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Import and Export of PhDs in Europe

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Abstract

Education is recognized as one of the most significant knowledge-intensive export industries and its contribution to the trade balance cannot be ignored for many countries. Although there are a wide range of educational services for trade, this study focuses on the trade of 'Doctoral Degrees' or 'Doctor of Philosophy (PhD)' in Europe with a special emphasis on the top European universities in economics. By investigating the imports and exports of PhDs in the top European universities, this paper discovers that European countries have relatively distinctive roles in the trade of PhDs, net exporters (Belgium, Switzerland and Germany), trader in balance (the Netherlands) and net importers (Spain and Denmark), in terms of its top universities.

Keywords: Global competition in educational services, trade of PhDs in Europe, the top European universities in economics, world's university rankings.

INTRODUCTION

Many countries, especially developed countries, have currently recognized that education is one of the most important knowledge-intensive export industries. Indeed, the value of trade in educational services reached 39 billion dollars in 1999 (Saner and Fasel, 2003). Thus, the contribution of education to the trade balance is enormous and will be more in the future (Barrow, Didou-Aupetit and Mellea, 2004; Verger, 2004).

There are a wide variety of educational services in trade. Verger (2004) distinguishes trade in education into four modes of services supply: cross-border supply (Mode 1), consumption abroad (Mode 2), commercial presence (Mode 3) and presence of natural persons (Mode 4). In Mode 1, educational services are provided without physical contact between the producer and the user (e.g. e-learning). Mode 2 can be a most familiar style of educational services supply in which students go to a country to study in another country, exporter of a service to students' country. In Mode 3, the educational services suppliers are physically displaced to the importing countries: for instance, a university in one country establishes its franchise in another country. In Mode 4, a researcher, in one country, an exporter of the educational service, is employed by institutes in another country for research or teaching.

Although miscellaneous types of educational services in trade, as described above, exist, this study focuses on the trade of 'Doctoral Degrees' or 'Doctor of Philosophy (PhD)'. There are generally two types of exportation of PhDs. In one case, a foreign student who obtains a PhD in one country goes to another country for research or teaching. This may not directly contribute to the trade balance of the service supply country. In the other case, a domestic student in one country who receives a PhD in the same country goes to another country for academic jobs. This is the Mode 4 type of the educational service supply and contributes to the trade balance. Although the former case does not directly lead to the positive effects onto the trade balance, it will indirectly bring about positive effects to the trade balance through Mode 2 because highly demanded PhDs of a university in one country attract foreign students to study there. As far as universities are concerned, one of the effective ways to attract students and improve reputation is to train doctoral students and then produce 'PhDs' that are globally demanded. Especially, 'selling' PhDs to the prestigious universities can undoubtedly positively contribute

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to improvement of reputation for universities. Successes in exporting PhDs can let universities lead international competition for foreign students.

The trade of PhDs may be thus one of the most concerned issues for both countries and universities, especially world's top universities because world's top universities are more ambitious in exporting PhDs than the other universities. This study then seeks to disclose the state of trade of PhDs in the top universities Europe. Europe is focused on in this study because it is an interesting region to study the trade of PhDs. European countries have a strong ambition to make Europe 'the most-favoured destination of students, scholars and researchers from other world regions' (EC, 2002:5). On the other hand, Europe seeks to stop the leaking of its own students and researchers to the other regions, especially the US (Verger, 2004). Because of both the offensive and defensive aspects of the European strategies for trade in educational services, the trade of PhDs within the region can be more active than other regions. For instance, the trade of PhDs within Northeast Asia, as Sagara (2014) identifies, takes place quite rarely. Therefore, the study examines the state of trade of PhDs in Europe, focusing on its top universities.

METHODOLOGIES

In order to examine the state of trade of PhDs in the top European universities, the study requires a subject focus. The subject on which the study focuses is 'economics'. Economics is chosen for this study because the subject is globally very popular and most of the top universities in Europe offer doctoral courses in economics. Then, the top European universities in the subject of economics is selected according to the QS University Rankings by Subject 2014: Economics & Econometrics . Though there are a variety of world university rankings and the reliability of the University Rankings are controversial (Baty, 2012; Holmes, 2013), the Rankings are used for this study because every ranking has flaws, and the QS University Rankings have been very actively revising themselves for improvements so that they are more reliable (Baty, 2012).

