

Motivations in East–West Doctoral Mobility: Revisiting the Question of Brain Drain

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Science is conducted in an increasingly international domain but it is highly questionable whether scientists have equal chances, both professionally and personally, as opportunities and working conditions vary enormously. Drawing on new empirical research with Eastern European scientists, this article explores the professional motivations of Polish and Bulgarian doctoral scientists who have 'gone West'. We consider the relationship between doctoral training, mobility and labour markets within the broader context of science careers. Conditions that create a 'migration potential' are coupled with doctoral candidates' own professional motivations for moving. Moves are found to be economically driven—not just in the 'traditional' sense that moves are made to earn more—as expenditure on research and development influences the number of positions available and their attractiveness to doctoral candidates. Eastern European doctoral scientists share the same rationales for moving as mobile scientists in other studies: for example, moving to prestigious centres or to access international environments. Although socio-economic factors shape attitudes towards mobility, the actual moves themselves were often down to 'chance' encounters or opportunities, although contacts also played an important role. Our findings indicate that, despite a net loss of researchers, scientists do regularly return to their country of origin for professional reasons and often maintain links there, even at early stages in their careers.

Keywords: Mobility; Migration Motivations; Eastern Europe; Doctorates; Science Careers

Introduction

Brandi (2003) suggests that the end of communism caused science in some Eastern European countries to go into decline. New opportunities and a reorientation towards the Western scientific community meant that many countries feared a 'brain drain' of scientific talent as Eastern European scientists took advantage of relaxed restrictions on travel. This concern was further amplified in the lead-up to accession in March 2004.¹ Unease was expressed

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from new and old member-states alike that extending the provisions on the free movement of persons would lead to a significant outflow of workers abroad, including highly skilled staff like scientists. Based on new empirical research into the mobility of Polish and Bulgarian scientists who are either studying or working in the UK and Germany (the 'MOBEX2 project'), this article focuses on the mobility of doctoral candidates in science, examining the factors that generate migration potential as well as mobility motivations.² The vast majority of moves described in this research, even for Polish respondents, had occurred pre-accession to the EU.

The MOBEX2 project examined the relationship between scientific careers and mobility in the context of EU enlargement. It focused on flows of scientists between Poland and Bulgaria and the UK and Germany and considered the implications of scientific mobility for sending and receiving countries and also for individual scientists and their families. The research combined legal and policy analysis at European and national levels with an online survey in all four countries and 89 qualitative interviews with Polish and Bulgarian scientists (at doctoral level upwards). The interviews were administered in all four countries. Table 1 lists the interviewees quoted in this paper, with their pseudonyms, home and host countries, etc. The study was concentrated in the broad fields of physics and biology and focused on academic researchers who were either based in universities or research institutes. Within the total sample, around a third of all interviewees were early career researchers, which we define as doctoral candidates.

[TABLE 1 NEAR HERE]

Poland and Bulgaria were selected as case studies to highlight some of the differences between science labour markets in Central and Eastern European countries. Poland is a significantly larger country with a population of 38 million; Bulgaria's population is around 7.5 million. Both countries had a strong tradition of higher education and scientific research during communist times. In terms of destination, the UK and Germany were selected as two of the most popular countries in Europe for mobile researchers to visit (see Van de Sande *et al.* 2005). Together with France, these two countries employed 54 per cent of all full time research and development workers in the EU-25 in 2003 (Gotzfried 2005). Three out of five foreign students in tertiary education in Europe are based in the UK, Germany or France (UNESCO 2005). These 'host' countries were also selected for some contrasting features. Historically Germany has closer ties with Central and Eastern European countries and it borders Poland. Unlike Germany, on the other hand, the UK chose not to impose any transitional measures on the free movement of persons after Enlargement in May 2004, though they do apply to Bulgaria and Romania following their accession in January 2007. Differences are also apparent in the educational systems of UK and Germany, particularly in terms of organisation, fees and length of study (Guth 2006).

