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Brazil in the Transition Towards Knowledge Economy: Between Qualification and Internationalization of Human Capital

Alfonso Giordano · Antonietta Pagano

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Abstract The last decades has been characterized by an increasing relevance of knowledge and innovation into the economic system, becoming two crucial factors in the global competition. Therefore, qualified human capital has turn to be an essential strategic factor strongly needed by advanced and emerging economies. The paper focuses on the international competition for skilled professionals that have increased more and more during the years, bringing in the field new economic actors. In particular, the article investigates the rising importance of Brazil in the international talents' competition, highlighting the current features of the local labour markets in the attempt to analyse the major elements of strength and weakness that characterizes the Brazilian scientific and economic system. To this end, the authors provide an analysis of the qualified migrants inflow and outflow, having the aim of a deeper comprehension of the attraction capability of Brazil.

Keywords Emerging economies · Human capital · Knowledge-based economy · Migration policies · Skilled migrations

JEL Classification: O30 · O54 · N36

Although this article is the result of the authors' shared ideas, the following paragraph is attributable to Alfonso Giordano: "Skilled migrations in knowledge society: developed and emerging economies compete for talents", while the paragraph "Human capital formation in Brazil" is attributable to Antonietta Pagano. The paragraph "The skilled migrants' new Eldorado: Brazil hunts for brains" and the "Conclusions" can be considered the work of both authors.

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Skilled Migration in Knowledge Society: Developed and Emerging Economies Compete for Talents

International migrations are gaining, currently, increasing relevance in the “wealth of nations”, especially as regards to highly skilled professionals migrations which are fundamental to ensuring to every economic and scientific system a growing competitiveness at international level.

One reason is to be found in the emergence in recent years, and specifically in the transition from the twentieth to the twenty-first century, of two phenomena: (1) the remarkable centrality of science and technology in leading economic sectors that show the highest growth rates, and (2) the polarization of employment and wages on knowledge-intensive sectors produced by a strong predilection for skilled professionals. This means that the progress achieved in the production techniques brought by technological innovations, have helped to originate and develop knowledge-based economies (Maunoury 1972),¹ in which factors such as physical strength and confidence in using a particular instrument have decreased their relevance, in favour of an increasing importance of human capital, defined as “The knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being” (OECD 2001).

Therefore, the quantity and quality of highly skilled professionals that a territory is able to attract is crucial in a strategy of economic growth and, in a long-term vision, for the overall well-being of a country. This is evident in today’s international competition, where the main developed and emerging countries are working on a dual scale: the national one, trying to keep within the country their homemade professionals and to re-attract the emigrated ones; on an international scale, improving the attractiveness of their economic-cultural-scientific system, supporting in this way the arrival a growing number of skilled migrants from abroad.

For a long time highly qualified migrations were studied basing on two main theories (Iredale 2001): the human capital theory (Becker 1964; Schultz 1971) and the theory of center-periphery relations (Bhagwati and Hamada 1974);² according to which, in both cases, international skilled migration are characterized by a centrifugal force of human capital from South to North. To this regard, although the first definition of “brain drain”—coined in the 60s by the Royal Society—described the emigration of scientists and technicians from post-war Europe to the USA and

¹ Machlup’s pioneering studies have opened a new research sector related to the knowledge economy, as he’s been one of the first to focus attention on the knowledge conceived as central factor of traditional economic activities. From his studies emerge, however, the perfect correspondence between knowledge and information, which then leads to an excessively broad definition of the knowledge economy. J.L. Maunoury in his work *Économie du savoir* (1972) expressed, though, the difference between knowledge, considered as the product of the research process and its consequent transmission and acquisition through education, and the information.

² The first is based on a micro-social vision, according to which the skilled migration flows depend on rational and optimizing choices made independently by individual migrants, who move in search of places where the wage differential and quality of life, especially in terms of education and training are higher than home country. The second tends, instead, to consider the differences between countries on a macro- social level, resulting in the migration routes from developing countries (the periphery) to the developed and industrialized countries (the centre).

Canada (Cervantes and Guellec 2002), most of the studies found a strong skilled migratory pressure from developing countries towards the more advanced economies. (Docquier and Marfouk 2004; Docquier and Rapoport 2005; Findlay 1995; Gould 1988; Salt and Findlay 1989; Todisco 1993).

