

Towards a Socio-Economics of the Brain Drain and Distributed Human Capital

Carolina Cañibano* and Richard Woolley***

ABSTRACT

This paper derives from our joint interest in understanding how scientific mobility affects developing countries. Many authors have addressed the topic previously, both from an economic and from a sociological perspective. However, recent literature evinces dissatisfaction with both analytical frameworks and the framing of public policies addressing the brain drain problematic. This paper is a contribution to understanding the historical and theoretical foundations of the “brain drain” debate. We aim to improve conceptual clarity regarding the itinerancy of human beings and the mobilization of human capital. We develop a critical review of the economics of the brain drain, highlighting the work of some key early thinkers and pointing out the way in which subsequent work has taken up selected aspects of their approaches leaving other challenges aside. We then consider the diaspora networks literature, which is characterized as taking a “connectionist” approach to the brain drain. We identify two fundamental problems: the sidelining of complementarity and context dependency as basic properties of human capital; and a failure to adequately disentangle the concepts of human resources for science and technology (HRST) and human capital in academic and policy discourse about the brain drain.

INTRODUCTION

Scientific discovery and knowledge diffusion have been associated with the itinerancy of scientists and scholars since the beginning of written history. In the modern era, flows of scientists and intellectuals increased after the Second World War, during the subsequent Cold War and the last decades of the twentieth century, linked to the social, economic and political disparities between countries and the development of systems of mass long-distance transportation (US House of Representatives, 1977). A prominent framing of contemporary global intellectual itinerancy is that which has been labelled the “brain drain”.

An early use of the term “brain drain” was in reference to the exodus of British scientists to the United States (USA) in the 1960s (US House of Representatives, Committee on International Relations, 1977), apparently denoting a permanent knowledge and welfare loss suffered by the sending country in such circumstances. Perhaps unsurprisingly, the bases of human capital theory in economics were being laid down around the same time, with Theodore Schultz publishing his first reflections on the role of education and human capital formation in economic development (1961, 1963) and Gary Becker his theory of human capital (1964). While economists were designing a

* INGENIO (CSIC–UPV), Universitat Politècnica de València, Valencia.

** Centre for Industry and Innovation Studies (CInIS), University of Western Sydney, Sydney.

theory addressing the crucial role that the accumulation of embodied knowledge plays in economic development, politicians and policymakers were becoming increasingly concerned about potential deleterious consequences associated with the emigration of the highly skilled. This concern continues today. Voices from Africa and Latin America describe the damaging effects that the brain drain has on their societies.¹ This discourse also remains prominent in Eastern and Southern European countries, such as Poland (Ackers, 2009) and Italy (Morano-Foadi, 2006). Brain drain has also been identified as a significant issue, and ameliorated via innovative policy strategies, in both North-East and South-East Asia (Krishna and Khadria, 1997; Song, 1997; Zweig, 2007). However, despite sustained attention on the issue, discontent remains regarding both analytical frameworks and public policy (Gaillard and Gaillard, 2003; Skeldon, 2009).

In this paper, we argue that the persistence of the brain drain problematic, whilst obviously largely due to uneven socio-economic and scientific development, is also partly due to the failure to resolve certain theoretical issues that frame policy thinking. As we see it, the most fundamental problem is the conceptual conflation of the demographic category of skilled human resources for science and technology (HRST) and the economic concept of human capital (HC). Despite being obviously closely related and intertwined empirically, they belong to distinct ontological registers. However, most work on the brain drain tends to conflate the two, leading to a situation in which human capital is conceived as bounded and enclosed by an individual body. Of course, this conceptual conflation is not unique to studies of the brain drain. However, we consider it particularly troublesome in relation to the brain drain problematic due to its methodological “convenience”, which over time has framed analysis in particular ways.

To illustrate our claims, in this paper we take a genealogical approach to the foundations of the economics of the brain drain debate. We will show that in the early debate regarding the brain drain in the 1960s, human capital was not treated as an easily divisible and “countable” category. We point out how subsequent work has taken up selected aspects that can be more easily assimilated to general equilibrium economic assumptions and calculative techniques.