This article considers the relationship between doctoral training, mobility and labour markets in the context of science careers. The first section examines

debates about East–West ‘brain drain’ and, in particular, the loss of investment and potential through ‘youth drain’. We then move on to unravel ‘migration potential’ and mobility motivations in the accounts Polish and Bulgarian PhD students provided of their careers thus far. Questioning the impact of doctoral mobility on the sending country, we provide evidence that Eastern European scientists do not fit neatly into a pattern of ‘migration then education’ (Zweig 1997) where they move abroad for tertiary studies and have little or no professional contact with their country of origin.

Why Worry about an East–West ‘Brain Drain’?

Scientists from Eastern Europe have always been mobile. During communist times, it was common for doctoral candidates to go to Russia or other Eastern Bloc countries. Whilst westbound moves were severely restricted, they were not impossible during this time. The scale of outbound mobility increased rapidly during the transition from communism and in some countries this increase has been phenomenal. Sretenova (2003) reported an exodus of some 40,000 Bulgarian scientists in the period 1990–92. Also referring to Bulgaria, Chobanova (2003: 24) states that ‘the country has lost one small town of 55,000 to 60,000 of its highest educated and skilled population each year during the last decade’. According to Kozłowski (2003), Poland is not witnessing such a strong, continuing outflow of workers: the proportion of Poles with tertiary degrees leaving Poland fell from 3.6 per cent in 1990 to 1.2 per cent in 2001. However, Kozłowski (2003: 7) notes particular drivers to move at the beginning of a career: ‘because of the relatively small disciplinary communities, relatively low level of interdisciplinary and research-industry mobility and barriers in geographical mobility (e.g. high costs of renting flats), young researchers that find their careers blocked in a “feudal” system often cannot remove to other institutions, thus deciding to find engagement in other countries’.

Concerns about the scale of migration from Eastern European countries persist, particularly in relation to ‘youth drain’. Reviewing evidence from various surveys conducted in Eastern Europe, Brandi (2003: 14) concludes that ‘the youngest and the most highly qualified are the workers with the highest propensity to emigrate’. Some have suggested that better opportunities for workers elsewhere in the EU may have a negative impact on the medium- and long-term development of Eastern European countries. Economist Jeremi Mordasewicz of the Polish Confederation of Private Employers is most concerned that migrants will fail to return:

I am afraid that young people, well educated with a great potential, may stay abroad for their whole life if they can't find a place in Poland, in for example the research and development departments in companies or in universities... They are people with ambition. If these people go abroad and stay there... it would be a disaster for our economy, for our companies (quoted in Easton 2004: 1).

These concerns about the continuing outflows of Eastern European scientists were borne out by scientists’ own experiences during the MOBEX2 fieldwork.

Ania, a Polish doctoral researcher in the UK speaks of her experience: 'When I was doing my MSc I think our supervisor had ten people and I think seven are abroad, which means only three people stayed in Poland'. Likewise Marta, a doctoral researcher in Poland, describes how many of her contemporaries went abroad to study without plans to return: 'From my experience when my friends finished their Masters degree about 50 per cent of them go abroad to do their PhD and they don't want to go back here'. Senior scientists, responsible for recruiting doctoral candidates, also report large outflows at doctoral level. Yulian, a Professor in a Bulgarian University, says that in his experience '80 per cent of PhD students here go abroad'.

Even where knowledge is still being reproduced (through the training of doctoral students) there is concern that their experience is poorer; not because they are weaker recruits, but because of the migration of the generation above them. Dessislava, a researcher in the Bulgarian Academy of Sciences explains:

Now there are no more good students because there are no more good teachers and my colleagues from the European countries and even the United States complained to me that, 'You know that since 2001 we cannot find any more people from Eastern European countries, what happened? Don't you have people willing to study science?' I told them we don't have professors any more.