Recently, however, major changes, such as an increasingly globalized labor market (Lucas 2008), the reduction of transport costs, the increased speed of the media along with the development of digital technologies, have supported greater movement not only of goods, but also of ideas and people, making it possible to overthrow, at least in part, the unidirectionality of skilled migration (Saxenian 2005). As a matter of fact, it is now possible to talk about “brain circulation”, in which case the skilled migrant is considered the linkage through which the country of origin can have easier access to advanced technology from other countries (Giordano and Pagano 2009). Is, indeed, more and more frequent and wide the number of qualified professionals that return to their mother country to establish new economic or scientific relations, or for creating and launching new companies, continuing to maintain their social and professional ties in the country of original migration. Another possibility that allows skilled migrants to produce benefits is the diasporas, as they can foster mother country’s interest in the host societies, for example encouraging foreign direct investments, just like is happening in India (Giordano and Terranova 2012).

In this way, the skills and know-how spread internationally, giving rise to a beneficial virtuous circle for all parties involved. The complexity of qualified international migration does not end, however, with the phenomenon of brain circulation. Indeed, there are other variables such as demographic and economic trends that profoundly affect the skilled migrations, resulting in the emergence and development of new migratory routes, such as those between high-income countries (therefore also North–North), those directed towards emerging economies (North–South migration, but also South–South) and return flows of talents and professionals.

The competition for the most talented and skilled human capital has become, therefore, global: it is no longer a competition between advanced economies; on the contrary, new Southern competitors have entered, leading to an increasing competition between states.

Although the underlying reasons are different, in both cases, the developed and the emerging countries are found to suffer from a shortage of highly qualified personnel essential to support the growth of their respective economies and scientific systems. While in developed countries the demographic trends show an aging population (Cipollone and Sestito 2010); emerging economies, especially the BRIC countries, have a favorable demographic window, which will allow Brazil, China and India to benefit from a working-age population particularly wide for several decades (Goldstein 2011). This means that the Northern countries have to deal with a double challenge: on one hand they will have to cope with the declining interest of young people for careers in science;³ on the other, increasing their ability

³ In the European Union, for example human resources employed in strategic sectors such as science and technology belong more and more to the 45–64 age group: it is estimated, in fact, that from 2000 to 2011 the average annual growth of this portion of the population was equal to 3.86%, compared to the growth rate of the 35–44 age group which was of 2.53%, even worse with regard to the population aged 25–34 whose average growth rate was 2.22% (Eurostat 2012).

to attract a larger number of professionals and highly qualified students. By contrast, students and professionals from emerging countries have shown different trends over the years, preferring specialization in scientific and engineering sectors.⁴ Therefore, the emerging countries can count on a large proportion of highly qualified professionals—from which will benefit by the phenomenon of brain circulation or brain return—and of local population that has to be trained and specialized in the homeland.

Human Capital Formation in Brazil

The strong vitality of the economy and industry of Brazil, that lately ranked as the sixth-largest economy in the world (BBC News 2012), has determined a significant increase in demand for highly qualified personnel to be inserted in its productive system. In this respect, the central authorities have implemented several programs to raise the level of skilled labour force necessary to meet the development needs of the country. Among the first and most important initiatives there is the establishment in 1951 of the *Capes—Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*, with the task to promote and disseminate the formation of human capital and scientific activities in the country, through, for example, investments aimed at highly qualifying education programs in the country and abroad; the development and consolidation of post-graduate studies and the on-going training of teachers; the promotion of international scientific cooperation. In the second half of the '60s have been also approved a series of legislative measures, such as *Programa Estratégico de Governo*, the first *Plano Nacional de Desenvolvimento* (1972–1974), university and education reform, as well as initiatives for the consolidation of the fundamental rules of the post-graduate courses with the adoption of the opinion 977 in 1965, which have brought major breakthroughs in the education and scientific-technological research policies of the country.

Over the years, the government has continued to adopt programs to develop education and science, as confirmed by the recent *Jovens Talentos para a Ciência e Ciência sem Fronteiras*: the first is addressed to graduate students from all disciplines and, providing grants, aims to bring together the largest number of students to the purely scientific disciplines; while the second one finances the postgraduate studies abroad of the most talented and gifted students in Brazil. The attention paid to the development of Brazilian human capital has produced a large expansion of the scientific community and a significant increase in its intellectual production, if we consider that the number of graduates has increased from 300,761 in 1998 to 800,318 in 2008 and the number of masters and doctoral degrees has increased from 800 in 1970 to nearly 3,700 in 2008, showing in the decade 1998–2008 an increase of 170.1 % in the number of students in possession of a master and 173.6 % for doctorates (Ramos and Velho 2010).