We then consider literature in which attempts have been made to develop an alternative approach to the brain drain problematic in the space left by the methodological enclosing of economic analyses. According to Favell et al. (2007: 19), the orthodox brain drain debate has largely failed to account for “the frequent back and forth movement of migrants, ideas, knowledge, information, and skill sets that is now a routine part of contemporary transnationalism”. Alternative approaches have emerged that consider these processes on the receiving side; for example, from perspectives of knowledge transactions (Williams, 2007) or innovation systems (Hart, 2007). However, work addressing the key brain drain problematic – the nature, value, scale and scope of benefits to countries of emigration – has largely stagnated since Meyer and colleagues developed their “diaspora knowledge network” approach more than a decade and a half ago. We take another look at this “connectionist” approach, arguing that in its theoretical critique of the neoclassical economics of the brain drain, it has much in common with the “lost fundamentals” of the early economics debate. However, we also suggest that their empirically derived descriptions of transnational spaces of circulation, organized around cultural/national identification, are not then translated into a conceptual approach to distributed human capital. This leads to the final section of the paper, in which we propose a broad agenda for reinvigorated scholarship directed at the problematic of the brain drain.

THE ECONOMICS OF THE BRAIN DRAIN: THE 1960S DEBATE

The first academic debate concerning the brain drain opposed two views of the consequences of scientific migration phenomenon: the so-called “nationalist” and “internationalist” models. Harry Johnson provided the touchstone for the internationalist model. He was one of the first authors to

discuss “the economics of the brain drain”, pointing out that the term “drain” conveyed a strong implication of serious loss (Johnson, 1965). The questions to be addressed were therefore “to whom does the loss occur and what sort of loss is it?” Clearly the loss does not affect “the brains that are being drained” (Johnson, 1965: 299). In fact, Schultz (1961) had earlier considered migration as a form of an individual’s investment in human capital. The loss derived from migration would thus affect those who continued to reside in the country of origin.

Johnson (1965: 300) connected concern about outward migration with “the philosophy of economic nationalism” and proposed an alternative “internationalist model” (Johnson, 1968), which considered the potential benefits of the outflow of the highly skilled, both for the home country and the world economy. He criticized policymakers’ automatic association of outflows with “drains”, concluding that the variety of potential gains and losses to the world economy as a whole, and to sending and receiving economies, did not allow for such simplistic interpretations. In contrast, authors such as Boulding (1968) and Patinkin (1968) argued the importance of human capital for national economies and the potential dangers of emigration from developing countries.

The debate was set, overall, within a broad conceptual framework reflecting the complexity of the phenomenon under study. Johnson found more reasons to be optimistic about the final welfare creation and distribution effects of the brain drain, whereas Boulding (1968), Kidd (1965) and Patinkin (1968) placed more emphasis on the potential negative consequences for developing economies. The main arguments sustaining the views of these authors are summarized in Table 1.

A certain conception of human capital can be argued to underlie the statements in Table 1. This conception contains several key elements structuring the analytical reflections of these authors:

- individuals are heterogeneous, interconnected, interdependent, face uncertainty, and are embedded in temporality;
- the productivity and value of human capital varies depending on the social and economic context of its use; and
- factors of production are complementary.

It is perhaps unsurprising that such assumptions can be found in the 1960s brain drain debate, given the close involvement of Kenneth Boulding, considered to be one of the fathers of evolutionary economics (Boulding, 1981). These fundamental assumptions have much in common with thinking in contemporary evolutionary economics.² As such, they differ markedly from those of the neoclassical equilibrium approach that was to become increasingly dominant from the 1960s.

Boulding developed a comprehensive body of economic theory, which moved away from Newtonian mechanics analogies and therefore from the general equilibrium paradigm that forms the base for what is commonly known as “standard” or “mainstream” economics. Instead, Boulding’s economic theory was explicitly inspired by the biological sciences (Boulding, 1981: 25).

When addressing the brain drain phenomenon, Boulding (1968) starts by insisting on the greater importance of human compared to physical capital for economic development: “Physical capital is merely human knowledge imposed on the physical world” but “it is not the existing stock of knowledge in a society which determines its rate of development as much as its capacity for learning” (Boulding, 1968: 112–113). For Boulding,

... human capital even more than physical capital is a structure, rather than an aggregate. We do not necessarily increase the productive capacity of a society by adding another person to it, even if he is very expensively trained, if that person does not fit into the matrix of information flows in a way that increases the productivity of the society. (1968: 113)

The problem of economic development is for Boulding (1966, 1973, 1991 [1956]) – as for Hayek (1945) – mainly one of organization of knowledge in society. His conception of the world as

