The global competition for talent: Life science and biotech careers, international mobility, and competitiveness

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Publication date
2015

Document Version
Final published version

Citation for published version (APA):
Kuvik, A. N. (2015). *The global competition for talent: Life science and biotech careers, international mobility, and competitiveness.*

"The key factor of the global economy is no longer goods, services, or flows of capital but the competition for people. The ability to attract people is a dynamic and sensitive process. New centers of the global creative economy can emerge quickly; established players can lose position. It's a wide-open game, and the playing field is leveling every day." (Florida, 2005, p. 16)

As discussed in Chapter 1, some research in the past ten years or so has aimed to further integrate reasons for immigration in a more comparative context, as partially reflected in the work of Florida (2002; 2005). Florida's research discusses more broadly for the 'creative class,' living in large cities, but it is not clear if his findings apply to other contexts. Although his work brought attention to the importance of lifestyle factors for location choice, Florida focuses on 'place' as attracting the people and does not examine the career drivers linked with 'productivity' in my research framework. Yet, the premise is similar -- The complexity and patterns of international migration have changed with the expansion of destination choices beyond traditional immigration countries.

How much is really understood about scientists' preferences globally for where to move during their career? The last chapter highlighted the importance of international mobility in current life science careers, showing that it features in a large percentage of careers and is seen as valuable particularly for academic careers. This chapter examines two interrelated research questions: **Which factors are considered and influence life scientists' intentions to move or moves abroad? Which countries are attractive to life scientists and why?**

This chapter aims to integrate the findings of the CiLS study into an existing framework for assessing factors influencing decisions to move. While international movements cannot be said to be predictable, it is important to try to better understand what scientists say is influential to their decisions. This chapter first presents a framework on drivers of skilled mobility from Papademetriou, Somerville, & Tanaka (2008; 2009). Next, the following CiLS survey questions are analyzed:

- Q.97 Factors used in deciding where to move: How much would the following factors influence your choice of country to move to in the future? Please use a scale of 1-5 where a 1 means "not important at all" and a 5 means "extremely important"
- Q112/Q115 To what extent has each of the following influenced your decision(s) to move/ not to move (separate questions for movers and non-movers)
- Q.92 Which country would you be most interested in working in? (Drop-down menu of all countries)- First choice
- Q. 93 Why would this country be your first choice? (type in open-ended response)

Next, the framework presented earlier from Papademetriou et al. is modified with findings of the CiLS survey, to make it in line with the mobility of life scientists in particular. These changes also take into account the 4P analytical framework I explain in Chapter 3, integrating aspects related to people, place, productivity, and policy into

scientists' migration location choice.

It should be noted that the framework by to Papademetriou et al. was only found after the CiLS results had been collected and did not guide the survey's design. One point of departure for this analysis is that the starting point is the career in life sciences, and common factors among this career that impact destination choice are discussed. This is important, as many studies use the country of destination as a starting point. However, this may overstate the importance of factors that are found in that particular country. For instance, one assumption made is that skilled migrants gravitate to countries where English is the native language, such as the US, UK, and Australia, yet a large percentage of research on skilled migration has also been conducted in these countries. Second, countries differ in terms of their strengths in various fields of research or the extent of opportunities offered for different job roles. All of these aspects need to be integrated to better understand reasons for migration location choice.
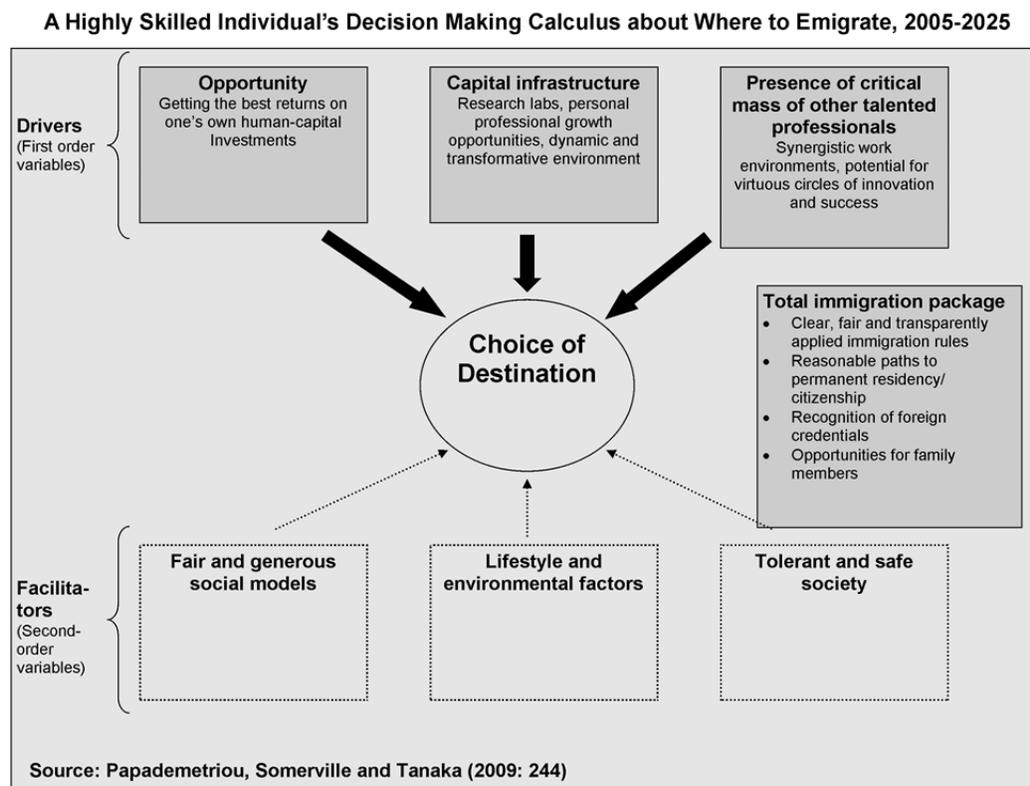
ASSESSING DECISIONS RELATED TO SKILLED AND SCIENTIFIC MOBILITY