⁴ For example, according to studies carried out in 2005, the main areas of specialization of the Chinese skilled professionals' community were engineering (41.7%), science (23.3%) and medicine (17.5%). (Giordano and Pagano 2010). In 1997, the Indians PhD candidates achieved their degree in the following specialization: 84, 5% had a doctorate in science or engineering, of these 42.3% in engineering and 25% in natural science (Khadria 2003). In Brazil, however, the number of doctorates has risen from 3,915 in 1998 to 10,711 in 2008 (Capes 2009).

Table 1 Scholarships from Capes awarded to Brazilian students and researchers abroad, by granted course (2002–2010)

	Sandwich (partial) bachelor degree	Full master degree	Sandwich (partial) master degree	Full PhD	Sandwich (partial) PhD	Post-Doctoral studies	Senior internship	Visiting professor	Total
2010	1,473	3	26	577	1,890	729	204	49	4,951
2009	1,061	0	17	660	1,682	847	79	0	4,346
2008	930	1	0	723	1,558	923	0	0	4,135
2007	791	2	5	915	1,500	830	0	0	4,043
2006	734	1	6	932	1,530	762	0	0	3,965
2005	693	1	6	947	1,298	641	0	0	3,586
2004	473	1	9	940	1,019	535	0	0	2,977
2003	285	2	6	967	969	455	0	0	2,684
2002	287	16	7	894	840	454	0	0	2,498

Source: Capes—Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, GeoCapes

Over the past decade, then, Brazil was able and is continuing to pursue one of its primary objectives: to increase the amount of human capital formed in the country. At the same time, however, Brazil has to increase the quality of skilled human resources, purpose very clear to the central authorities, as demonstrated by the program *Ciência sem Fronteiras*. The number of scholarships guaranteed for studies abroad, in general, has increased over the years, from 1,877 Brazilians funded to attend abroad a high-level qualification course in 1998 to nearly 5,000 in 2010 (Capes 2012). The increase in the number of scholarships has been substantial, although over the years there were variable growth rates, particularly in 2007 and 2008, years in which the grants awarded increased respectively of 1.9 and 2.2 % in comparison to the previous year. 2010 represents a year of renewed vitality of the specialization programs abroad for Brazilians, as confirmed by an increase over 2009 of 12.2 % of scholarships granted, probably due to the urgent need for qualified professionals essential for the success of important events that will occur in Brazil, such as the 2014 Soccer World Cup and 2016 Olympic Games (Table 1).

On the basis of a detailed analysis of the internal composition of scholarships financed by the State is possible to raise interesting observations, especially for what concerns the type of course that the government has encouraged over the years. As a matter of fact, examining the data related to the period 2002–2010 it is possible to highlight the sharp increase in scholarships granted for temporary programs, the so-called “sandwich”, in comparison to an entire education program. While “sandwich” exchange programs for Bachelor’s and PhDs have increased with an average annual growth rate of respectively 17.4 and 9.4 %, ⁵ full doctorates abroad and post-doctoral courses after an initial phase of development in 2008 and 2009

⁵ The Master showed greater variability in the number of beneficiaries, although since 2009 the growth rates are increasing and seem to be promising.

have considerably decreased, to around 9 %. The decrease in 2010 compared to the previous year was even more significant, considering that the rate of reduction was 14.4 % for PhD and 16.2 % for the post-doc.

The decision to favour short-term study programs is due to the interest of Brazilian authorities that abroad-educated talents return in the motherland. To this end, the sandwich programs—that do not normally last more than a year—although support the process of qualification and specialization of students and researchers; on the other hand, the short stay, do not allow them to participate fully in the academic life of the receiving institutions, and is even worse their integration into the local social system. In addition, the remarkable performance of the Brazilian economy and the consistent labour supply, especially skilled, in the Brazilian market encourage a greater number of Brazilians (and not only) to return to the motherland. To ensure, however, the return of their brains, the Brazilian government, as was done in the 80s in China⁶ (Giordano and Pagano 2010), adopted legislative measures that have encouraged this trend: the granting of scholarships with a guaranteed job at the employer institution; the insertion of a clause in the grant letter which includes a commitment of the researcher to return once obtained the degree abroad; finally, the government recently has worked hard to establish international agreements that prevent the granting of permanent visas for former beneficiaries who do not comply with the return clause (Schwartzman 1978; Balbachevsky and Marques 2009).