This seems a particularly acute problem in Bulgaria where researchers often speak of a missing generation of researchers. As a result it has one of the largest proportions of ageing scientists in Europe—47 per cent of scientists and engineers were aged between 45 and 64 in 2004 compared to 39 per cent in Germany, 38 per cent in the UK and 32 per cent in Poland (Wilén 2006). This raises interesting questions regarding the sustainability of Eastern European science labour markets but, most importantly, it also suggests that to understand mobility it is important to consider the opportunities available to potential candidates in the home countries as well as the 'pull' factors abroad.

Worries about a current 'brain drain' of early career researchers, then, have several linked facets. A key question emerging from this anxiety is whether the scale of outbound mobility will remain high. We explore this by looking at the opportunities open to doctoral candidates from Poland and Bulgaria, reviewing mobility opportunities and the emphasis placed on mobility in science careers. Another important question is whether this mobility has a negative impact on scientific capacity in the home country. There is no straightforward answer to this. Our analysis below does, however, indicate that, despite a net loss of researchers, scientists do regularly return to Poland and Bulgaria for professional reasons and often maintain links there, even at early stages in their careers.

Mobility Motivations

Mobility between institutions, countries and to a lesser extent sectors has become the norm in science careers. Studies show that most mobility occurs during the formative years of a research career and is viewed positively in terms of personal and scientific development by researchers and their supervisors (Van

de Sande *et al.* 2005). Previous work has noted that mobility is becoming more important in science and is now an expected and integral part of a science career (Ackers 2005a, 2005b; Casey *et al.* 2001; European Universities Association 2005; Rothwell 2002). For some doctoral candidates the motivation to become mobile arose simply out of that expectation. In other words they became 'socialised to the idea of mobility' (Ferro 2006: 181). Many scientists such as Jerzy simply accept that mobility is part and parcel of science: 'so he [my supervisor] always told me that it's just [normal in a] scientific career [that] you have to go abroad to meet other people'. As well as being the norm in science generally, there are other motivations for Eastern European early career scientists to head west.

While the OECD identifies potential increases to earnings as one of the most important reasons why people migrate (OECD 2001a), the UK's Department for Trade and Industry (DTI) 'Knowledge Migrants' report (2002) listed additional major factors: adverse political, economic and social conditions, unemployment or perceived inadequate economic and intellectual returns as well as the desire to work with leaders in the chosen field. The number of vacant posts and meritocratic systems of recruitment have also been identified as pull factors which might encourage scientists to leave their home countries (Jałowicki and Gorzelak 2004). Literature on highly skilled mobility—and on scientists in particular—is often framed in terms of knowledge migration. Mahroum (1999: 7) describes scientists as 'pilgrims' migrating towards the best opportunities for science. In addition there is a so called in a 'global competition for talent' (OECD 2001b; Economist 2006) or a 'skills war' (Iredale 2001). The debates around scientific mobility seem focused on the idea that what drives scientists to move is the acquisition and transfer of knowledge and skills. However, as Ackers (2005a) has pointed out, the traditional dichotomies of knowledge migrants versus economic migrants, or even voluntary versus forced migration, are unhelpful when trying to understand scientific mobility. Rather, she argues, it is useful to think of a 'continuum of choice' (2005a: 104). Likewise, Dickinson (2003: 1) argues that 'many scientists leave their home countries not so much because of wages but rather to seek an environment in which they can work effectively with enthusiasm and support'. This section describes the professional migration motivations of doctoral candidates within this continuum of choice. We stress here that personal lives were equally as important in deciding when, where, and if, to move.

Viable Opportunities

In spite of the comparatively low number of graduates in science and engineering (Gotzfried 2005), Poland and Bulgaria award significant numbers of PhD degrees each year (Kwiek 2004; National Statistical Institute 2005). However, our respondents abroad point out that, for them, opportunities for doctoral studies were limited or not viable in their home countries. Marcin, for example, had to move because the field of physics he wanted to work in barely existed in Poland. Similarly Vanya, now based back in Bulgaria, explained why she went to the UK