TABLE 1
TWO VISIONS OF THE BRAIN DRAIN: THE 1960S DEBATE IN ECONOMICS

Nationalist–pessimistic	Internationalist–optimistic
<p>N.1. If education is financed by general taxation of the resident population, every educated migrant takes with him a gift from the place he leaves to the place to which he goes (Boulding, 1968; Johnson, 1965).</p> <p>N.2. Accumulation of human capital generates economies of scale, which are lost as a consequence of emigration (Johnson, 1965).</p> <p>N.3. Exporting skilled trained adults implies a loss of learning capacity and therefore of growth potential for the sending society (Boulding, 1968).</p> <p>N.4. Highly skilled human resources perform important social functions that are not captured by market prices and salaries (these are therefore considered as “externalities” within economic analysis), such as teaching and mentoring, inspirational and leadership qualities, institutional entrepreneurship and so on. These functions are particularly crucial in less developed countries (Boulding, 1968; Johnson, 1965, 1968; Kidd, 1965; Patinkin, 1968).</p> <p>N.5. The movement of a few scientists and engineers can cripple and destroy a field or a department in less developed countries (Kidd, 1965, Patinkin, 1968).</p> <p>N.6. Science and technology must be adapted for and in less developed countries if they are to be useful for economic development: much research done on applied problems in one environment is not transferable to another (Kidd, 1965).</p>	<p>I.1. Migrants from developing countries frequently maintain their family ties and send remittances, which may compensate for the eventual losses (Boulding, 1968; Johnson, 1965, 1968).</p> <p>I.2. Migrants may also return, letting the home country benefit from the learning and skills acquired abroad. New ideas and discoveries are frequently generated by the confrontation of an individual with a new and different culture (Boulding, 1965, 1968).</p> <p>I.3. Migration frequently acts as a liberating force, freeing the human mind for creative work that it would not otherwise produce (Johnson, 1965).</p> <p>I.4. Skills embodied in human capital are complementary to other inputs into research or production. It is too easy to assume wrongly that the migrant would have made the same or a comparable contribution to research or to national income in the country from which he migrates (Johnson, 1968).</p> <p>I.5. The services of emigrants are available to a region if they are needed to the extent that the region is prepared to pay for them, especially given the cheapness of modern transportation (Johnson, 1965).</p> <p>I.6. Discoveries from basic scientific research benefit the world as a whole, including the home country of scientists who have emigrated (Johnson, 1965).</p> <p>I.7. Emigrants can influence policies in their new country of residence towards their native country (Johnson, 1965).</p>

system brings him to stress the connections between the different factors contributing to production processes, of which know-how and learning are of major importance. His focus on the dynamic and interactive dimension of the system contrasts with the mechanical models involving constant parameters relied on by mainstream economics (Boulding, 1981). Consider the argument supported by Kidd (1965) and Patinkin (1968) – N.5 in Table 1 – that the movement of a few scientists and engineers can cripple and destroy a field or a department in less developed countries (see Table 1). As Boulding implies, a few scientists may play crucial roles in social structures (as educators or leaders) that might be broken into disparate parts if they migrate. In this context, actors are connected and complement each other. It is therefore not the number of emigrants that is crucial, but where they are integrated into the human capital structure.

We might also recall Johnson’s (1968: 74) statement I.4 (Table 1). Johnson argues that the migrant might fit better into a production structure in a country of migration than in the country of origin. It is wrong to assume that their role was crucial in the home country. Rather, it is how the

location of individuals configures, or reconfigures, particular human capital structures that is decisive. Migrants may return, or establish connections from abroad; in either case, the associated reconfiguration of human capital structures could potentially entail socio-economic benefit.

According to this analytical framework, *heterogeneous contexts* (different roles, connections and the fit to the productive structures) and *complementarity* (between production factors and social and economic structures) are key elements for understanding the varied consequences of geographical flows of highly skilled scientists and engineers. Human capital is understood as entering a specific production structure in which it needs to fit. This implies, for example, that an economy cannot be defined or evaluated in terms of the number of biologists it contains. To assess the value derived from having biologists, there is a need to study what, if any, role they play in social and productive structures.

