negative effect of the interaction variables are in reverse order of the family resoruces level for enrolment, withall of these interaction variables being significant. The coefficient of the interaction with *highresources* (-33.36) is (negatively) greater than that of *uppermidresources* (-12.86), which in turn has greater negative impact than that of *lowermidresources* (22.72). Thus, we regress *highresources*, *upperresources* and l*owerresources* respectively on GFC dummy with country fixed effects in order to identify different magnitude of association with GFC on high and upper high resources.

In unreported tables, we find the magnitude of the coefficients of GFC decreases from high to low resources. Interestingly, the net effect of *highresources* and *uppermidresources*

are not significant whereas *lowermidresources* is significant. Almost identical findings are observed for commencement as per Columns (8)-(10).

Table 7 also reports interactions between GFC and students from different sectors including ELICOS, School and VET. It shows that the 1 percent statistical significance of the net effect of ELICOS and School on enrolment is intact, even when we control for the interaction variables. The statistical significance of the net effect of VET dropps to 10 percent. However, the results presented in Columns (8)-(10) show that only the net positive effect of ELICOS on commencement is significant when we control for the interaction variables. This finding suggests only the positive 'net' effect of ELICOS is robust both for enrolment and commencement.

Table 7: Global Financial Crisis and Income Effect on Higher Education

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Highereducation enrolment					Highereducation commencement				
gfc	11.154	7.570	15,780	10.278	39.880	3.200	0.315	4.432	-1.506	14.022
	[0.116]	[0.250]	[0.142]	[0.228]	[0.031]	[0.175]	[0.766]	[0.153]	[0.257]	[0.047]
highresources			-0.617					-0.153		
			[0.793]					[0.845]		
gfcXhighresources			-33.36					-9.948		
			[0.012]					[0.023]		
uppermidresources				2.389					0.526	
				[0.422]					[0.556]	
gfc1Xuppermid				-11.864					-3.427	
				[0.035]					[0.071]	
lowermidresources					17.642					5.120
					[0.003]					[0.296]
gfcXlowermid					22.724					7.780
					[0.083]					[0.083]
gfcXELICOS			-1.378	1.749	2.519			-0.642	1.037	1.106
			[0.586]	[0.532]	[0.361]			[0.608]	[0.533]	[0.490]
gfcXSchool			29.371	31.192	34.272			24.181	27.512	30.046
			[0.049]	[0.037]	[0.028]			[0.012]	[0.010]	[0.011]
gfcXVET			-9.070	-14.701	-15.123			-10.271	-13.77	-13.617
			[0.063]	[0.044]	[0.030]			[0.011]	[0.013]	[0.010]
ELICOS		9.303	12.335	9.498	8.314		7.149	9.202	7.609	7.389

		[0.000]	[0.000]	[0.001]	[0.002]		[0.000]	[0.000]	[0.000]	[0.000]
School		22.698	21.599	20.281	21.184		15.474	4.912	4.397	5.332
		[0.000]	[0.002]	[0.003]	[0.003]		[0.001]	[0.399]	[0.451]	[0.357]
VET		1.693	2.533	3.748	3.680		-0.237	3.714	3.918	4.126
		[0.331]	[0.155]	[0.076]	[0.070]		[0.897]	[0.097]	[0.079]	[0.056]
Exchangerate	11.815	14.824	16.358	13.492	16.647	3.155	4.396	4.981	4.063	5.032
	[0.027]	[0.042]	[0.044]	[0.043]	[0.048]	[0.063]	[0.059]	[0.060]	[0.062]	[0.063]
ldistance	-76.67	-75.36	-59.59	-64.22	-59.91	-22.74	-17.66	-17.73	-19.08	-17.83
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Time effect	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country effect	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
_cons	674.04	667.48	547.63	563.47	537.00	200.87	162.74	158.54	157.23	160.06
	[0.00]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
N	614	513	513	513	513	614	513	513	513	513
$\overline{R}^2$	0.817	0.864	0.864	0.870	0.870	0.842	0.878	0.878	0.878	0.879

Figures in [ ] show p-values after correcting the heteroscedicity problem. $\overline{R}^2$ refers to adjusted R2. gfc is a binary variable equals to one if year belongs to 2007-2011 and zero otherwise.