For what concerns the countries of destination of the Brazilian skilled migrations, it should be noted that in 2010 just over 93 % of them were concentrated in North America and Western Europe (Fig. 1).

Surprisingly, the country to lead with a greater presence of Brazilian scholars was France, which in 2010 showed the presence of 1,502 skilled migrants, accounting for 30.3 % of total skilled migrants funded by Capes.⁷ United States ranked second, with Brazilian skilled migrants representing the 20.7 % of total qualified foreigners, followed by Portugal (13 %), Germany (9.1 %), Spain (7.7 %), United Kingdom (5.3 %), Canada (3 %), Italy (2.4 %), the Netherlands (1.8 %) and Argentina (1.3 %).

With a closer look, however, the primacy of France is explained thanks to the high number of Brazilian students enrolled in an sandwich undergraduate program (848 students out of 1,502) and sandwich PhDs (426 students). Analyzing, instead, the post-doctoral course is possible to notice the leadership of United States attracting almost 23 % of most qualified Brazilians funded by Capes, followed by France (19 %) and Spain (17 %). Finally, the main destination chosen by students and researchers in Brazil in 2010 to attend a PhD program were, once again, the United States (32.9 %), the second was the United Kingdom (16.1 %) while Germany ranked third (15.9 %).

⁶ In the 80s companies were authorized to send abroad the best employees for specialization courses or degree, with the obligation to return and re-employment in the same company once the study permit ended.

⁷ France represents, indeed, an important destination country of the international skilled migration, especially from the North African and European basin (Pagano 2012).