In *Talent in the 21st-Century Economy,* Papademetriou et al. (2008; 2009) first summarize the work on skilled migration and competitiveness and then create a framework for looking at skilled migrants' decisions to move to various places. This research was found to be a good starting point for better understanding scientific mobility as well. Their framework is divided into a top row of drivers, which they consider to be "essential" when skilled migrants decide where to move (2009, p.243). The framework also has a bottom row of 'facilitators," which they say have an influence on the decision where to move, but "are not likely to determine the outcome." (p.243). In between the two levels are the policies, or rules and conditions, that also influence migration destination choice.

Papademetriou et al.'s (2009, pp. 242-253) framework for individual skilled migration decision-making (see Figure 14) is explained in brief here. These authors note that the primary drivers of skilled migration are both "mutually dependent and intentionally overlapping" (p.245) and include: 1) "the opportunity", defined as return on human capital investments already made 2) "capital infrastructure," which they define as "facilities that allow highly skilled immigrants to realize personal and professional goals." Their list of examples of capital infrastructure include research labs, strong universities for themselves or family members, clusters that allow entrepreneurs to bring innovations to market, and "such intangibles as dynamism—that is the crossroads where knowledge, creativity and transformation meet." 3) "presence of critical mass of other talented professionals" in their own and related fields to facilitate networking, development of new ideas and products, and to attract further talent. Papademetriou et al. (2009, p. 245) also list secondary factors, for which the importance will vary some depending on individual career and family situations, including "generous and fair social models" (which they feel apply especially to those with families or those who are interested in staying long-term); "lifestyle and environmental factors" (refers mostly to quality of life in a given location) and living in "safe and tolerant societies, where the acceptance of, and even respect for, diversity of language, ethnicity, race and cultural and religious practices – and a welcoming environment toward immigration – are part of the national narrative can be a very strong element of attraction, particularly given the growing intolerance of many societies" (p.246). They state that in this regard, countries

with a longer history and more regard for immigration historically, such as the US and Canada, Australia and New Zealand, have an advantage (p.246-247).

FIGURE 14 FRAMEWORK ON SKILLED MOBILITY DESTINATION CHOICE FROM PAPADEMETRIOU ET AL. (2009)

A Highly Skilled Individual's Decision Making Calculus about Where to Emigrate, 2005-2025

Source: Papademetriou, Somerville and Tanaka (2009: 244)

The overall migration decision in their framework is also considered to be influenced by migration policies, including opportunities for family members and long-term settlement (p.247-253). These are placed in the middle of the framework to show that they are "important enough to exert strong influence in the decision of a destination choice but not necessarily a determinant of it" (p.247). They identify four key elements, two which are linked directly to immigration rules, and two that instead relate to chances of economic success for both the immigrant and his or her family members. These can be considered to be structural factors. Much of the focus in their discussion is on policies revolves around the importance of allowing permanent residency, whether or not the immigrant decides to pursue a long-term option, and also clear paths to citizenship. They even anticipate that "as interest in the most talented immigrants intensifies, we believe that more and more countries will find that offering permanent status up front will be what is expected by the most sought-after would-be immigrants" (p.249). The first element related to potential for economic success is the recognition of education and other credentials. They also discuss debates around having fluency of the native language as a prerequisite for immigration. They suggest a better approach is to have programs that facilitate language acquisition, as some immigrants may not need to know the national language for their job, and possibilities of learning a new language may be attractive to certain immigrants. The final element that can make a country more attractive is allowing family reunification and giving family members the right to work. They explain "while spouses are often allowed to accompany an immigrant employee, many countries do not

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allow them to enter up front or have a long waiting periods before visas become available" (p. 253).

Papademetriou et al.'s framework was designed to address skilled migration on the whole, based on circumstances they thought would apply between the years 2005-2025. Furthermore, these authors analysis had an explicit focus to integrate the various perspectives needed to understand mobility, including the firms, governments and the individuals involved and for strategies for 'talent' for both developing and developed countries. Such a broad perspective has rarely been applied in skilled migration research and their work represents an excellent starting point for looking at various issues needed to understand recent changes and talent strategies. This framework is interesting as it can be applied across cities or countries and is therefore a good step in further understanding the global competition for talent; however, further modifications may be needed based on new empirical research, which takes an international perspective for specific economic sectors or with careers, rather than destination, as the key focus. Their framework was therefore found to be an excellent starting point and very applicable to scientific mobility, as it not only integrates aspects similar to technology, talent, and tolerance but also integrates the role of factors related to productivity, as well as immigration and social policies for skilled migration. The remainder of this chapter will use CiLS data on mobility decisions to discuss how Papademetriou et al. (2009) framework can be further modified to understand the mobility decision-making factors of life scientists, as a more specific form of skilled migration. It questions the extent to which the elements listed in their framework apply when looking at scientific jobs in particular. This modified framework can also help build understanding of skilled migration decision-making in the global, rather than national context.

Factors that influence life scientists' location choice abroad in the CiLS study

Respondents in the CiLS study were asked to rate the importance of various factors in their decision to move. In line with the other research on scientific mobility, the CiLS results (see Table 19) show that "equipment and possibilities for good scientific work" is seen as the most important (mean=4.51), along with "possibilities for career advancement" (mean=4.39) "quality of education" (mean=4.14), and "openness to foreigners" (mean=4.05). This list is reflective of the findings discussed on scientific mobility – that excellence for a given field of research and similarly good facilities and career opportunities – lead scientists' decisions on where to move. However, it is also interesting to note the relatively high importance given to openness to foreigners. This finding is in line with the research of Florida (2002, 2005), but to my knowledge has not been discussed within the context of scientific mobility. Papademetriou et al. (2009) list tolerance as a facilitator of mobility among the high-skilled, but the CiLS results suggest it is actually a core concern in decisions where to move.