Instruments and Two-stage least squares estimates

Table 8 reports instrumental variable estimation of the impact of international higher education student on Australian exports. Dependent variables on Columns (1)-(3) are total exports, measured by country *i*'s share in Australian total export in year *t*), on Columns (4)-(6) is primary goods exports, measured by country *i*'s share in Australian primary goods export in year *t*, and on Columns (7)-(9) is manufactured goods, measured by country *i*'s share in Australian manufactured goods export in year *t*.[5] All estimations are by GMM method although 2SLS estimation results (unreported) produced very similar results.

Highereducation, scaled by one million of population aged between 15 and 64 in student's home country, is positive and significant irrespective of model specifications and types of exports. This is a supportive evidence for the positive network effects as our hypothesis H4 indicates. We continued this estimation for the commencement and found similar results (unreported). Included control variables such as log (multiplication of area),

[5] Because of data availability, we use all these variables in dollar values.

binary variable indicating WTO membership of two countries, and log (physical distance) are from the gravity equation. Following the traditional trade theory, we include (import country's) family income and its square as direct determinants of trade. Exchangerate is to control for effect of non-quantity such as exporter's pricing behaviours.[6] Sign of all these control variables (with some exceptions for bothin and ldist) is consistent with the prediction by trade theory. Using Column (6) and (9), we standardise the Highereducation variable to compare relative magnitude of the effect of the variable on dependent variables. The standardised Highereducation on Columns (6) is 0.111 (=0.082*4.329/3.733) and on Column (9) is 0.033 (=0.042*2.919/3.733), implying that the impact of Highereducation on exports of primary goods is greater than manufactured goods by the factor of 3.4 in Australia.

The lower panel provides information of the first-stage estimation. The p-values of both F-statistics and Hansen's J statistics (except for total exports) justify model specifications and validity of instrument variables. Estimation results of our main variable (Highereducation) are robust even when we chose different sets of excluded instrument variables.

Table 8: Instrumental variable estimation of the impact of international higher education student on Australian exports

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total Exports			Primary goods exports			Manufactured goods exports		
Highereducation: Enrolment	0.090	0.090	0.067	0.085	0.082	0.082	0.040	0.040	0.042
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.004]
lareap	0.036	0.167	0.268	0.093	0.180	2.023	1.227	0.275	1.061
	[0.646]	[0.068]	[0.123]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
bothin		0.441	6.317		1.080	-18.43	7.150	1.958	3.832
		[0.378]	[0.000]		[0.000]	[0.004]	[0.000]	[0.000]	[0.022]
ldist		-1.126	2.939		-0.562	-12.45		-1.021	1.309
		[0.000]	[0.015]		[0.000]	[0.001]		[0.000]	[0.189]
Exchangerate			0.226			0.400			0.292

[6] Exchangerate, together with time fixed effects, is also viewed as a variable to control for macroeconomic effects. The results, particularly Highereducation, did not change much without the Exchangerate variable.

			[0.077]			[0.073]			[0.004]
F.Resources			1.890			11.742			3,498
			[0.076]			[0.000]			[0.000]
F.Resources2			-0.431			-0.798			-0.217
			[0.003]			[0.000]			[0.183]
Year			-0.018			-0.380			-0.100
			[0.000]			[0.000]			[0.000]
Time effect	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country effect	yes	yes	yes	yes	yes	yes	yes	yes	yes
_cons	-1.348	4.291	467.73	-2.18	-0.247	801.71	-32.081	0.984	154.85
	[0.399]	[0.004]	[0.881]	[0.000]	[0.374]	[0.000]	[0.000]	[0.000]	[0.003]
N	797	797	517	748	748	530	748	748	530
$\overline{R}^2$	0.925	0.925	0.935	0.918	0.918	0.937	0.970	0.970	0.973
First stage estimation									
Excluded instruments									
ELICOS	Y	Y	Y	Y	Y	Y	Y	Y	Y
School	Y	Y	Y	Y	Y	Y	Y	Y	Y
VET	Y	Y	Y	Y	N	N	N	N	N
Comlang	Y	Y	Y	Y	Y	N	N	N	Y
Ldistance	Y	N	N	Y	N	N	N	N	N
Researchonly	Y	Y	N	y	N	N	N	N	N
F-value	28.93	28.93	30.33	28.67	30.57	46.66	30.57	30.57	45.21
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hansen's J P-value	0.51	0.51	0.00	0.95	0.87	0.93	0.43	0.43	0.95