According to the QS University Rankings by Subject 2014: Economics & Econometrics, there are 14 European universities in the world's top 50 and 23 in the top 100. The list of the European universities in the world's top 100 is shown in the Table 1. Then, doctoral degrees or PhDs of economics researchers were investigated through their websites in September 2014.

RESULTS

Exports

As shown in the Table 2, LSE is the top exporter of PhDs among the top European higher institutes. LSE exports 31 PhDs to 13 of the top 37 European higher institutes. Because, as it is shown below, the number of PhDs Oxford exports, the second biggest exporter, is 16, LSE's achievement is quite impressive. Two Spanish universities, UPF (10 PhDs) and UC III (7 PhDs) are the largest and the second largest export destinations. Other export destinations include TSE (3 PhDs), KUL and Bonn (2 PhDs), and UCLu, Mannheim, Aarhus, UAB, TCD, Bologna, Bocconi and SSE (1 PhD).

The University of Oxford exports the second largest number of PhDs (16 PhDs) to 10 top European universities. UPF again is the main export destination (4 PhDs). Other destinations are TSE, Bologna, Tilburg and VU Amsterdam (2 PhDs), and UC III, UCLu, UAB and Zurich (1 PhD). The third largest exporters of PhDs are Tilburg and VU, both of them exporting 11 PhDs to 8 and 10 top European institutes respectively. The major export destination for Tilburg's PhDs is York (3 PhDs). Nottingham (2 PhDs), and Aarhus, Copenhagen, Oxford, Edinburgh, UAB and SSE (1 PhD) come after York. York is again the biggest export destination for VUB's PhDs

(2 PhDs) followed by Amsterdam, Aarhus, Copenhagen, Warwick, LBS, TSE, UC III, Bocconi and EUR (1 PhD).

Bonn and UCLu are equally the fifth largest exporter of PhDs (10 PhDs). The main importers of Bonn's PhDs are Aarhus and UAB (2 PhDs). Other export destinations include Maastricht, Oxford, Edinburgh, UPF and Zurich (1 PhD). UCLu's PhDs are most imported by TSE (4 PhDs). Maastricht (2 PhDs), and Aarhus, UPF, LSE and Bologna (1 PhD) follow the French university. TSE comes next with 9 PhDs exported. UPF, UAB and Mannheim import 2 PhDs respectively from TSE followed by UC III, Tilburg and Nottingham (1 PhD). Paris I and Zurich are the eighth biggest exporters of PhDs (8 PhDs). UCLu is the main export destination for PhDs of Paris by 3 PhDs. Bologna (2 PhDs), and Nottingham, UCL and WU (1 PhD) are other destinations for its PhDs. Zurich's PhDs are most imported by Tilburg and Bonn (2 PhDs) followed by UAB, Amsterdam, Copenhagen and EUR (1 PhD).

Table 1. List of the top European universities in Economics

	Institute	QS Rankings	Country
1	London School of Economics (LSE)	3	UK
2	Cambridge	10	UK
3	Oxford	12	UK
4	University College London (UCL)	17	UK
5	Bocconi	20	IT
6	Warwick	21	UK
7	LondonBusiness School (LBS)	31	UK
8	Stockholm School of Economics (SSE)	32	SE
9	Erasmus University Rotterdam (EUR)	38	NL
10	Universitat Pompeu Febra (UPF)	40	ES
11	Eidgenössische Technische Hochschule (ETH)	41	CH
12	Pantheon-Sorbonne University (Paris I)	44	FR
13	Universidad Carlos III de Madrid (UCIII)	46	ES
14	Tilburg	50	NL
15	Vrije Universiteit Brussel (VUB)	51-100	BG
16	Université catholique de Louvain (UCLu)	51-100	BG
17	Bonn	51-100	DE
18	Toulouse School of Economics (TSE)	51-100	FR
19	Zurich	51-100	CH
20	Universitat Autonoma de Barcelona (UAB)	51-100	ES
21	Katholieke Universiteit Leuven (KUL)	51-100	BG
22	Amsterdam	51-100	NL
23	Mannheim	51-100	DE
24	Munich	51-100	DE
25	Aarhus	51-100	DK
26	Copenhagen	51-100	DK
27	York	51-100	UK
28	Maastricht	51-100	NL
29	Lund	51-100	SE
30	VU University Amsterdam (VU)	51-100	NL
31	Notthingham	51-100	UK
32	Manchester	51-100	UK
33	Trinity College Dublin (TCD)	51-100	IE
34	Wirtschaftsuniversität Wien (WU)	51-100	AT
35	Bologna	51-100	IT
36	Edinburgh	51-100	UK
37	Birmingham	51-100	UK