Structural factors linked to the overall city or country and opportunities afforded by the country on the whole were given slightly lower levels of importance when ranked among total concerns, although most were still seen as being important (statements with median or mode of 4). It is important to keep in mind that an individual's life stage and family situation influence both on whether or not to move and on destination choice. "Possibilities for my partner (husband/wife/boyfriend/girlfriend) to work there as well"

was among the highest rated structural/ policy-related factor and is even higher when looking at those in a serious relationship or marriage. Individuals who listed themselves as single and not in a serious relationship had a mode of 4 on the importance of the partner being able to work abroad, whereas all other groups (single in a serious relationship, living with partner, and married) had a mode of 5. Among the individuals who have a partner with a career, only small difference are seen between career types (partner has life science career: mean=4.35; career not related to life sciences: mean=4.41; compared to currently does not have a career: mean= 3.95). The cost of childcare, as expected is also more important when looking at those who have children (mean=3.98) versus those who do not (mean=3.13). Childcare is not one of the top rated items, even among those with children, which may be an indication that it is an issue that is solved after moving, rather than a consideration beforehand.

Factors related to social networks (having friends and family in the country or business contacts in the country) and possibilities for entrepreneurship were among the lowest rated concerns. The lack of relevance could be due to some scientists aiming for an academic, rather than industry (business-based), science career, as the statement listed focuses on business contacts. However, it also suggests that the location's reputation, in terms of its excellence, is a bigger driver for people than having existing contacts in that location. A similar result was seen for ratings of possibilities to start one's own business; it is relevant for only a small group of scientists. Most scientists surveyed were not aiming to start their own company, but rather to work in research, and further analysis of the open-ended answers shows often in prestigious institutions (academic or companies), and therefore ratings on the importance of these factors are also among the lowest of all the factors mentioned when looking at the total CiLS survey ratings for these statements. This is in line with other research:

> But although biotechnology, genetic manipulation and bioinformatics have brought the life sciences to the forefront of industrial interests, empirical studies suggest that academic entrepreneurship and technology transfer, though immensely grown in status and achievement, are still a passion of the few, albeit a prestigious and influential few. (Morris & Rip, 2006, p. 260)

TABLE 19 FACTORS FOR DECIDING WHERE TO MOVE IN THE FUTURE

	N		Mean	Median	Mode
	Valid	N/A			
Equipment and possibilities for good scientific work (Q97equip)	586	8	4.51	5	5
Possibilities for career advancement (Q97career)	589	5	4.39	5	5
Quality of education (Q97education)	586	8	4.14	4	5
Openness to foreigners (Q97open)	583	11	4.05	4	4
Stable political situation (Q97politic)	582	12	3.88	4	4
Possibilities for my partner (husband/wife/boyfriend/girlfriend) to work there as well (Q97partner)	567	27	3.82	4	5
Better ratio between cost of living and	579	15	3.77	4	4

salary than in my current country (Q97salary)					
Can move to a city I really like (Q97city)	580	14	3.74	4	4
Ease of getting residence and/or work permits (Q97permit)	579	15	3.73	4	4
Strong economic situation (Q97economy)	584	10	3.72	4	4
Quality and price of housing (Q97house)	582	12	3.54	4	4
Knowing the local language well (Q97language)	581	13	3.49	4	4
Working hours (Q97hours)	584	10	3.31	3	3
Cost and quality of childcare (Q97child)	550	44	3.23	3	4
Familiar with the culture (Q97culture)	579	15	3.06	3	3
Having friends and/or family in the country of choice (Q97friendsfam)	586	8	2.98	3	3
Tax rates (Q97tax)	568	26	2.90	3	3
Having business contacts within the country (Q97contacts)	550	44	2.89	3	3
Possibilities for self-employment or starting my own business (Q97selfemp)	565	29	2.86	3	3
Place has the same religion as mine/where I come from (Q97religion)	563	31	1.87	1	1

One factor was seen as *unimportant* to life scientists – "Place has same religion as mine/where I come from". This factor was asked in part to better gauge feelings of openness. It is possible that religion itself is not seen as a relevant factor, or another interpretation would be that scientists are more concerned about how open and accepting others are to them and particularly their work, and not on ascribed religious or cultural differences.

Influence on decisions to move versus not to move

The CiLS respondents also asked separate questions for people who have moved versus those who have not, to assess how various elements influenced their decisions (Table 20). Statements were asked related to opportunities, relationships, and work permits. This list is not exhaustive, but gives some indication of how strongly people felt various aspects influence their decisions.

Both movers and non-movers stated that they were more influenced by whether or not they had a specific offer for work or study and the economic/work opportunities, rather than the other factors, which mostly had a median of 2. It is important to note that the country of citizenship does have an influence on the relative importance of work permits, with individuals from developing countries rating this as a more important factor than those from European countries. This will be discussed in more detail later in this study, when differences in the opportunity structure are addressed. There is a large difference seen in the importance of the relationship with partner, as it depends on the individual's relationship status, but among those in long-term relationships it generally has a strong impact on mobility decisions. The same can be true of relationships with other family

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member. However, while for some people family is an important consideration, many others feel it is not influential:

TABLE 20 INFLUENCE ON DECISIONS TO MOVE/NOT TO MOVE

Scores (5=strongly; 4=slightly; 3=somewhat; 2=not very much; 1=not at all)

	Movers			Non-movers		
	Mean	Median	Mode	Mean	Median	Mode
Specific offer for job or study (movers)/ Have not had a specific, attractive job offer or offer to study at specific university/institute (non-movers)	4.28	5	5	3.56	4	5
Economic/work opportunities	3.58	4	5	3.37	4	5
Work permits	2.54	2	1	2.61	2	1
Relationship with partner	2.39	2	5	2.67	3	1
Brothers/sisters/parents	2.12	2	1	2.92	2	3
Friends	2.34	2	1	2.64	2	3

I never had the money or a good opportunity yet to spend about one year abroad, but I think about doing my Master degree abroad. It's very important to me, that the partner could live in the same country, if you stay there longer. Family is not that important, because I consider it okay, seeing them twice a year and I think that would be possible. (Female, 20, Germany)

In the open-ended responses on why individuals had not moved, 5 main reasons were given.