As this overview suggests, aspects of the 1960s brain drain debate were conceptually sophisticated and considered human capital to be distributed, characterizing this in terms of the connectivity and complementarity between individuals in forming productive structures. However, despite the broadness of this initial debate, the subsequent economic models that assessed the role of the brain drain in economic development followed a conceptually and methodologically “standard” tradition, relying on neoclassical equilibrium premises. In the following section, we describe the major assumptions and contributions of this neoclassical economics of the brain drain.

THE NEOCLASSICAL ECONOMICS OF THE BRAIN DRAIN

In contrast to the diversity of the economic debate on the brain drain of the 1960s, our review found that subsequent approaches to the brain drain have been predominantly built on the assumptions of general equilibrium economics and standard human capital theory. General equilibrium models rely on the concept of homogeneous representative agents. An individual with a certain accumulation of human capital, defined in terms of years of schooling or experience, is representative of any other individual with the same level. Individuals are autonomous and respond to market signals when making decisions about investments in education and their professional choices, including migration.

The basic neoclassical model for homogeneous labour

The conceptual starting point is a market that operates in perfect competition and in which workers earn an income that is equal to their marginal product. Differences in skills or human capital endowments of workers are not yet considered: any worker is a perfect substitute for any other in the economy. All agents have perfect information about market prices and automatically respond to changes. Labour markets adjust to the equilibrium levels of supply and demand assuring full employment. A person leaving the productive system would not harm the national economy, as she would only take away the value of her marginal product, which she herself earns anyway.³ The departure of a person could even raise the nation’s capital/labour ratio (Grubel and Scott, 1966). The assumption of diminishing returns to scale in the use of labour implies that emigration will raise per capita income if the endowments of all other factors of production remain constant (Bhagwati and Rodriguez, 1975).

The basic brain drain framework (with heterogeneous labour)

To assess the effect of the emigration of the highly skilled, the above assumptions are changed. Workers are considered to be endowed with different levels of human capital, which implies the recognition of certain market inefficiencies. This is due to the particular characteristics of human capital

compared to other production factors. According to Becker (1993 [1964]: 312), “knowledge is not subject to diminishing returns in the same way as is physical capital because greater knowledge raises the productivity of further investment in knowledge”. The increasing returns of human capital imply that the rate of return on human capital grows as the stock of human capital increases.

Economies of scale are therefore associated with the accumulation of human capital in the economy. External economies also appear, as highly skilled persons have the capacity not only to increase their own productivity, but also to encourage the productivity of other agents.⁴ The social product of skilled persons is therefore higher than their marginal product. The inefficiency relies on the fact that the market that rewards skilled individuals with an income equivalent to their marginal product fails to compensate them for their contribution to society. The market thus fails to provide an optimum level of investment in human capital because social benefits of this investment are higher than private ones. This failure is normally addressed through governmental investment in education.

Some implications of the above premises are as follows: (i) skilled individuals will be attracted to locations with high stocks of human capital and therefore higher returns to their accumulated skills;⁵ (ii) skilled emigrants take not only their marginal product with them but also their social product; and (iii) if skilled emigrants’ education was financed by the government, then emigrants fail to repay this investment through their contribution to the tax system.

It follows that low-income countries will suffer the consequences of net welfare losses associated with the departure of skilled individuals. The net losses will be especially high if the government funds education, as is normally the case.

Returning to the questions posed by Johnson (1965) (to whom does the loss occur and what sort of loss is it?), we may summarize the implications of the above basic framework by pointing out that the particular economic properties of human capital, and the fact that the market fails to allocate it efficiently, imply that emigration of skilled individuals has a negative effect on the home economies, as they lose their investments in education and the productive potential of the emigrated capital. This would justify why an outflow tends to be automatically considered as “a drain”. From the 1970s, the economic debate on the brain drain revolved around discussion of this basic framework and its effects. Below, we review the principal arguments that have contributed to this debate. First, we focus on the discussion of losses (drains) and, second, we review the discussion on the potential gains that have also been linked to skilled emigration.