during her doctorate: 'Here it's not possible to do really what I wanted to do within the subject on plant metabolism'. Marcin and Vanya had no possibility to pursue the work they wanted to do at PhD level at home. However, even where that is possible some researchers prefer to move in order to increase their chances of being able to continue their careers outside their home countries. In both Bulgaria and Poland the unemployment rate for science and technology graduates is slightly higher than the EU25 average of 3.5 per cent, whereas Germany is close to that average and the UK fares best with a rate of 1.8 per cent (Wilén 2006: 4). If, however, the 25 to 34 age group is considered, the difference between the home and host countries becomes more striking. With science and technology unemployment rates amongst that age group at 1.9 per cent and 2.8 per cent in the UK and Germany respectively, and 7.5 per cent and 5.6 per cent respectively in Poland and Bulgaria, it is not surprising that Marta suggests that 'when you finish your PhD studies here it is very hard to find a job in an institute...and it is very hard to stay in science here in Poland'.

[TABLE 2 ABOUT HERE]

Marta also alludes to the difficulty of making a living in science in Poland and our research shows that pay is, perhaps unsurprisingly, a motivation for moving. A comparison of typical scholarship levels (Table 2) demonstrates this. Considering the scholarship levels in conjunction with information in relation to the cost of living differentials, the difference in pay becomes clearer. According to the Mercer Human Resources Cost of Living Survey (Mercer Human Resources 2005), London is ranked the third most expensive city in the world and the most expensive in Europe. More surprisingly, perhaps, is that Warsaw is ranked 27th, before any of the German cities (Düsseldorf 32nd, Munich 37th and Berlin 38th). Sofia is ranked 81st. The financial difficulty faced by doctoral candidates becomes even clearer when considering the costs of some basic expenses, as described by Vanya:

Doing science in Bulgaria is a luxury. You have to have the right background otherwise its very difficult. Rent can be 150 Euro [per month] just for the apartment, small rooms. When you pay the electricity, the internet etc add another 150 Euro.

Our respondents highlighted that the pay they received made it possible for them to undertake a PhD, whereas the financial situation in their home countries would have made it impossible. It seems that, at this relatively junior level, it is not so much the ability to command a greater salary or scholarship, but the fact that the money normally paid to PhD candidates in Germany and the UK as a matter of course is enough to live on, and this is attractive to Polish and Bulgarian scientists. Others are motivated to move by the medium- or long-term prospects in their home countries, where poor pay was again a deterrent to staying.

Science Funding, Working Effectively and Excellence

When discussing the question of salary and pay, scientists at all levels conflate the issue of pay for themselves and science funding in general:

Neither the level of the necessary scientific equipment, nor the available library information make it possible to carry out any meaningful research, if one relies on national sources in Bulgaria. The Bulgarian salaries of young scientists in higher education and research cannot attract any gifted and bright students. The only motivation to stay in science is mobility, the contacts with devoted researchers from abroad and with modern equipment as well as the prospect of some better payment in terms of fellowships during scientific visits (Professor, Bulgarian Academy of Sciences).

Given the decline of science funding in Bulgaria and Poland mentioned earlier, it is perhaps obvious that large and expensive equipment is not available in those countries and that when equipment does exist it is often very dated and shared by many more scientists than it has capacity for. According to Kalina, 'the problem is really that the conditions for work are not that good and nowadays we don't get new machines and old machines, of course, are already too old'. However, it is not just the lack of large, expensive machines that is the problem. Much more basic things such as glassware and access to chemicals can prove equally problematic. It is perhaps in this area where there are the most marked differences between the Bulgarian and the Polish contexts. Many of our Polish respondents have indicated that good science can be done in Poland; it will just take longer. Comments such as this one from Lech: 'We have every kind of equipment [in Poland] but not so many like here [in Germany] so you can learn everything but not so fast as here', were typical from Polish respondents. However, our work with Bulgarian scientists in the host countries as well as in Bulgaria highlights a more limited infrastructure. When conducting interviews in Bulgaria, for example, we experienced a power failure in one of the institutions and were told that it was common for this to happen, effectively making any kind of experimental scientific work impossible. Todorka explains why doctoral candidates seek positions abroad and stay abroad: 'They don't want to [return] because there are such poor conditions for work. It is not only salary, it is equipment, chemicals, they are so expensive'.