- Family reasons, typically due to spouse's career, child raising, or needing to care for other family members, such as parents:

I got married early and I didn't want to leave my husband for example 3-4 years to make a PhD abroad. My husband is also a scientist. And it is not easy to find a place for two people in one place/city. (Female, 28, Poland)

It's simple; I have friends and family here. Especially my boyfriend has a very good job and a sure future... and jobs in life science are most often just for 2 years. (Female, 26, Germany)

My father was rather ill and I felt that I could not move myself abroad until solving my family problems. (Male, 28, Spain)

- There is a lack of interest in moving/happy in current job, city, etc.

I have an attractive job in a research institute. I love my city, Barcelona. (Male, 33, Spain)

The most important issue are work opportunities - if there is nothing more attractive than in my country then there's no point in moving internationally. (Female, 21, Poland)

My primary decisions have been motivated by excellent opportunities in the community I grew up in. There has been active fostering of bioscience here that has allowed me to settle within minutes of the home I grew up in. This allows my children to have constant access to their grandparents, which enriches their lives greatly (both children and grandparents!). While I would have taken a postdoc abroad if I was single, my wife was not interested in such opportunities. (Male, 34, US)

- Assumed to be better/ plan to go abroad at a later stage

Working in the field of cancer research has been my childhood dream and definitely going abroad for me has also been one of my priorities. (Female, 35, India)

I preferred to finish my education till PhD degree and after have an international experience. (Female, 34, Switzerland)

- No response to efforts to apply for positions abroad

I would like to do my PhD studies abroad, but for the past 2 years I have not worked in the field related to life science due to my family situation since Science did not provide enough money to feed my family. I'm very much interested to do my Doctoral studies in abroad but since I do not have research experience, my application always gets rejected in United States and Canada. But my aspiration is to do PhD. If really given an opportunity surely I'll prove myself and become a great scientist. (Female, 24, India)

- Lack of resources, whether financial or related to information, was commonly cited in the open-ended answers. Lack of resources and information is most commonly mentioned as a barrier why one did not pursue studies abroad, but it also applies to job offers. The concerns about resources were found both among people from developed as well as developing countries:

My university section was shitty when it came to studying abroad. They were not helping at all. On the contrary, they were not qualified and/or willing to help. (Male, 24, Switzerland)

I am from a rural area of India. So advanced knowledge about opportunities are not reaching me in time. I had come to know about international opportunities only after my postgraduation. If I know it early, I could try for it effectively. (Male, 24, India)

CILS SURVEY RESULTS: WHICH COUNTRIES GLOBALLY WOULD LIFE SCIENTIST LIKE TO WORK IN?

Following this discussion about *what* influences scientific mobility in general, is discussion of *where* scientists would most like to work and what s influences the preference for one destination over another. The CiLS survey asked for respondents to name their first choice country for work from a drop-down list of all countries and then state why that country would be their first choice. The CiLS data presented needs to be interpreted with caution. As explained in the methodology chapter, not all countries are represented equally so there may be a bias in this regards. It should also be pointed out that the CiLS survey was conducted in English, which again likely influences which countries have higher numbers of respondents. Instead of using the CiLS data to decide a

strict rank order of places, it is instead used to assess more generally what is considered and possible strengths and weaknesses in the attractiveness of various countries for life science careers. Table 21 lists countries by number of respondents saying it is their first choice and shows the percentage of citizens within first choice as compared to the number from outside of Europe. The United States is most popular destination, but only marginally, named as first choice by 18% of all respondents. This shows that while the US is a leader in attracting life scientists, it is far from a situation where the majority of life scientists have a preference to work in the US. Germany, Switzerland, and the UK also are among the countries most often named as first choice in the CiLS survey.

The percentage of citizens in Table 21 is instructive as it point out where there is a skew to nationals, versus EU or international migration. The percentage born in developing countries also suggests whether or not the destination country has broad international appeal. The most popular destinations -- the US, UK, Switzerland and Germany -- received a significant proportion of endorsements from people of other nationalities; whereas the *majority* of respondents naming Spain are Spanish citizens, followed by other EU nationals. The results for Spain are in line with what is shown in the migration literature, which shows that Spain has lower rates of international migration.

TABLE 21 TOP 5 'FIRST CHOICE' DESTINATIONS FOR LIFE SCIENTISTS: BY CITIZENSHIP

	First Choice-Counts *% of total responses*	% of first choice made up of citizens (to see if potential skew)	% with citizenship from other country in EU, EFTA or Switzerland	% citizens of developing countries and India
United States	**109** **18%**	6.4%	38.5%	47.7%
Germany	**96** 16%	32.0%	19.6%	47.4%
Switzerland	**78** 13%	30.8%	47.4%	23.1%
United Kingdom	**66** **11%**	10.6%	47.0%	36.3%
Spain	**32** 5%	57.6%	36.3%	6%
% of First choice responses captured in top 5 countries	**64%**			

It is also important to acknowledge that there are fewer UK nationals and foreign individuals living in the UK in the CiLS sample than the respective numbers for Germany or Switzerland. This means that the ratings for the UK may be a bit lower than what would truly occur if sampling was based on the most competitive life science locations, as has been done in other research which shows the UK as one of the top destinations.