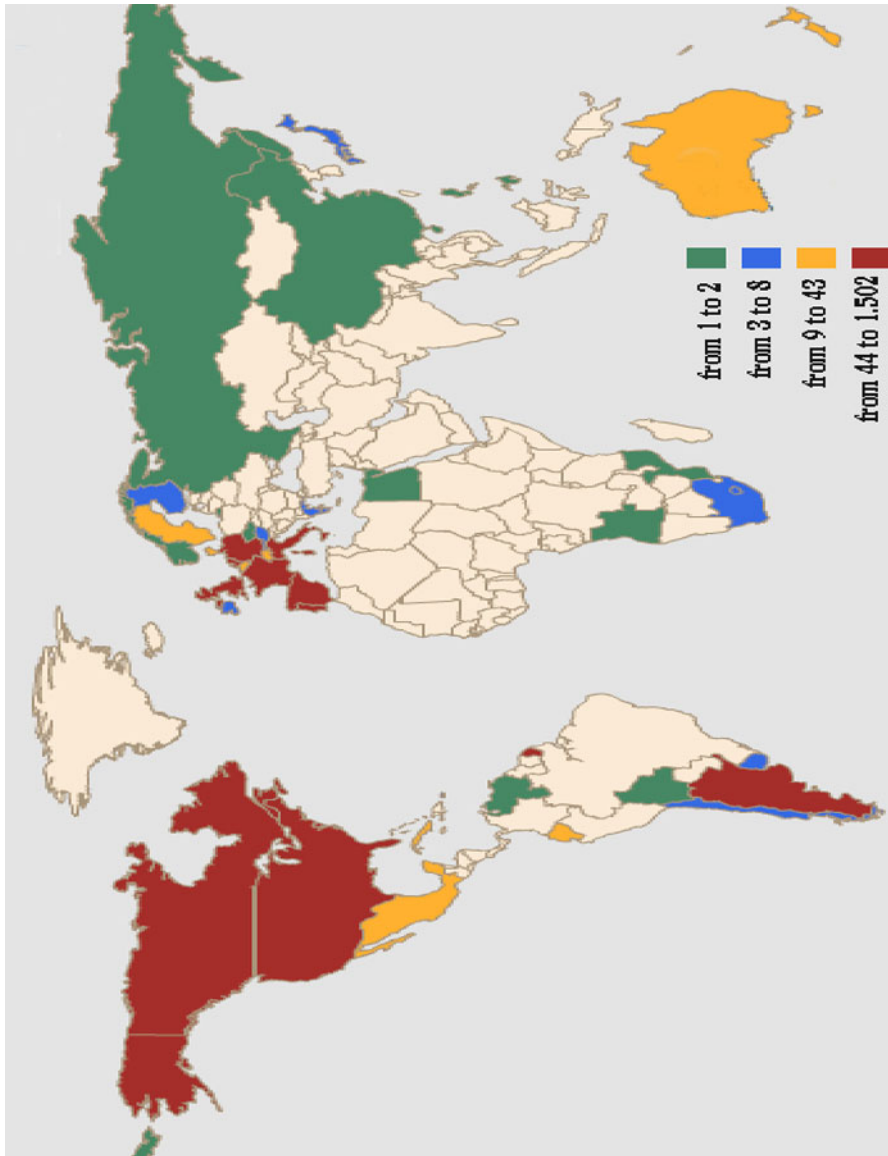


Fig. 1 Spatial distribution of skilled Brazilian scholars awarded by Capes in 2010. *Source:* Capes—Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, GeoCapes

A conclusive, but important aspect in the examination of recent Brazilian skilled migration concerns the fields of specialization chosen: as reported by Capes' statistical data, in 2010 the majority of scholars (about 24 %) focused on engineering studies, reflecting the growing influence that the urban and infrastructure development is having on the labor market and education system in Brazil (Fig. 2).

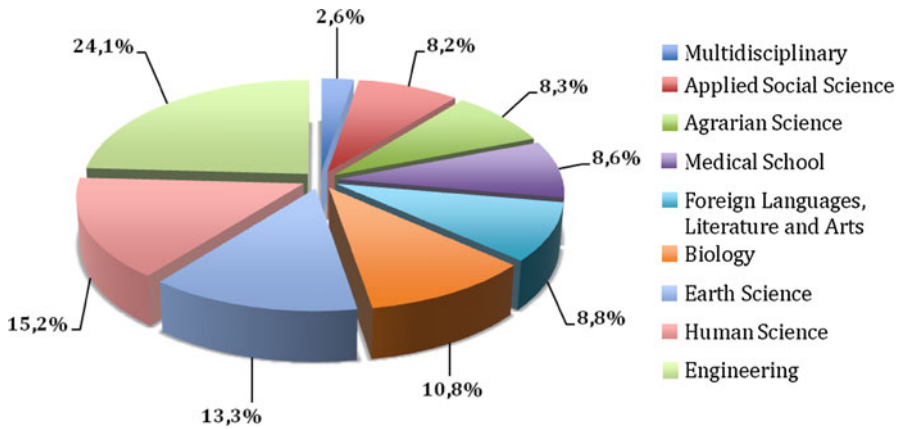


Fig. 2 Capes' scholarship field of specialisation in 2010. *Source:* Capes—Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, GeoCapes

It should be noted that, although a good portion of scholars was enrolled in the faculty of engineering, in 2010 the majority was participating to an exchange program (sandwich) for the undergraduate program and only a small part a PhD (about 20 %), despite to what was noted in the other areas of specialization. In fact, the average concentration of beneficiaries enrolled in PhD programs in all the other disciplines (both sandwich and full cycle) was approximately 60 %, stands the case of the PhD candidates in Human Sciences, which accounted for about 69 %.

The Skilled Migrants' New Eldorado: Brazil Hunts for Brains

With a population of 194 million and a GDP average annual growth rate of 4 % (World Bank 2012), Brazil is today a desirable destination for international migration, both skilled and unskilled. It represents an important example of the redirection of migration trends, as the economic dynamics—it is estimated that the value of the country's economy is currently 2.09 trillion dollar (Rampini, 2012)—have produced new and important pull factors, due, for example, to the growing number of job positions, the greater and faster career opportunities and a wider availability of resources. Elements that if added to the contemporary deficit of qualified professionals of the Brazilian labour market, are encouraging an increasing number of highly skilled human capital to migrate from the economies most affected by the global crisis to Brazil.