Scientists are clearly attracted to places where the conditions allow them to work effectively. They are also keen to work at the forefront of their field, with the newest and best equipment, and with the leading researchers in that subject. Scientists working in Poland and Bulgaria clearly recognise the embedded culture of international collaboration in science:

Nearly 90 per cent of my publications are carried out in collaboration with scientists whom I met and interacted with during stays abroad. The same applies to international citations of my scientific articles—90 per cent refer to joint publications with European scientists (Professor, Bulgarian Academy of Science).

The quote also alludes to the question of whether being part of such collaborations and building the necessary networks are easier to do abroad than in Bulgaria or Poland. Most of the PhD candidates we interviewed wanted to continue with a career in science research and many of them recognise the

benefits of working with those who are at the forefront of the discipline, as Ivan explains: 'For me it is very important to be in a good group, to have a good PhD thesis and just to be competitive'. Other research has also concluded that prestige is a particularly important factor in shaping mobility and location decisions of the highly skilled (Mahroum 1999, 2000; Meyer 2001; Tremblay 2002; Williams *et al.* 2004).

Mahroum (2000) talks about scientists moving to gain access to 'scholarly power'. This may refer to a high-quality research environment as a whole but it may also apply to individual professors or groups. The following quote highlights how attractive an individual or group can be, not only in terms of their reputation and prestige, but also in terms of the support they can offer potential PhD candidates:

I didn't look for a place to go abroad. I was sort of thrilled and honoured to work with this particular professor in this particular area...And I also had very powerful support from him...he was my referee (Irina).

Our work accords with other research (Department of Trade and Industry 2002; Millard 2005; Puustinen-Hopper 2005) that suggests that the reasons highly skilled workers leave their home country are mainly career-related and that the most critical mobility motivations are the availability of a high level of research environment and career development. As Beata, a female Polish PhD candidate in Germany, notes: 'I think now for me the hardest thing when I would like to work in Poland would not be getting paid not enough but being limited in the research outlet'. However, motivations are not always career-related—that is, finding the best place to work effectively or to learn new skills and disseminate knowledge—but are often presented in much more pragmatic terms of actually being able to follow a chosen career path and make a living.

What are the Alternatives to Doing a PhD Abroad?

It is impossible to second-guess what might have been had the scientists in question not moved abroad, but there are some indications of possible alternatives to scientific mobility in our data. There are, of course, researchers who complete their entire doctorate in the home country. For those PhD candidates whose field of specialism does not exist in the home country, they may instead choose to stay and work, often in a different field. Potential PhD candidates also have to consider carefully whether they can afford to do a doctorate in their home country. Some will decide that they can, perhaps by working alongside in an unrelated job or by relying on partners or family to help. Others, however, will decide that they have to leave science because a scientific career is not viable for them. This creates what has been termed a 'brain waste' (Iredale 1999) or 'internal brain drain' (Sretenova 2003).

Our research, however, revealed another alternative: there were a number of respondents who were registered for their doctorate in their home country but spent a significant amount of time in Germany or the UK. Within our sample of 31

who were doctoral candidates at the time of interview, two-thirds were completing the full doctorate outside of their home country. The remaining third were spending between three months and three years in Germany or the UK while continuing to be registered for their doctorates at home. In one case the respondent spent the entire duration of their PhD in Germany and only returned to Bulgaria to complete the writing-up. In other instances, supervisors have no choice but to try and find places for their doctoral candidates to conduct experiments abroad, as Yulian describes:

In our system usually the student spends the three years here. Maybe you know at this moment scientific equipment is old. We have no possibilities to make science on a higher level and we use our contacts abroad for our PhD students spending some months or years abroad to make experiments.

Sending doctoral candidates abroad is not unusual here and this allows them to gain valuable experience and learn new skills and techniques. It also gives them the opportunity to take advantage of better equipment and facilities and can thus ultimately benefit the research group or supervising scientists in the home country. Again this indicates that the registration or overseas visit of a doctoral candidate does not constitute a straightforward 'loss' to the country of origin.