Why would this country be your first choice?

One other way to look at why life scientists move is to look at what attracts them to various destinations, the pull factors. It is conceivable that the list of factors presented to respondents in Q97 may not reflect all the aspects considered important by life scientists.

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Furthermore, decisions about where to go need to be understood within the context, that is where does the individual hope to move? The analysis of the answer to an open-ended question, "Why would this country be your first choice?," which follows after they select the destinations they would be most interested in moving to is therefore also instructive for understanding the factors considered when making mobility decisions. This section will add to the discussion given so far by showing reasons which are top-of-mind, or unprompted. This open-ended question (Q93) was asked before the list of factors (Q97), and therefore would not have influenced their responses. It was felt to be important to ask people to name what attracts them without providing a list of reasons, as a certain destination could have a unique factor drawing individuals to it, and to check if lists at other questions were complete, as this is exploratory research. The open-ends were coded through open coding, that is categories were made as the responses were read.

Table 22 summarizes the factors mentioned spontaneously by life scientists on why a certain destination would be their first choice, regardless the country was named. The groupings were done at a later stage, and placed within the categories defined in the modified framework (Figure 15). In line with the discussion by Papademetriou et al. (2009), there is often considerable overlap for the factors mentioned in their model, particularly in regards to those related to research excellence and those related to work opportunities. These were coded separately, but given the subjective nature, a net was made that combines the codes as well, listed as "career drivers," and were mentioned by 343 respondents or 57.7% of the total. The non-career based factors, were defined as drivers related to quality of life issues and the ease of adjusting. High numbers of respondents also name these as important, with 305 CiLS respondents (51.3%) naming a reason within this broader category.

The reasons given for why a certain country is their first choice indicate that 'productivity' plays a key role. Most responses are centered on the excellent research departments or facilities, funding, career opportunities, and scientific environment, in line with other literature on scientific mobility. For instance, a 40 year old, female, German citizen living in Germany who has previously completed two post-docs in France, feels that the US '*still (has) best conditions to do basic research and to move up the career ladder; Easier to obtain grant money; Better networks*' and a 27 year old female Chinese citizen living in the United Kingdom chose the United States as first choice because there are '*a lot of biopharmaceutical companies, big investment in life science projects.*' In line with this career focus, countries in Europe with the largest life science sectors also emerge as places of interest for future work, particularly the UK, Switzerland, and Germany. However, new destinations are also appearing based on perceived opportunities. Although Spain is not considered one of the tope countries globally in the life sciences or biotechnology, some people are drawn to Spain given its growth, and the innovative environment that results. This is an important observation, that it is not only the strongest countries that are attractive, but also those that are seen as up-and-coming. For instance, Spain is attractive to some due to its 'emerging' scientific industry, which affords new opportunities, coupled with the other lifestyle elements it offers. A 26 year old male, Italian who has previously worked in US as research technician, named Spain as his top choice because '*It's in Europe. It is growing, young and innovative under many different aspects. Lifestyle and climate are definitely things that fit me.*' Given the importance of research excellence in location choice, Appendix E provides additional

examples of reasons given for the top countries selected to be the scientist's first choice: US, Germany, Switzerland, UK, and Spain.

One of the most mentioned lines of reasoning for choosing a certain country, other than career and productivity based reasons, was coded as the "ease of adjustment or familiarity." A very small number of individuals seek out moves to places that are as dramatically different from their own country as possible either due to interest or feeling it would broaden their perspective: For example: *I am interested in living in China because the culture is totally different, but not for that long* (24 year old German male). The majority of people wish to move to a country where they expect to adjust more easily. One of the aspects that helps the ease of adjustment is the proximity and access to one's home country. While, the United States is still the top destination globally, many Europeans state a preference to stay in Europe. Another important aspect is having previous experience in that country or knowing about the experience of others who have been there. Already having family and friends in the area is a facilitator for some individuals, although the closed-ended questions show it usually is not a primary driver among life scientists.

Language issues are one of the most named reasons that a country is selected, and can also be considered an aspect of the ease of adjustment. The interest in learning new languages was also found to be one of the most important reasons for intra-EU mobility in other research (EUROFOUND, 2006). Living and working in an environment where one's native language or English is spoken is one of the key advantages for countries such as the United States and United Kingdom. Places where English is not the main language can also be attractive due to the opportunity to improve other language skills, combined with the draw of scientific opportunities. A 41 year old from and living in Turkey after obtaining his PhD in the US says he would be interested in moving to Spain because '*I would like to learn a second foreign language and Spanish is going to be a dominant language in coming years in Europe and the rest of the world. Also, life science research of Spain speeds up and very active science and technologies are developed in Spain.*' A 28 year old Indian citizen living in South Korea names Germany as most attractive because '*There are many universities and research institutes doing highly advanced research in the field of Biotechnology. Secondly, I know well about culture of Germany and I did four months classes in India to learn German language...*' These statements act as anecdotal evidence of the increasing pull of 'new' skilled migration destinations based on a combination of changing competitive advantages in the career field and language differences are not always seen as a barrier to moving, but sometimes as an opportunity to improve skills, including language skills. Nonetheless, enthusiasm for being in an environment with a foreign language can wane. A female scientist, 32 years old, from India and living in Germany says she would like to work in the US: *Since I am more or less an English native speaker, I prefer my working language to be English. In Germany the science is fantastic, but there are times I would have been happy, if I knew German like my mother tongue.*