The tie-10th universities that export 6 PhDs to the top European universities include UAB, Cambridge, KUL, SSE and UPF. UAB most greatly exports its PhDs to Edinburgh (2 PhDs) followed by Amsterdam, Nottingham, UCL and Manchester (1 PhD). UPF, Amsterdam, Tilburg, TSE, VUB and Lund (1 PhD) are the export destination for PhDs from Cambridge. KUL's PhDs are most imported by Aarhus (2 PhDs) followed by Amsterdam, Tilburg, TSE and Maastricht (1 PhD). Aarhus, Tilburg, TSE, Cambridge, Zurich and Copenhagen are the importers for SSE's PhDs. UPF exports its PhDs to Zurich, Edinburgh, UAB, EUR, Paris I, Bologna, and Bocconi (1 PhD).

Amsterdam, Mannheim, UCL and Munich come next by 5 PhDs exported. Zurich, UAB, Mannheim, TSE and Manchester (1 PhD) are the export destinations for Amsterdam's PhDs; Tilburg, UAB, UPF, Aarhus and Birmingham (1 PhD) for Mannheim's PhDs; UPF, UAB, UC III, Zurich and Bologna (1 PhD) for UCL's PhDs; and Zurich (3 PhDs), and UAB and TSE (1 PhD) for Munich's PhDs.

Table 2. Export of PhDs

Rank	Institute	Country	Number
1	LSE	UK	32
2	Oxford	UK	16
3	Tilburg	NL	11
3	VUB	BG	11
5	UCLu	BG	10
5	Bonn	DE	10
7	TSE	FR	9
8	ParisI	FR	8
8	Zurich	CH	8
10	Cambridge	UK	6
10	SSE	SE	6
10	UPF	ES	6
10	KUL	BG	6
10	UAB	ES	6
15	UCL	UK	5
15	Munich	DE	5
15	Amsterdam	NL	5
15	Mannheim	DE	5
19	Warwick	UK	4
19	EUR	NL	4
21	Bocconi	IT	3
21	Aarhus	DK	3
21	Copenhagen	DK	3
21	York	UK	3
21	Maastricht	NL	3
26	ETH	CH	2
26	Lund	SE	2
28	UC III	ES	1
28	TCD	IE	1
28	VU Amsterdam	NL	1
28	Notthingham	UK	1
28	Manchester	UK	1
33	LBS	UK	0
33	WU	AT	0
33	Bologna	IT	0
33	Edinburgh	UK	0
33	Birmingham	UK	0

Table 3. Import of PhDs

Rank	Institute	Country	Number
1	UPF	ES	24
2	TSE	FR	18
3	UAB	ES	12
3	Aarhus	DK	12
5	UC III	ES	11
6	Tilburg	NL	10
6	Bologna	IT	10
8	Zurich	CH	9
9	Amsterdam	NL	6
9	EUR	NL	6
9	Copenhagen	DK	6
9	Maastricht	NL	6
13	Mannheim	DE	5
13	York	UK	5
13	UCLu	BG	5
13	Edinburgh	UK	5
13	Bonn	DE	5
13	Notthingham	UK	5
19	Oxford	UK	3
19	Manchester	UK	3
19	Lund	SE	3
19	VUB	BG	3
19	Bocconi	IT	3
19	SSE	SE	3
25	LSE	UK	2
25	LBS	UK	2
25	Cambridge	UK	2
25	UCL	UK	2
25	VU Amsterdam	NL	2
25	Birmingham	UK	2
25	TCD	IE	2
25	KUL	BG	2
33	Warwick	UK	1
33	ParisI	FR	1
33	WU	AT	1
35	Munich	DE	0
35	ETH	CH	0