Location Decisions and Policy Contexts

While it is apparent that many Polish and Bulgarian scientists feel that they might have better opportunities abroad, a whole host of factors can influence the choice of destination: available employment, previous experience of the country, language compatibility, and knowledge of job and career availability (Department of Trade and Industry 2002). However, some of our respondents had not considered leaving their home country until an opportunity to go abroad presented itself. In those cases it is almost impossible to separate the decision to move from the decision where to move. Even where our respondents had considered leaving or even had firm plans to leave their home country to do a PhD, 'it might be a mere chance that decides which country the individual will move to' (Puustinen-Hopper 2005: 19). Despite this chance element, our data clearly suggest that personal contacts play a central role in the recruitment of researchers and PhD students. In her study of Italian PhD candidates who spent a period of time abroad, Avveduto (2001) conceptualises the choice of destination as fixed by two parameters: the type of research; and the PhD candidate's networks—what Stalker (2000) calls 'human chains'. In line with Avveduto (2001), the majority of our respondents relied on a proven track record of collaboration and joint research or formal programmes to facilitate their mobility. In fact, as studies by Ackers (2001) and King and Ruiz-Gelices (2003) have found previously, a significant proportion of our respondents had some experience of their host country during their first degree and either stayed on or returned for their PhDs. Student mobility schemes allow students to spend some time abroad and experience the study and research culture in another country. As Georgi explains:

For these five months you really see how much work you can do in a lab, and you have the possibility because you have the money for supplies in the lab and to buy basic things...things which we do for several days you could do for one afternoon in Holland and this had a lot of impact when you see what is different.

Moreover, a stint abroad at undergraduate level indicates a certain level of employability (UK Socrates–Erasmus Council 2005), which supervisors look for in their doctoral candidates and which continues to be an asset throughout the career trajectory. In the words of Roman, ‘studying abroad is very prestigious’.

In the context of globalisation and the increasing internationalisation of academic and science labour markets, formalised channels of mobility—such as student mobility programmes—are gaining in importance and it is ever more vital to present the opportunities available to foreign researchers as attractively as possible in order to keep pace with other European countries and the US. The interview with Beata highlights some differences between Germany and the UK:

I started to look only a few months before my Masters abroad. I first actually looked in the UK because I knew English and I didn't know any German... It was already too late to apply. ...For people outside the EU the price is much higher so you have to find somebody who will fund your studies and someone who will give you some money to live with. I found an offer of this international PhD programme in Göttingen which was still open for application. [Interviewer: How did you find out about that?] Actually there were posters in our Institute, they sent round emails and posters and flyers and tried to promote it in different places. ...in most German universities they have some kind of international Masters or PhD programme.

Even though Britain has the advantage of language in this particular case, and the respondent actually initially searched for a position there, she still opted for Germany in the end. As part of an ‘aggressive shift’ in policy (Lowell 2003: 2), many European countries now offer study programmes in English to make themselves more attractive to foreign researchers (Hilgendorf 2005). Beata's account also highlights the importance of marketing and promoting mobility schemes as well as making the application procedure as easy as possible (in terms of process, not in relation to quality). Germany has been proactive in both these areas. The German Academic Exchange Service (DAAD) website functions as a portal for students and researchers wanting to come to Germany,³ and the German Research Foundation (DFG) and Alexander von Humboldt Foundation have equally informative websites.⁴ In addition the German government tries to promote Germany as an attractive destination country for researchers through a number of websites.⁵ Funding opportunities in Germany also seem to be well advertised abroad, as Beata points out. Our fieldwork showed evidence that there were many more posters in institutions in Poland and Bulgaria advertising opportunities in Germany than the UK.