TABLE 22 REASONS COUNTRY IS FIRST CHOICE

Q93 Why would this country be your first choice?	# of people: 594
CAREER DRIVERS	**343**
Research or scientific excellence (net)	**240**
Research or scientific excellence	146
Funding	40
Leader / Strong in life sciences or biotech	58
Access to equipment and technology	21
Excellence for specific field of research/ particular institute	20
Good reputation (General)	11
Strong policies for life sciences/policy support	6
Good policies/place for international students	3
Opportunities (net)	**116**
Many opportunities (general)	33
Career opportunities	46
Salary/High pay in this country/Reward scientific work	36
Developing/Growing place/life science market/or specific field	16
Science skills development	6
Received scholarship	1
Critical mass of talented professionals (net)	**62**
Work culture/ethic/work conditions	50
Good scientists/scientific community/networks	14
QUALITY OF LIFE/ LIFESTYLE DRIVERS	**305**
Ease of adjusting/Familiarity (net)	**219**
Language (subnet)	78
English as main language/ widely spoken here	39
Build or improve language skills	19
Family and friends	69
Like the country	39
Have experience with or work experience in the country	37
Proximity to home country/Family (other than home country)	30
Living Standard/Quality of Life (net)	**82**
Quality of life/Living standard	63
Political reasons/social political rights/equal opportunities	11
Social services and benefits including healthcare/childcare	10
Peaceful/ quiet place/Low Crime/Safe	11
Lifestyle, cultural and environmental (net)	**76**
Like culture/experience new culture	36
Like the people there	18
Landscape and weather	22
Lifestyle	10
Tolerant Society (net)	**27**
Diversity/International Environment	27
Home country/already live here	**123**
Make positive contribution to own country	11
Other	
No real location preference/consider various countries	21
Prefer short trips instead of moving	4
Did not provide an answer	21

Very few individuals mention specific policies when choosing a destination; however many base decisions on the competitiveness (status as a leader) in life sciences or biotechnology, or their specific field, which can be influenced in part by policy. For instance, a 27 year old, Belgian citizen named Germany as the top choice because, "*Apparently very good science policy. Competent people are leading. (Germany is) the leading country in many aspects of society.*" Immigration policy was not be frequently known or noted by scientists, and science policy may have a more discernable effect, due to the visibility of cutting-edge research as well scientists seeking out information about available funding. Scientific funding is closely tied to the institutional context (Hackett, 1987; Laudel, 2006), and is one area where governments and universities have the potential to create a strategy that differs them from other places, whether the funding is for student degree programs or advanced research projects.

One other commonly named reason that features in the interest of where to move among some life scientists is the perceptions of being diverse, international, or multicultural societies, and this is often named in combination with career or productivity related reasons. In this regard, the Anglo-Saxon countries, traditional countries of immigration, have an advantage as was also described by Papademetriou et al (ibid). For instance a 24 year old female who is a citizen and living in Italy wants to go to the UK '*because in the UK there is a multicultural environment that allows the comparison and exchange of knowledge.*' A 26 year old Italian female, states "*In my opinion United Kingdom, and especially London, offers a wide range of opportunity in science/biotechnology field being an international and multi-cultural reality.*" A 28 year old male from and living in India names the US as his first choice, '*Because of its diversity, language, living standard, quality of research work, international recognition and good salary.*' Some other countries also have this advantage, for instance Singapore: A 31 year old Malaysian woman names Singapore due to its "*good funding opportunity/career advancement opportunity multi-cultural research environment near to home country.*" Diversity can also feature as a reason people want to stay in their home country, as a 28 year old Swiss citizen names Switzerland as his top choice due to "*Quality of life, Political rights, Density of population, diversity.*"

Furthermore, broader reasons for place attractiveness also feature, including perceptions of the characteristics of the culture, weather or lifestyle. While research on the creative class (Florida, 2002; 2005) has assumed that 'talent' is most drawn to cities, it cannot be expected that all prefer a fast-paced, large urban atmosphere. A 28 year old German citizen who currently lives in Switzerland says the country remains her first choice because of '*Nice landscape (hiking, swimming, close to sea), nice people, international, high living standard, and high salary*'.

More analysis on differences between the opportunity structures in various countries for life scientists is provided in the next chapter.

DISCUSSION OF FRAMEWORK: WHAT INFLUENCES SCIENTIFIC MOBILITY AMONG LIFE SCIENTISTS?

The CiLS study aims to better understand factors that influence mobility decisions of life scientists. The framework setup by Papademetriou et al. (2008, 2009) was found to be an

excellent starting point for discussing the mobility decisions of global life scientists and the aspects named in their framework were confirmed as being important in the CiLS survey results. Yet, the model also seemed slightly incomplete and new modifications[36], indicated in white boxes in Figure 15, arose by using the CiLS data to apply their research specifically to careers in life sciences. These results have been found based on the total survey sample and are expected not only to apply to life scientists, but to improve understanding of scientific mobility on the whole.