Discussing the basic brain *drain* framework

Grubel and Scott (1966) start from the basic model, but argue that losses associated with skilled emigration are normally only temporary. In the long run, economies will adapt to frictional inefficiencies associated with skilled migration. Other skilled workers will replace emigrants (Grubel and Scott, 1966: 271). In relation to the loss of public investment in education, these authors argue that emigrants take along their contribution to tax revenue, but also their children, on whom this share of revenue would have been spent. According to Grubel and Scott, the losses that a country suffers due to skilled emigration are not as great as the basic brain drain model would suggest.⁶

Bhagwati and colleagues challenged this optimistic outlook, which supported Johnson’s “internationalist view”. Bhagwati and Hamada (1974) acknowledged the possible losses of skilled emigration described, focusing on additional factors that may cause welfare losses in sending/developing countries. In Bhagwati and Dellalfar (1973), Bhagwati and Hamada (1974), Bhagwati and Rodríguez (1975) and Bhagwati (1979), the assumption of perfectly competitive labour markets is removed. Wages respond to market forces, but also to other factors. According to these models, in developing countries the salary levels of the educated elites tend to imitate the wages of comparable groups in more developed countries, reaching a level above the equilibrium market price and

encouraging unemployment among the educated. The high salary levels encourage the demand for education, which in turn may accentuate skilled unemployment if wages do not react to the higher supply of skills in the economy and remain high. Additionally, the wages of the unskilled tend to be pulled up by the highest wages, also encouraging unskilled unemployment. In these models, migration of skilled manpower leads to a distortion of salary levels, encouraging general unemployment and an overexpansion of educational facilities (Bhagwati and Dellalgar, 1973). Additionally, the possibility of migration inhibits the internal diffusion of skills. Bhagwati (1979: 20) illustrates this phenomenon (“brain waste”) with the example of a Filipino doctor working as a cab driver in Manila while he awaits the opportunity to pass an examination to migrate to the USA, instead of starting medical practice in his own country.

In summary, these authors conclude that skilled emigration from developing countries entails important losses for the sending economies that go far beyond the consequences of frictional temporary adjustments. This results in higher levels of public expenditures and lower welfare. More recent models have supported these conclusions. Wong and Yip (1999) build a model in which growth is endogenously determined by human capital accumulation and reduced by the human capital loss that follows migration. Pieretti and Zou (2009) challenge Grubel and Scott (1966) by focusing on the effects on per-capita income of different grades of substitutability between skilled and unskilled labour. Another possible negative effect follows from changes in the composition of human capital in sending countries. Different paths of development require different types of skills. Migration prospects may distort the agents’ incentives to accumulate the most appropriate skills for their country of origin, which reduces growth rates (Di Maria and Stryszowski, 2009). However, “modern brain drain theory” (Glytsos, 2009) challenges these conclusions by adding new dimensions to the analysis, arguing that they turn the “brain drain” into a beneficial phenomenon, an argument to which we now turn.

The beneficial brain drain, or brain gain

Alternative models to those described in the previous section argue that the overall impact of the brain drain is eventually beneficial due to internal dynamics. The important argument here is that the prospect of migration raises the expected potential returns on education and encourages workers to invest more in human capital (Stark et al., 1998). This raises the average level of human capital and the productivity levels of the economy (Stark, 2004).

The positive effects of the prospect of migration on human capital accumulation and productivity of the sending countries have been also addressed by Beine et al. (2001, 2008), Easterly and Nyarko, (2008), Kapur and McHale (2005), Mountford (1997) and Solimanos (2008). Beine et al. (2008) conduct an empirical analysis of 127 developing countries, estimating brain drain and gain effects. They conclude that, from a global perspective, the benefits to major gaining countries such as China, India and Brazil outweigh the losers’ losses. These recent studies refer to this phenomenon as beneficial brain drain or brain gain. Methodologically, these studies retain the assumptions of the prior neoclassical models and general equilibrium theory and, as pointed out above, they consider the changes in expected returns on education that the possibility of migration entails. The elements that these studies have added to the 1960s discussion are summarized in Table 2.

ASSESSING THE ECONOMICS OF THE BRAIN DRAIN: LOST FUNDAMENTALS AND AGGREGATIVE PUBLIC POLICIES

There are fundamental reasons why Tables 1 and 2 should not be merged. As pointed out earlier, the 1960s discussion summarized in Table 1 was not enclosed by general equilibrium assumptions