Then, EUR and Warwick come with 4 PhDs exported: UPF, Aarhus, Copenhagen and VUB (1 PhD) are the export destinations for EUR's PhDs while EUR, Amsterdam, VUB and Tilburg (1 PhD) are for Warwick's PhDs. Aarhus, Copenhagen, York, Maastricht and Bocconi follow EUR and Warwick by 3 PhDs exported: Maastricht, Cambridge and SSE (1 PhD) are the export destinations for Aarhus's PhDs; LSE, Oxford and Lund (1 PhD) for Copenhagen's PhDs; UPF (2 PhDs) and EUR (1 PhD) for York's PhDs; Manchester, Aarhus and Bonn (1 PhD) for Maastricht's PhDs; and Birmingham, LBS and TCD (1 PhD) for Bocconi's PhDs. Lund and ETH are the next exporters by 2 PhDs: Copenhagen and TSE export one PhD to Lund respectively while TSE (2 PhDs) is the only one export destination for ETH's PhDs. VU Amsterdam, Nottingham, Manchester, TCD and UC III are then the exporters of one PhD: Bologna for VU Amsterdam's PhD, Lund for Nottingham's PhD, EUR for Manchester's PhD, Bologna for TCD's PhD and Mannheim for UC III's PhD. Finally, WU, Bologna, Edinburgh, LBS and Birmingham does not export PhDs to the top European universities.

Import

As demonstrated in the Table 3, the university importing PhDs from the top European universities most is UPF. UPF imports 24 PhDs: LSE (10 PhDs), Oxford (4 PhDs), York and TSE (2 PhDs), and Cambridge, UCL, UCLu, Bonn, Manheim and EUR (1 PhD). TSE is the second biggest importer (18 PhDs). UCLu is the biggest exporter for TSE (4 PhDs) followed by LSE (3

PhDs), Oxford and ETH (2 PhDs), and VUB, Cambridge, SSE, KUL, Munich, Amsterdam and Lund (1 PhD). The third biggest importers are UAB and Aarhus by 12 PhDs. Exporters for UBA are TSE and Bonn (2 PhDs), and Oxford, Munich, Mannheim, LSE, Amsterdam, UCL, Tilburg and Zurich (1 PhD). Aarhus imports PhDs from KUL and Bonn (2 PhDs), VUB, EUR, UCLu, Tilburg, Maastricht, SSE, LSE and Manheim (1 PhD).

UC III gets ranked fifth by importing 11 PhDs, mostly from LSE (7 PhDs) followed by Oxford, VUB, TSE and UCL (1 PhD). Tilburg and Bologna are the sixth biggest importers by 10 PhDs. Tilburg imports PhDs from Oxford and Zurich (2 PhDs), and TSE, Cambridge, SSE, KLU, Warwick and Mannheim (1 PhD). Oxford and Paris I are the biggest exporters for Bologna (2 PhDs) followed by VUB, UCLu, LSE, UCL, UPF and TCD (1 PhD). The eighth biggest importer is Zurich by 9 PhDs, importing them from Munich (3 PhDs), Oxford, UCL, Bonn, UPF, Amsterdam and SSE (1 PhD).