All estimations are obtained by GMM method. Total exports (primary goods/manufactured goods) refer to country *i*'s share in Australian total (primary goods/manufactured goods) exports in year *t*. Figures in [ ] show p-values. $\overline{R}^2$ refers to adjusted R2.

Instrument variable estimation above provides a consistent estimation and is a standard approach to handle endogeneity problems. A remaining question is possible persistency of trade variables and immigration data. The presence of lagged dependent variable among regressors, however, leads to an endogeneity problem because of the correlation between this lagged variable and residuals. To address this endogeneity and to reverse causality from the dependent variables and Highereducation we employed the two-step GMM-system estimator (Blundell and Bond, 1998; Roodman, 2009).[7] In an untabulated table, estimated coefficients

[7] In contrast with the two-stage instrument variable estimation, the system dynamic panel data estimation finds instrument variables largely within the system. In our estimation, we lagged dependent variable, Highereducation (enrolment) and lagged Highereducation (enrolment) are predetermined and endogenous respectively. Excluded exogenous variables include Comlang, ldistan and the predicted value of the factor

of lagged dependent variable, Highereducation(enrolment) and lagged Highereducation (enrolment) was 0.970(p-value=0.000), 0.067 (p-value=0.001) and -0.058 (p-value=0.001) respectively. These findings suggest that the long-run effect of enrolment (commencement) of higher education on manufacturing exports is 0.3. We continued this estimation for total exports and primary good exports but the Highereducation and its lagged were not statistically significant.

Columns (5) and (6) in Table 9 report that the impact of international higher education on imports of manufactured goods is positive and significant, which is similar to the case of Australian exports. The impact on total imports (Columns 1 and 2), however, is positive but not statistically significant. The impact on imports of primary goods is also not significant irrespective of model specifications. This finding may reflect the structure of Australian economy where primary goods have a comparative advantage in the global market. We control for Australian income (Income_A), measured by logarithm of Australian ppp-adjusted GDP per capita, to proxy importer's purchasing power on Columns (2), (4) and (6). In contrast to exports, however, this income variable is not significant for manufacturing and primary goods imports. Income_A on Column (2) is negatively significant for total imports, which is counter-intuitive. All in all statistics of the first stage estimation on lower panel indicate the robustness of the estimation of imports is somewhat poor.

Table 9: Instrumental variable estimation of the impact of international higher education student on Australian imports

	(1)	(2)	(3)	(4)	(5)	(6)

analysis (i.e., pathways). GMM estimations also produce more efficient estimations than the standard instrument variable estimates in the presence of heteroskedasticity of unknown form. We reran the model including lag and 2 lags of dependent variables and significance of our main covariates, Highereducation, remained intact. All our estimations are based on no-autocorrelations in residuals (ie. Arellano-Bond test for AR(1) and AR(2)) and validity of (aggregated) instruments (i.e., Hansen test of overidentification statistics).