There are various estimates on the number of human resources that the country will need in the near future, a figure, however, is certain: the school and university systems are currently unable to train qualified personnel capable of responding to the skills and know-how needs of the local economic, industrial and scientific systems. Despite the increasing number of graduates, the Brazilian economy is growing at a faster velocity. According to *the Conselho Federal de Engenharia e Agronomia—Confea*, the skilled labor force deficit will push local firms to seek

more and more employees abroad, given that Brazil will need approximately 300,000 professionals in the technology sector, while the country can train only half of it. Most of the remaining vacancies will be, then, occupied by foreign personnel (Salvador 2012). In addition, as reported by Inter Press Service, Brazil will have a shortage of professionals in the fields of mining, oil and information technology, accounting for about 400,000; while it is estimated that by 2012 the deficit of IT professionals will amount to 800,000 (Frayssinet 2012).

Although these figures could represent a critical element for the technical and economic development of the country; the Brazilian current deficit is for skilled migrants an appealing opportunity. Aware of the duality of the situation in which the country is, the central authorities, following the example of Australia and Canada, is examining the different migration policies designed to attract more skilled immigrants, precisely through the selective immigration. Indeed, the government intends to contrast unskilled migration and, simultaneously, is planning to provide a specific channel for migrants with high qualifications, offering incentives to facilitate their arrival into the country. To this end, there is the possibility of adopting a special residence visa for skilled workers, through the removal of bureaucratic obstacles that hinder and discourage people from entering in Brazil (Tavener 2012). Furthermore, in August 2012 was established a working group within the *Secretaria de Assuntos Estratégicos* (SAE) *da Presidência da República*, which will be responsible to review and propose amendments to legislation in order to facilitate and encourage the immigration of highly qualified professionals (SAE—Secretaria de Assuntos Estratégicos 2012).⁸

Despite the momentary absence of an adequate migration policy able to cope with the necessity of skilled professionals, the country is already having a strong capacity to attract foreign human capital: for example, between January and September 2011, the *Ministério do Trabalho e Emprego* granted 51,353 work permits to foreigners, an increase of 32 % compared to 2010 (Tavener 2012).

The levels of qualification and competences of visas applicants are the most varied, for what concerns this analysis, it should be noted that foreign skilled human capital arrived in Brazil is growing, although the figures shows higher inflows of migrants with Bachelor degree and technicians, compared to those professionals with a master degree or a PhD.⁹ (Fig. 3).

As a matter of fact, data shows a high concentration of medium qualifications rather than highly skilled migrants, although the number of professionals with a master or a PhD is increasing, especially in the latter case, where the average annual growth rate was equal to 51 % (CGI—Coordenação Geral de Imigração 2012).

With regard to the time spent, temporary visas turn out to be greater than the permanent ones, even if it should be noted that the requests for these latter might

⁸ Some of Brazilian multinationals, in order to speed up and facilitate the procedures for obtaining visas, are opening up recruitment offices in foreign countries, especially in Europe, in order to employ locally the most qualified professionals.

⁹ It should also be noted that the immigration authorities couldn't survey a good portion of the competencies and skills of migrants, depriving in this way the analysis of completeness of the information provided. The data are, however, exposed, to show the trend that is characterizing skilled migration to Brazil.

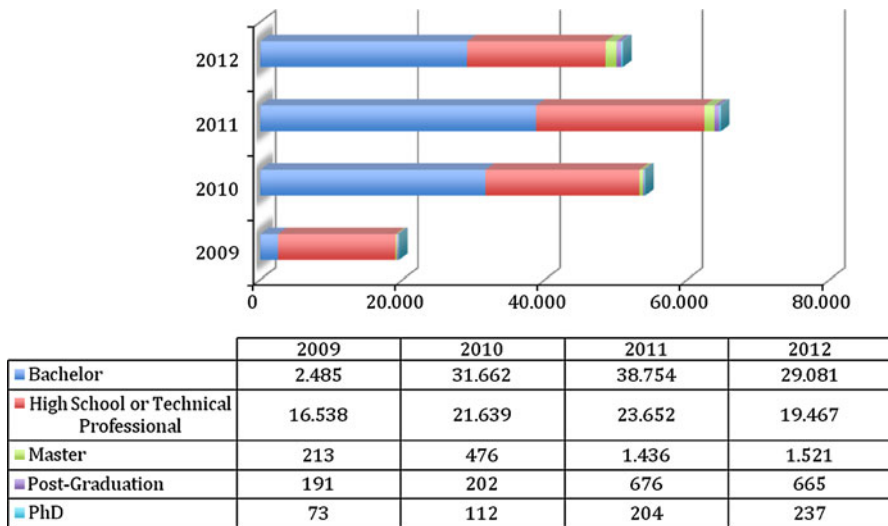


Fig. 3 Skilled migration in Brazil by education attainment (2009–2012) (The figures for 2012 are not to be considered definitive, but adjusted as reported on the website of the *Ministério do Trabalho*). *Source*: Coordenação Geral de Imigração—CGI