The ninth biggest importers are Maastricht, Amsterdam, EUR and Copenhagen by 6 PhDs. Maastricht imports PhDs from Bonn and UCLu (2 PhDs), and Aarhus, KUL and Copenhagen (1 PhD). Amsterdam imports PhDs from Cambridge, Zurich, UAB, VUB, Warwick and KUL (1 PhD); EUR imports PhDs from Zurich, VUB, UPF, Warwick, Manchester and York (1 PhD); and Copenhagen imports PhDs from EUR, Zurich, VUB, Tilburg, SSE and Lund (1 PhD). Next, UCLu, Bonn, Mannheim, York, Nottingham and Edinburgh import 5 PhDs: UCLu imports PhDs from Paris I (3 PhDs), and LSE and Oxford (1 PhD); Bonn does so from LSE and Zurich (2 PhDs) and Maastricht (1 PhD); Mannheim does so from TSE (2 PhDs) and LSE, UC III and Amsterdam (1 PhD); York does so from Tilburg (3 PhDs) and VUB (2 PhDs); Nottingham does so from Tilburg (2 PhDs), and UAB, TSE and Paris I (1 PhD); and Edinburgh does so from UAB (2 PhDs) and Tilburg, Bonn and UPF (1 PhD).

Oxford, VUB, Bocconi, Lund, SSE and Manchester comes next by importing 3 PhDs: Tilburg, Bonn and Copenhagen (1 PhD) for Oxford; Cambridge, Warwick and EUR (1 PhD) for VUB; VUB, LSE and UPF for Bocconi; Cambridge, Copenhagen and Nottingham (1 PhD) for Lund; LSE, Copenhagen and Tilburg (1 PhD) for SSE; and Maastricht, UAB and Amsterdam (1 PhD) for Manchester. 2 PhDs are then imported by LSE, Cambridge, UCL, LBS, Birmingham, VU Amsterdam, TCD and KUL: Copenhagen and UCLu (1 PhD) for LSE, SSE and Aarhus (1 PhD) for Cambridge, Paris I and UAB (1 PhD) for UCL, Bocconi and VUB (1 PhD) for LBS, Mannheim and Bocconi (1 PhD) for Birmingham, Oxford (2 PhDs) for VU Amsterdam, LSE and Bocconi (1 PhD) for TCD, and LSE (2 PhDs) for KUL. Warwick, WU and Paris I imports only one PhD from VUB and UPF respectively. Finally, the import of both ETH and Munich is zero.

DISCUSSION

In the previous section, the trade of PhDs between the top European universities was described. Then, this section seeks to discover each country's main characteristics of PhD trading by examining trade balance of both individual university and country and mutual relationship between the top European universities.

Trade Balance

Here the relationships between imports and exports of each university and each country, namely the trade balances of them, are examined. The top European universities can be categorized into universities with trade surplus (+3 or above), those with trade in balance (from -2 to +2), and those with trade deficit (-2 or below). Those universities categorized into 'trade surplus' include LSE (+30), Oxford (+13), VUB (+8), Paris I (+7), UCLu (+5), Bonn (+5), Munich (+5), Cambridge (+4), KUL (+4), SSE (+3), UCL (+3) and Warwick (+3). Five of them are British, three of them are Belgian and two of them are German, followed by France and Sweden by one university respectively.

Those into 'trade in balance' are ETH (+2), Tilburg (+1), Mannheim (0), Bocconi (0), WU (-1), Zurich (-1), Amsterdam (-1), Lund (-1), VU Amsterdam (-1), TCD (-1), EUR (-2), York (-2), Manchester (-2), LBS (-2) and Birmingham (-2). Four of the 'in balance' universities are from the Netherlands; four from Britain; two from Switzerland; and one from Italy, Austria, Sweden and Ireland. Those into 'trade deficit' then include Copenhagen (-3), Maastricht (-3), Nottingham (-4), Edinburgh (-5), UAB (-6), TSE (-9), Aarhus (-9), UC III (-10), Bologna (-10) and UPF (-18). In terms of their countries, Spain occupies three of them and Denmark and Britain account for two of them respectively followed by the Netherlands, France and Italy by one university.

From the categorization described above, the characteristics of each country in trading PhDs can be discovered though some are clear but others are not so. The characteristics of Spanish universities (UPF, UC III and UAB) and Danish universities (Aarhus and Copenhagen) are clear because all of their universities import PhDs from the top European universities more than exporting them, namely net importers. Especially, the top Spanish universities are apparently big PhD importers as the total trade loss of these three Spanish universities is -34, as that of the two Danish universities is -12. All of the top Belgian universities, VUB, UCLu and KUL, on the other hand, export PhDs to the top European countries more than importing them, a net exporter. The total trade surplus of the Belgian universities is +17. All of the top Swiss universities, ETH and Zurich, are categorized into 'trade in balance', and the total trade balance of these two Swiss universities is +1.