Tuition fees remain very influential in decisions regarding doctoral studies. While in Germany doctoral studies have been free and look to remain free even where tuition fees have been introduced at lower level,⁶ the UK charges significant fees for doctoral studies.⁷ As Tzonka puts it, ‘people don't come to the UK because of the fees, students I mean’. The issue of tuition fees and the

difficulties in funding doctoral research in the UK may also explain why we were able to locate far more Polish and Bulgarian doctoral candidates in Germany than in the UK. With Poland's accession to the EU, there has been a significant change in their status and the fees expected by UK universities have dropped dramatically from around £10,000 per year (for 'overseas' students) to around £3,000 per year (for home/EU students). In addition, the regulations concerning payment of maintenance grants to non-UK nationals also changed to EU nationals' advantage following the case of *Bidar*, that enforced equal treatment of EU nationals.⁸ For our respondents, this ruling came into force too late to have any kind of impact, but there are several instances of universities being flexible and waving fees to allow doctoral candidates to register at a UK university. In Germany, the majority of doctoral candidates was employed on part-time positions within a research group and were thus able to support themselves while focusing on their research. Having the status of 'worker' as opposed to 'student' was seen as particularly attractive by our respondents. Sylwia, in the context of comparing Germany to the US, stated: 'I think also the difference is that if you are here [in Germany] doing a PhD you are treated as independent and as a worker whereas in the US you are treated like a student'. The same argument would apply to many institutions in the UK.

In addition to formal mobility programmes there are, of course, a whole host of international projects in all areas of science.⁹ Many of these projects have linked doctoral positions and for those candidates working within one of these projects it is not unusual to be given the opportunity to spend some time abroad in the partner institution. The role of networks in this process is readily apparent in situations where supervisors send their doctoral candidates abroad, but the links can also be much more complex. The benefits of having a well-connected supervisor are often not as direct as the supervisor being able to match the doctoral candidate with available positions. This becomes clear when considering Lucjan's story. We asked Lucjan where he heard about his position in the UK: 'It was my former supervisor [from Poland] who started in England... one year before I graduated ... We collaborated ... I came to Cambridge for holidays twice'. He goes on to explain that, although the link was there, getting a position was not so easy: 'No he didn't offer me a position, because obviously nobody has got the money but after the two visits I presented some work and basically I was told to apply for a grant'. Our data suggest that in some cases the existing links between established scientists lead to requests for PhD candidates. In Michal's case his supervisor at undergraduate level had links with a UK university and suggested that Michal should do his doctorate there. He explains: 'my supervisor had spent some time in [the UK] and sent him an email to see if he had any students interested in applying'. Similarly Roman was recruited for a doctorate at another UK institution with which his old supervisor had a link:

Actually the professor [from the UK] came to my University and asked for one person, my university chose me. I had an interview with this professor and he decided to give me this PhD... My old supervisor told me about the UK opportunity.

However, it is not always the case that mobility is precipitated by a supervisor or his or her networks. The PhD candidate's own networks can be equally influential. Krystof went to France on a joint degree programme and was given a business card of his supervisor's research contact in the UK. While that initial contact was facilitated by the supervisor in France, Krystof later maintained links with that contact himself and eventually successfully applied for funding to work with her. This type of recruitment, which is primarily based on previous collaboration and personal acquaintance, is in contrast to more general labour migration from Eastern European countries where workers are likely to move through formal channels such as employment agencies (Currie 2006; Ward *et al.* 2005).

Returns

The mobility of doctoral candidates is inextricably linked to the question of return. Would concerns about 'brain drain' be so grave if it was found that circulation—at the very least in the form of returns—is taking place? As scientists move through networks, does this also shape returns? Within our sample, 64 per cent of the interviewees in Germany and 45 per cent in the UK had made repeated moves with return/s. Of the four doctoral candidates in the UK, none had yet returned. Out of the 20 doctoral candidates or equivalent in Germany, 12 had already made repeat moves with returns, seven had made a single outbound move and one was a repeat mover who had not returned to their country of origin so far. The returns in question were often necessitated by a pre-existing commitment to complete studies undertaken in the home country (this includes undergraduate and postgraduate studies); these were often followed by a subsequent move to undertake either further studies abroad or employment (that is, later moves often to the same hosts).