increase at a greater rate than temporary visas. In fact, the number of requests accepted in September 2012—as published by the *Ministério do Trabalho*—for permanent visas has already exceeded that of 2011, with 5,991 applications, compared to 3,834 of the previous year. Denoting a greater desire for stability of the skilled professional's migratory project. (CGI—Coordenação Geral de Imigração 2012).

An interesting motivation useful to, at least partially, explain the higher number of requests for temporary visa as well as the lower level of qualification is the strategy adopted by some migrants who decide to enter Brazil as students or tourists, without an employment contract, to be enrolled in an MBA or a post-graduate course, in order to get experience, linguistic-cultural know-how and an extensive business network that are essential to access to the local labour market. As confirmed by Prof. Oliver Stuenkel, a professor of international relations at the Getulio Vargas Foundation, who highlights that the number of foreign students increased at the University of São Paulo: in 2006 there were only 399 students from foreign universities, in 2011 the number is increased to 977; similarly, also foreigners enrolled in specialization courses of the University grew, in the same period, from 785 to 1,150 foreign students (Salvador 2012).

The first to benefit from the opening policy to skilled migrants are precisely the Northern countries and, more specifically, those countries that have had significant and previous migration relations with the Latin continent: Portugal and Spain. Not surprisingly, these two states have been deeply affected by the recession in the Eurozone, and in 2011 stood out to be the main countries of origin of the skilled migration in Brazil, rising from 276,000 to 328,000 in the case of Portugal and from

58,000 to 80,000 with regard to Spain, then followed Bolivia, China and Paraguay (Petrova 2012).

Conclusion

The attraction and circulation of highly qualified human resources for Brazil is a further factor necessary to develop and consolidate the economic and technological progress that has characterized the country in the past few years.

The policies set up to train and specialize skilled personnel are, at the moment, not sufficient to support the economic and scientific system of the country, not only because the graduated population is not yet adequate in terms of quantity, but also in terms of networking with the international world. As noted, a large part of Brazilian foreign talents attended courses of specializations in the short term, with the risk of non-inclusion in the scientific and social environment of the host society. The brevity of the financed scholarships, together with the strong Brazilian propensity to return may slow the realization of international cooperation projects with other foreign universities and research centres and, in the long run, it could cause a decrease of attractiveness for the country. As a matter of fact, a weak internationalization of the university and research system undermines the ability to attract highly qualified human resources, who instead are pulled towards those countries that offer better job opportunities, a dynamic scientific and entrepreneurial community and advanced technologies and equipment. Therefore, it is of primary importance to encourage those programs abroad with a duration greater than 1 year, because in this way scholars and beneficiaries will be capable of creating linkages through which access to the most advanced knowledge of the destination countries and, at the same time, to establish a scientific network from which they might benefit of the brain circulation effects, in other words the spread and transmission of tacit and informal knowledge, skills and know-how.

With regard to the mismatch between labour demand and supply, the central authorities can currently benefit from the recent skilled migration flow. Developed independently, thanks to several demographic, social and economic factors that are encouraging more and more young talents, professionals and graduates to migrate to Brazil, the phenomenon is still too recent and the data cover a period too small to coming to conclusion or any predictions. Of course, the trend is very positive and Brazil has the economic, academic, social and natural feature to become a highly attractive destination on a global scale. Hence, it is necessary to quickly define the skilled migration policy, which may focus primarily on the reduction of bureaucratic barriers that prevent a larger arrival of skilled migrants. Secondly, it would be useful to provide visa permits based on qualifications and competence, so as to give priority to those economic and scientific disciplines that are at the moment underemployed but that represent a critical element for a proper progress of the Brazilian economy.

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