Table 4. Trade balance of universities

Rank	Institute	Country	Number
1	LSE	UK	30
2	Oxford	UK	13
3	VUB	BG	8
4	ParisI	FR	7
5	UCLu	BG	5
5	Bonn	DE	5
5	Munich	DE	5
8	Cambridge	UK	4
8	KUL	BG	4
10	SSE	SE	3
10	UCL	UK	3
10	Warwick	UK	3
13	ETH	CH	2
14	Tilburg	NL	1
15	Bocconi	IT	0
15	Mannheim	DE	0
17	WU	AT	-1
17	Zurich	CH	-1
17	Amsterdam	NL	-1
17	Lund	SE	-1
17	TCD	IE	-1
17	VU Amsterdam	NL	-1
23	EUR	NL	-2
23	York	UK	-2
23	Manchester	UK	-2
23	LBS	UK	-2
23	Birmingham	UK	-2
28	Copenhagen	DK	-3
28	Maastricht	NL	-3
30	Notthingham	UK	-4
31	Edinburgh	UK	-5
32	UAB	ES	-6
33	TSE	FR	-9
33	Aarhus	DK	-9
35	UC III	ES	-10
35	Bologna	IT	-10
37	UPF	ES	-18

Table 5. Trade balance of countries

Rank	Country	Number
1	UK	36
2	BG	17
3	DE	10
4	SE	2
5	CH	1
6	AT	-1
7	IE	-1
8	FR	-2
9	NL	-6
10	IT	-10
11	DK	-12
12	ES	-34

The UK has universities which belong to all three categories. However, it can be observed that the higher-ranked British universities are likely to be net exporters while the lower-ranked British universities tend to be net importers. Those British universities that export PhDs more

than importing them are LSE, Oxford, Cambridge, UCL and Warwick, all of which are the top 50 universities according to the QS University Rankings. On the other hand, those British universities that are categorized into 'trade loss' or 'trade in balance' are York, Manchester, LBS, Birmingham, Nottingham and Edinburgh, and all of them, except LBS, do not get ranked in the top 50. Nevertheless, the total trade balance of the British universities is positive, +36. Britain can achieve such great trade surpluses thanks to LSE and Oxford because the trade surpluses of these two universities are +30 and +13 respectively. By excluding the contributions made by LSE, the total trade balance of the British universities becomes only +7; if PhDs exported by both LSE and Oxford are excluded, it becomes even negative, -7. Thus, it is clear that two great exporters of PhDs, LSE and Oxford, especially the former, let Britain achieve such great trade surpluses.

As for Germany, the total trade surplus of the German universities is positive, +10, because all of them are categorized into either 'trade surplus' (Bonn and Munich) or 'trade in balance' (Mannheim). It can be thus said that the top German universities tend to be net exporters. All of the top Dutch universities, Tilburg, Amsterdam, VU Amsterdam and EUR, except Maastricht, are categorized into 'trade in balance'. Because Maastricht's trade loss is only -3, it can be nearly identified that exports tend to equal imports for the Dutch universities. The total trade balance of these five Dutch universities is -6.

As for France and Italy, it is difficult to specify the characteristics of the top French and Italian universities in PhD trading. Regarding France, while Paris I is a net exporter by +7, TSE is a net importer by -9. Concerning Italy, while the net export of Bocconi is zero, Bologna is a net importer by -10. Thus, there is a huge difference between two universities for both France and Italy. Comparing with France and Italy, the difference between the total balance of SSE and that of Lund is not so much remarkable for Sweden as the total balance of the former is +4 while that of the latter is -1. The characteristics of the top universities of Ireland and Austria cannot be appropriately identified because each country gets only one university ranked in the top 100, TCD for Ireland and WU for Austria. Further, TCD imports only one PhD and exports two PhDs, while WU does not export a PhD and imports only one PhD.