Although we have established that the long-term pattern for these scientists is likely to be ongoing mobility (including to and from the country of origin), the early career researchers interviewed for the study often did not know what they would do after they completed their doctorate. Commonly they said they would look for the best opportunity available to them. Kalina was just finishing her doctoral studies and expressed some discontent with her life in Germany: 'I cannot say that I don't like the life here but somehow my social life is not the same as in Bulgaria'. Nevertheless, she was planning to apply for post-doctoral positions to remain abroad, as her impression of working conditions in Bulgaria put her off returning: 'I would like to go [to Bulgaria] of course but when I talk to my friends who are there who work as physicists there the position is not good and they don't get good conditions to work, not at all'. Returns are generally not ruled out by early career migrants but are being 'put on ice' with the hope that scientific conditions will improve by the time they have completed a post-doctoral position or two. A minority are laying plans to return immediately after their doctorate abroad, such as Ludwika who plans to return to work in Poland and sees greater long-term career opportunities for her and her EU national husband there: 'I think it's our subject—waste management—there's much more to do in Poland'.

It is evident therefore that scientists, particularly those who have already been mobile, are weighing up their career opportunities by comparing countries, socio-economic and scientific conditions. In this context no country can afford to be complacent about a steady supply of talent. Increased mobility, greater opportunities to move and returns do make the possible losses and gains brought about by mobility less cut and dried.

Conclusions

It is evident that large numbers of scientists have already left Poland and Bulgaria and continue to do so. Our findings indicate that the professional motivations expressed by Eastern European doctoral candidates echo those of migrant researchers from elsewhere (Department of Trade and Industry 2002; Van de Sande *et al.* 2005). Socio-economic factors and labour market characteristics in sending and host countries do indeed have a bearing on researchers' mobility. Yet, mobility within this group was not found to be economically driven in the 'traditional' notion of moving to earn more (although this could influence moves). Rather it was science expenditure that more broadly influenced moves, for example through the number of positions available and their attractiveness (e.g. infrastructure, equipment and expediency in the working environment). Furthermore the prestige and 'capital' of the host supervisor, group or institution were all magnets alongside available infrastructure. Germany was found to be more proactive in the recruitment of Eastern Europeans and this, coupled with the fact that no tuition fees were charged in Germany, had influenced a lot of the doctoral candidates to go there. Nonetheless, deciding to do all or part of a doctorate abroad often comes down to a chance opportunity or 'being in the right place at the right time'. Often, it was a supervisor in Bulgaria or Poland who informed students about opportunities abroad, rather than the students finding these themselves. Contacts not only influence when and where mobility might take place but also act in their own right as a motivational force in order for researchers to establish their own networks abroad (something often felt to be helpful in establishing a science career). Bulgaria and Poland face strong criticism about continuing under-investment in research and development from their science communities—a situation that is driving doctoral candidates to leave the country to undertake science careers.

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Notes

- [1] The Czech Republic, Estonia, Hungary, Latvia, Lithuania, Slovenia, Slovakia, Poland became EU member states in 2004. Bulgaria and Romania became the latest EU member-states in 2007.
- [2] The MOBEX2 project 'Mobility and Excellence in the European Research Area: Promoting Balanced Growth in an Enlarging Europe'; see www.liverpool.ac.uk/law/elprg/
- [3] See <www.daad.de>
- [4] See <www.dfg.de> and <www.avh.de>
- [5] See <www.campus-germany.de>, <www.young-germany.de> and <research-in-germany.de>
- [6] See <<http://www.studis-online.de/StudInfo/Gebuehren/index.php>>
- [7] Science postgraduate degree fees are currently listed as being between £6,500 and £9,950 for international students. See www.prospects.ac.uk
- [8] Case C-209/03 Bidar v London Borough of Ealing.
- [9] Annual reports of research institutes and funding bodies indicate the high level of international co-operation in both Germany and the UK.

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