	Total Import		Primary goods imports		Manufactured goods imports	
Highereducation:						
Enrolment	0.008	0.008	-0.036	-0.036	0.018	0.018
	[0.543]	[0.543]	[0.208]	[0.208]	[0.017]	[0.017]
lareap	1.641	1.641	0.529	0.529	1.907	1.907
	[0.000]	[0.498]	[0.000]	[0.000]	[0.000]	[0.000]
bothin	-7.878	-7.878	3.623	3.623	-10.563	-10.563
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
ldist	3.607	3.607	-4.575	-4.575	4.840	4.840
	[0.000]	[0.013]	[0.000]	[0.000]	[0.000]	[0.000]
Income_A		-0.026		-0.032		-0.009
		[0.039]		[0.180]		[0.531]
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Country effect	Yes	Yes	Yes	Yes	Yes	Yes
_cons	-61.90	-60.89	25,32	26,57	-82.24	-81.90
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
N	599	599	599	599	599	599
$\overline{R}^2$	0.955	0.955	0.882	0.882	0.948	0.949
First stage estimation						
Excluded instruments						
Income	Y	Y	Y	Y	Y	Y
Income2	Y	Y	Y	Y	Y	Y
ELICOS	Y	Y	Y	Y	Y	Y
School	Y	Y	Y	Y	Y	Y
VET	Y	Y	Y	Y	Y	Y
Comlang	Y	Y	Y	Y	Y	Y
Ldistance	N	N	N	N	N	N
Researchonly	Y	N	Y	N	Y	N
F-value (p-value)	18.86 (0.00)	18.86 (0.00)	18.86 (0.00)	18.86 (0.00)	18.86(0.00)	18.86(0.00)
Hansen's J P-value	0.00	0.00	0.02	0.02	0.00	0.00

All estimations are obtained by GMM method. Total imports (primary goods/manufactured goods) refer to country *i*'s share in Australian total (primary goods/manufactured goods) imports in year *t*. Figures in [ ] show p-values. Income_A is natural logarithm of Australian ppp-adjusted GDP per capita in thousand. $\overline{R}^2$ refers to adjusted R2.

Table 10 reports impact of international students on the immigration from the student's home country to Australia. Dependent variables on Columns (1)-(4) are immigration numbers in thousand and on Column (5)-(8) are the ratio, calculated by immigration from country *i* scaled by total immigration number in the same year.

Estimation results illustrate the positive impact of the export of higher education on immigration is statistically significant irrespective of model specifications. This is consistent with the prediction by the empirical hypothesis H6, suggesting a positive impact of international higher education on human capital mobility. Indeed, international students who have obtained an Australian qualification may apply for permanent residency onshore, providing they meet the selection criteria, under the General Skilled Migration Program. In 2004, for example, there were 42,300 overseas students had completed their higher education course and 34% (14,400 students) of these were approved for permanent residence onshore under selected skilled categories (Australian Bureau of Statistics: http://www.abs.gov.au).

Table10 also indicates that ELICOS does not directly affect immigration although it affects immigration through higher education whereas VET directly and negatively affect immigration to Australia. It also suggests that immigration to Australia from common language (i.e., English) is greater than non-English language countries due possibly to transaction costs to settle down after immigration. Columns (3) and (7), compared to (4) and (8) respectively, do not have time effects assuming there is no significant global shocks affecting all countries homogenously. Our main covariate Highereducation remains as significant although the magnitude of estimated coefficients is somewhat smaller than those with time effects.

Table 10: Immigration impact of international higher education

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Immigration number('000)				Immigration ratio			
Highereducation:								
Enrolment	10.577	14.744	19.148	23.542	0.023	0.032	0.048	0.053
	[0.001]	[0.006]	[0.000]	[0.000]	[0.001]	[0.008]	[0.000]	[0.000]
ELICOS		-19.36				-0.044		
		[0.363]				[0.366]		