FIGURE 15 MODIFIED FRAMEWORK FOR SCIENTIFIC FIELDS, BASED ON CILS RESEARCH
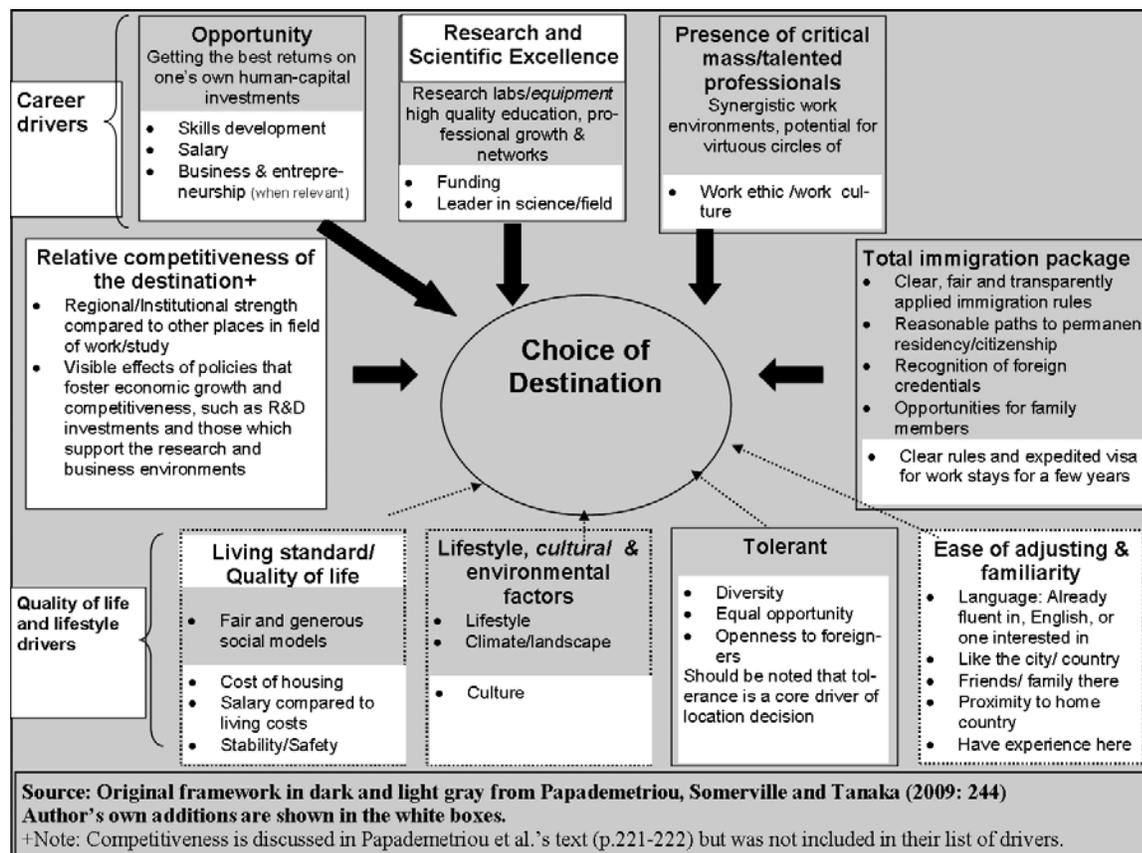
As was also noted by Papademetriou et al. (ibid.), there is considerable overlap in concerns. The two levels of drivers were renamed from first order and second order to career drivers and quality of life and lifestyle drivers. This is to indicate that *both* levels are important in mobility decisions. In other words, the CiLS study brings about reason to question that it is the career drivers that *most* influence the choice of where to move abroad. The places that fare the best in the global competition for talent will need to combine as many of the elements found to be important as possible. They will also need to be sure their unique advantages within these categories are recognized.

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[36] These changes are made based on survey answers and qualitative analysis but have not been modeled and quantitatively tested.

The strongest influence among career drivers is then information and perceptions regarding the *quality* of science research and *reputation* of various institutions in one's specific field, particularly universities and research institutes, as well as perceptions about places that have an appealing work culture and conditions. What an individual is looking for is subjective. Nonetheless, a few things that are mentioned are a lack of hierarchy, respect for scientists, and a hard-working attitude. The main changes that have been made to the **career drivers** include:

- The opportunity is assessed not only in terms of returns on human capital investments already made, but also the possibility for further skill development and career growth. The skills that are seen to be important range from science-specific skills, which often cannot be accessed on the same level in the home country, to 'soft' skills that increase one's ability to work in international environments.
- Furthermore, the opportunity is defined to some degree by the offer, including but not limited to, salary or scholarship packages. The CiLS research confirms the findings of other research on scientific mobility -- while the salary should be sufficient, it is seen as less important than the factors that influence the quality of the work and research environment.
- Business and entrepreneurship opportunities can be influential in scientists' location choices, but only for a small sub-group of scientists who have business-related aspirations. As shown earlier (see Chapter 5), most respondents in the CiLS survey aim for a research career. Although the competitiveness literature often purports the need to capitalize on findings to foster innovation and spin-off companies from university research are associated with the strength of biotechnology clusters, individual scientists do not necessarily hold the same value to entrepreneurship. Rather, they are focused more on research and publication, fitting the traditional model of the academic career.
- The main goal of scientific mobility, as shown both in other research and the CiLS analysis, is to be able to do *high-quality research*. In order to better reflect the concerns of life scientists, the category of capital infrastructure has been renamed "research and scientific excellence." One of the most important elements of this new, broader category is a place's reputation as a leader in the sciences, both in industry and academia. This means that it is not only the research and education quality that is assessed, but also the reputation of companies (in this study, particularly biotech and pharmaceuticals). The various elements within the capital infrastructure, such as the quality of research labs and education, are included as *part* of scientific excellence. The availability of research funding is also of high importance to research careers and quality in the life sciences.
- The presence of critical mass/talented professionals is undoubtedly important as well, but is closely coupled with the research excellence. One cannot exist without the other in the sciences. The CiLS research draws out another element that is important to scientists – the work ethic and work culture. Research is not conducted in the same way or with the same intensity in various countries.

The elements named as facilitators or second-order variables by Papademetriou et al were changed to quality of life and lifestyle drivers. The factors which Papademetriou et al.

call 'facilitators' are named spontaneously by a nearly equal number of respondents as those mentioning career drivers (see Table 22). Therefore, the term second-order variables may be misleading – they appear to work together in tandem, or figuratively as two sides of the same coin. Therefore, a modification to the framework was made, whereby the top row reflects career drivers and the bottom contains quality of life and lifestyle preferences. The importance of each will vary based on personal preferences, and life stage, including as related to family issues (spouse and children).