Mutual Exchange Relationship

Among the top European universities, 197 PhDs are totally exported and imported. However, the exchange relationship is not normally mutual but asymmetric. There are only 13 mutual exchanges of PhDs between the top European institutes. They have either one exchange relationship or two, and the number of PhDs exchanged is one PhD or two. The institutes holding two exchange relationships include: Tilburg (with Oxford and SSE), Maastricht (with Bonn and Aarhus), EUR (with VUB and UPF), UCLu (with LSE and UAB), VUB (with Warwick and EUR), SSE (with Aarhus and Tilburg), Aarhus (with SSE and Maastricht), Zurich (with Amsterdam and Bonn) and Bonn (Maastricht and Zurich). Those holding one exchange relationship include: UAB (with UCLu), UPF (with EUR), LSE (with UCLu), Oxford (with Tilburg), Warwick (with VUB), Lund (with Copenhagen), Copenhagen (with Lund) and Amsterdam (with Zurich).

In terms of their countries, the Netherlands (Tilburg, EUR, Maastricht and Amsterdam) occupies 7 of all the 26 universities which have mutual exchange relationships and Belgium (UCLu and VUB) accounts for four of all. Sweden (SSE and Lund), Denmark (Aarhus and Copenhagen) and Britain (LSE, Oxford and Warwick) follow these two countries, respectively occupying three of all. Switzerland (Zurich), Germany (Bonn) and Spain (UAB and UPF) individually account for two of all the 26 universities. Considering the number of PhDs exported and imported, it is regrettably said that the mutual exchange relationships between the top European universities are very weak.

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CONCLUSION

In order to discover each country's main characteristics of the PhD trade in Europe in terms of their top universities, this study examined the trade balance of both individual university and country and mutual relationships between the top European universities. Then the main characteristics of some countries in the PhD trade in terms of their top universities were identified such as Spain (net importer), Denmark (net importer), Belgium (net exporter) and Switzerland (net exporter). Further, the paper argued that the Netherlands is a 'trade in balance' country and Germany is a net exporter because all of the German universities are categorized into 'trade surplus' or 'trade in balance' and all of the Dutch universities except Maastricht (-3) are into 'trade in balance'.

As far as Britain is concerned, it is maintained that the higher-ranked British universities tend to be net exporters though the lower-ranked British universities tend to be net importers or traders in balance. As for the other countries, this study could not reach a conclusion because France, Italy and Sweden did not have clear characteristics and the number of PhDs exported/imported was too small for Ireland and Austria. Further, this study found that the exchange relationships in PhDs between the top European universities are normally asymmetric as there are only 13 mutual exchanges of PhDs though 197 PhDs are totally exported/imported among the top European universities. Additionally, the Netherlands has the largest number of mutual exchange relationships, which confirms that the country is categorized into 'trade in balance'.

It is therefore concluded that European countries, in terms of their top universities, have relatively clear roles in the PhD trade as a net exporter, a trader in balance or a net importer. Indeed, there is a quasi-symmetric relationship between the net exporters and the net importers: for instance, the net export of the UK is +36, while the net import of Spain is -34; the net export of Belgium is 17, while the next import of Denmark is -12; the net export of Germany is +10, while the next import of Italy is -10. This unbalanced state of the PhD trade between the top European universities will not change at least in the near future, considering the nature of the 'goods'. Training and producing high-quality PhDs is undoubtedly costly and taking many years. Further, improving quality of PhDs may be not enough for one university to export its PhDs because traditions in employments and reputation of universities such as LSE and Oxford may not easily change. Despite these negative factors, it is still possible to change the state of the PhD trade between the top European universities in the long run because some universities have been importing PhDs from the world's best universities to produce high-quality PhDs by themselves. For instance, UPF, the biggest net importer, imports a number of PhDs from the world's top 3 universities such as Harvard (6), Massachusetts Institute of Technology (4) and LSE (10). The efforts for producing high-quality PhDs and then increasing the exports of their PhDs may change the state of the PhD trade between the top European universities.

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