VET			-39.660 [0.000]	-43.540 [0.000]			-0.095 [0.000]	-0.100 [0.000]
ldistance			-244.18 [0.000]	-244.96 [0.000]			-0.531 [0.000]	-0.555 [0.000]
comlang			145.761 [0.000]	175.523 [0.000]			0.352 [0.000]	0.395 [0.000]
Time effect	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Country effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_cons	40.02 [0.658]	-129.4 [0.401]	2067.8 [0.000]	2237.09 [0.000]	0.046 [0.828]	-0.211 [0.549]	4.865 [0.000]	5.053 [0.000]
N	765	765	765	765	765	765	765	765
$\overline{R}^2$	0.435	0.436	0.443	0.449	0.430	0.430	0.447	0.448
First stage estimation Excluded instruments								
F.Resources	Y	Y	Y	Y	Y	Y	Y	Y
F.Resources2	Y	Y	Y	Y	Y	Y	Y	Y
ELICOS	Y	Y	Y	Y	Y	Y	Y	Y
School	Y	Y	Y	Y	Y	Y	Y	Y
VET	Y	Y	Y	Y	Y	Y	Y	Y
Comlang	Y	Y	N	N	Y	Y	N	N
Ldistance	Y	N	N	N	Y	N	N	N
Researchonly	Y	Y	Y	Y	Y	Y	Y	Y
F-value (p-value)	18.63 (0.00)	20.63 (0.00)	9.97 (0.00)	12.87 (0.00)	18.63 (0.00)	20.63 (0.00)	9.97(0.00)	12.87(0.00)
Hansen's J P-value	0.29	0.24	0.34	0.97	0.31	0.26	0.83	0.98

All estimations are obtained by GMM method. Dependent variables are total number of immigrants from the student's home country to Australia (Columns 1-3) and the portion of county *i*'s immigrants in total immigrants (Columns 4-6). Figures in [ ] show p-values. $\overline{R}^2$ refers to adjusted R2.

Further analysis for instrument variable estimation

Table 11 reports commencement effects of international higher education on exports, imports and immigration, which is re-estimations of unrestricted models in Table 8 (Columns 3, 6, 9), Table 9 (Columns 2, 4, 6) and Table 10 (Columns 4, 8). All included regressors are same as before but only the estimated coefficient of our main regressor (Highereducation: commencement) is reported for brevity.

Columns (1)-(3) in upper panel show the commencement effect on exports is positive, which is similar to the effect of enrolment but with greater estimated coefficient. Similar to enrolment, Highereducation:commencement is statistically significant only for manufactured goods imports. Immigration effects of commencement are significant irrespective of the definition of dependent variables: the numbers in Column (7) and ratio in Column (8).

One may concern about time difference between commencement and beginning of doing business or the time of migration. Considering standard duration of higher education in Australia is three years, we used 3 and 4 lagged Highereducation: commencement in middle and lower panel respectively. Columns (1)-(3) in middle panel report the effect of the 3 lagged commencements on exports remain significant. Interestingly, the magnitude of estimated coefficients for manufacturing goods exports (Column 3) increased while those for total exports and primary goods exports are somewhat dropped. Columns (4) and (5) report opposite signs those in the upper panel, which is consistent with our expectation. Last two columns show the effect of commencement remain significant.

Lower panel reports the estimated effect of 4 lagged commencement. Columns (1)-(3) show commencement effect on total exports largely similar to 3 lagged commencement although statistical significance of primary goods exports dropped. Despite the lost number of observations due to increased the lag lengths, Columns (4)-(5) show the commencement effect on imports (particularly for manufactured goods) is statistically strengthened and significant. This finding implies the effect of higher education on imports (from the education service provider: Australia) takes time. In contrast, the effect of commencement on migration in the last two columns is not statistically significant. This finding suggests overseas student's migration to Australia is immediate rather than long-term plan.

Table 11: Commencement effects of international higher education on exports, imports and immigration