A caveat should be made in regards to interpreting which lifestyle and environmental factors are important for deciding where to move. Florida (2002, 2005) has focused on urban environments, as places where the 'creative class' gravitate. The lifestyle factors of importance that emerge are linked to both diversity in the population and the leisure activities available in cities. However, not all skilled migrants in demand are drawn to large cities. The factors provided by Papademetriou et al. (2009) generally reflect the opposite group, those who are interested in living in beautiful, clean, peaceful surroundings. Both ends of the spectrum are important, and different places will have their own unique values that make them attractive destinations for certain individuals.

Lifestyle, cultural and environmental aspects: Cultural factors were not part of the original framework, and those named in the CiLS study range from generally "liking the people there" to specific aspects related to the country's history or heritage. Landscape is often mentioned, particularly as it has an effect on how one can spend their free time in the mountains or at the beach, for example.

Tolerant society should not be considered as just a facilitator as it was in the original framework, but instead as a primary driver. Living in a tolerant society appears to be a prerequisite for most global life scientists and is considered strongly along *with* the career-related factors. It is also highly linked with the job opportunities that are afforded in an open atmosphere and whether or not the individual expects to have equal opportunities there. The aspect of safety was instead included in the lifestyle and environmental factors, as it seemed to be more linked to quality of life. However, this distinction is debatable and there is noticeable overlap.

The CiLS data suggested that a new category should be created, related to the ease of adjustment in the new location. The factors related to ease of adjustment were supported through the open-ended answers. This includes issues related to language. Past research often mentions the possibility of speaking English or their native language as a key driver of skilled migration location choice. While this is true, it may have been overstated in the past due to most of the skilled migration research having been conducted in English-speaking countries. Naturally, it is important that the individual does not have language barriers in their workplace. However, there are also many respondents who see time working abroad as a chance to build new language skills, whether in English or another language of interest. This is identified by Papademetriou et al. as well, but not necessarily frequently named in the skilled migration literature as a whole. In addition to language, a few other aspects help to aid in the ease of adjustment. These include liking the city/country where one will move to, having friends or family in the area, and having previous experience in that country, whether through travel, study, or work. Some

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respondents also mention that the proximity to their home country is important, or for instance, wanting to stay within Europe.

Although Papademetriou et al. rightfully draw attention to policies that influence institutional differences between countries (middle layer of framework), further modifications and key points are suggested by the CiLS data and include:

- Recognizing interest in various durations of stay: Papademetriou et al. focus much of their discussion of immigration policies on possibilities to extend stays or become citizens. Yet, scientific mobility is often characterized by shorter-term moves. It is my perspective that having transparent and expedited visas for *shorter* stays, ranging from a few months to a few years, is very important, and may be enough to boost the attractiveness of the country if it is coupled with a strong scientific work environment. As will be discussed in the next chapter, most people intend to have stays for work or study lasting a maximum of a few years. Therefore, although not having clear paths to citizenship or longer stays may cause stress in a later stage, it will not likely influence their decision for life scientists on whether or not they move there initially, at least in the current phase of global mobility attitudes. On the other hand, if longer-term immigration paths are not available, it could affect the country's image as being less 'open', which is an important driver of location choice and also an element discussed in the original framework. More research is needed on this topic and the relationships between immigration policies, perceived openness, and decisions to move and stay in any given country. Expedited visas for families to work are also important. It is important to keep in mind, as shown in the last chapter, that many life scientists have spouses with a different citizenship and also that there are many dual-life science career households. This means that visas that base decisions on citizenship can add extra complexity if there is not a more open visa giving spouses the right to work.
- A new box has been added related to the competitiveness of a destination and the policies that influence it. To better understand the global competition for talent, elements related to economic competitiveness and productivity should be seen as equally important as those related to immigration in skilled migration decision-making, particularly for knowledge-based sectors. The competitiveness is influenced by a myriad of policies, as listed in Part I.

CONCLUSION

In terms of preferred destinations for life scientists, the United States remains among the most popular destinations and can be seen as a 'magnet' country, attracting scientists based on its reputation for scientific research, but it has a very marginal lead. Additionally, the UK, Germany, and Switzerland are also seen as highly desirable locations, due to the size of the life science sector and quality of research and job opportunities there. It is important to realize many life scientists would consider moving to any of a range of different countries, provided the job, funding and/or research equipment available were good.

While the framework is useful to look at destinations for mobility, it should also be kept in mind that the interest in moving will vary by the individual, his or her current study

level or work status, and life stage. While the last chapter showed that most scientists express a desire to move, it is not universal. Furthermore, international mobility often is seen as most beneficial in a later stage, often as graduate or post-graduate research. There also can be various barriers to mobility. The main barriers in the CiLS study were linked to a lack of opportunities, including not having enough information or financial resources to access opportunities. One's personal life also can have a strong influence for some individuals, particularly related to needing to care for family members, and whether or not moving abroad is interesting and seen as beneficial for one's spouse or partner.

Finally, what is the role of structural differences in the individual's decisions on where to move? It is my point of view that structural factors have the most impact on migration decision-making when personal experience is involved. This means that problems/advantages of places where one has already lived are likely to be the most influential, as push factors. Without experience, individuals have only partial information about structural factors at any given destination, and these will therefore have more influence on decisions only *after* moving to that place or having spent time there. In other words, it is the reputation, combined with specific opportunities given to that individual that most influences where scientists want to move, whereas the structural factors will have a greater influence on their satisfaction there and hence how long they want to stay.

The next chapter will address differences in competitiveness in various countries, and its impact on life scientists' mobility decisions.