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Total exports	Primary goods exports	Manuf. goods exports	Total imports	Primary goods imports	Manuf. goods imports	Migration number ('000)	Migration ratio
Highereducation: commencement	0.163	0.230	0.110	-0.005	-0.126	0.053	26.980	0.059
	[0.000]	[0.000]	[0.006]	[0.895]	[0.160]	[0.002]	[0.008]	[0.010]
N	517	530	530	490	599	490	792	792
$\overline{R}^2$	0.913	0.937	0.973	0.953	0.885	0.945	0.424	0.418
First Stage								
F-value (p-value)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hansen's J (p-value)	0.00	0.550	0.767	0.00	0.018	0.00	0.129	0.140
Highereducation: Lag3. commencement	0.121	0.108	0.153	0.038	0.072	0.027	40.151	0.086
	[0.008]	[0.054]	[0.000]	[0.089]	[0.098]	[0.102]	[0.017]	[0.016]
N	365	371	371	343	420	343	533	527
$\overline{R}^2$	0.937	0.950	0.980	0.978	0.975	0.973	0.471	0.471
First Stage								
F-value (p-value)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hansen's J (p-value)	0.00	0.198	0.886	0.055	0.283	0.010	0.829	0.937
Highereducation: Lag4. commencement	0.190	0.070	0.131	0.056	0.108	0.041	14.232	0.031
	[0.000]	[0.329]	[0.015]	[0.023]	[0.172]	[0.014]	[0.318]	[0.327]
N	313	318	318	294	360	294	438	438
$\overline{R}^2$	0.945	0.956	0.980	0.983	0.982	0.979	0.513	0.505
First Stage								
F-value (p-value)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hansen's J (p-value)	0.00	0.238	0.346	0.120	0.333	0.020	0.797	0.842

Estimations are based on unrestricted models in Table 8 (Columns, 3, 6, 9), Table 9(Columns 2, 4, 6) and Table 10(Columns 4, 8). The main regressor is changed from enrolled students to commencement. All included regressors other than Highereducation: commencement are not reported for brevity. Instrument variables for Highereducation are same as in Tables 8, 9 and 10 (not reported) with their 3 lags for mid panel and 4 lags for lower panel. Dependent variables in each estimations are as in first row. Middle and lowest panel respectively reports estimated coefficients of 3 and 4 lagged Highereducation: commencement.

Summary and conclusion

Our estimation results demonstrate that both student's family resources and other pathways such as ELICOS, high school and VET positively affect demand for higher education from international students. Magnitude of total effect of School on enrolment and commencement is greater than those of ELICOS and VET although the estimated coefficient of ELICOS is the most consistently robust. An increase of one thousands school enrolment leads to a rise in

the higher education enrolment by minimum (maximum) of 15.582 (33.365)$\times 10^{-6}$ $\times$number of 15-64 aged population in the student's home country. For example, an increase of thousand of School enrolment (commencement) from a country with 2 million of 15-64 aged population leads to an increase of the higher education enrolment (commencement) by the range of 31-67 (17-40). As expected, negative effect of common language (largely interacted with variable indicating Enlgish Intensive Learning Program) on demand of higher education is observed both for enrolment and commencement.

Estimation results also suggest that costs of studying such as travelling costs, proxied by physical distance and the tuition fees, proxied by the bilateral exchange rate have negative effect on the demand. In contrast with physical distance, the statistical significance of the bilateral exchange rate variable varied somewhat depending on model specification. Our results also suggest that the portion of research intensive staff positively affect the demand, due possibly to the reputation/quality of education reflected to internationally announced university ranking.

A further analysis indicates that the direct negative impact of global financial crisis (GFC) on higher education is not significant but indirect impact through income is observed. In particular, the negative impact of GFC is accelerated for students from high income and upper mid income countries.

Results of instrument variable methods illustrate the positive impact of international higher education students on exports to the student's home country is significant irrespective of model specifications and different combinations of instrument variables. This positive impact is observed for total (i.e., aggregated) exports as well as primary goods exports and manufactured goods exports. The standardisation of the estimated coefficient suggests that the impact of international student's enrolments on exports of primary goods is greater than manufactured goods by the factor of 3.4.

In contrast, only the impact of international students on imports of manufactured goods is observed. These findings are consistent with the structure of Australian trade which has a strong comparative advantage in commodities in global market.

Estimation results also illustrate the positive impact of the export of higher education on immigration is observed, supporting the hypothesis of a positive impact of international higher education on human capital mobility across the border. A further analysis implies this migration effect is immediate rather than long-term plan.

Overall, our estimation results imply that export of higher education leads to bilateral market integration through trade promotion as well as human capital mobility between Australia and the student's home country.

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