TABLE 2
BRAIN DRAIN AND DEVELOPMENT: THE “MAINSTREAM” DEBATE

Nationalist–pessimistic (2)	Internationalist–optimistic (2)
<p>The salary levels of the highly skilled in developed countries encourage an increase of wages in developing countries, inducing unemployment and an overexpansion of educational facilities (Bhagwati and Dellalgar, 1973). Migration prospects inhibit the internal diffusion of accumulated skills in developing countries (Bhagwati, 1979).</p> <p>Emigration reduces the endogenous growth capacity of the economy (Wong and Yip, 1999). Emigration prospects encourage a change of skill composition that may harm sending countries' economies (Di Maria and Stryszowski, 2009).</p>	<p>The losses that a country suffers from skilled emigration are only temporary and frictional. In the long term, the economy will adapt to changes or to a certain migration rate (Grubel and Scott, 1966). The prospect of migration encourages the formation of human capital, which may compensate for the loss caused by emigration (see, e.g., Beine et al., 2001, 2008; Easterly and Nyarko, 2008; Mountford, 1997; Stark, 2003; Stark et al., 1998).</p>

and, instead, assumed interconnection and complementarity among agents and production factors. In contrast, the general equilibrium–based brain drain models provide formal descriptions of human capital accumulation (or un-accumulation) dynamics, in a context in which connectivity and complementarity are not integrated. Economic growth and welfare automatically benefit from the aggregation of human capital units, which are accumulated through the training of new people within the national education system and their incorporation to the labour force or through immigration. In turn, human capital is mainly lost through emigration, retirement or mortality of skilled personnel.

The neoclassical brain drain models discussed reach different conclusions depending on which elements of these aggregative dynamics are emphasized. For example, in Bhagwati (1979), the emigration prospect *discourages* highly skilled persons from looking for a job in their home country, leading to brain drain and un/under-employment – a net human capital loss. Alternatively, in Beine et al. (2001, 2008), the emigration prospect *encourages* more persons to get tertiary level education: some of those people will then remain in the national labour force – a potential net gain in human capital.

From a policy perspective, the implications of such analyses are quite straightforward. An economy or a scientific system should *maximize* the number of highly qualified and skilled individuals as a proxy for the *accumulation* of human capital. The precise policy strategies adopted to achieve maximization would depend on the particular aggregative model considered. For example, where emigration prospects are assumed to encourage human capital formation, the ideal level of emigration might not be nil.

In Europe, a compatible policy approach has indeed emerged, promoting three main actions to achieve the accumulation objective: to train, to retain and to attract human capital (including attracting emigrants to return). The document that sets the bases for the formation of the European Research Area (CEC, 2000) clearly states that Europe suffers a brain drain (mainly to the USA) and sets the objectives of “attracting the best researchers from all over the world ... and encouraging the return to European laboratories of researchers who have left” (CEC, 2000: 19). The “train, retain, attract” policy strategy has recently been restated by the European Commission (CEC, 2007: 10), but it has been enriched by other approaches to which we will later refer.

Numerous examples may also be found of policies in developing countries where “train” and “attract back” rationales predominate. In China, overseas PhD support funded by the Chinese Scholarship Committee normally requires the recipient to return to China to work for 2 years fol-

lowing completion of their doctorate abroad. Such conditionality of international research training grants has been a common practice in Latin American countries – in Peru, for example, where the brain outflow increases while publicly funded opportunities to train abroad remain vacant due to the lack of opportunities to find a job in the country after compulsory return (Portillo, 2010). The limited success of this type of programme has been acknowledged (Villanueva, 2009). Claims have emerged for multifaceted policies in developing countries that go beyond “classical programmes” aimed at preventing outflows and encouraging the return and reintegration of emigrated specialized human capital (Tuirán, 2009). We will return to the policy debate later. These examples aim simply to illustrate the influence of the neoclassical economics of the brain drain and its aggregative approach.

In contrast, as was discussed earlier, the bases for a different vision, which were laid out on the eve of the brain drain debate, have had little apparent influence. Boulding’s (1968) description of human capital as a “structure” that resists aggregation is admittedly a methodologically challenging conception. As Loasby (2008: 50) describes,

[e]ach individual and each established connection between individuals may be regarded as a bearer of capital, but the effectiveness of each unit of capital depends on the structure in which it is embedded.

Loasby stresses the fact that human capital is not reducible to isolated individuals, and that its value depends on the structure of differentiated complementary and context dependent elements in which it is mobilized. Here, it seems that the thinking that reflected Boulding’s earlier description of human capital has re-emerged in economics discourse after a prolonged hiatus.

The lost fundamentals of complementarity and context have allowed economic thinking about the brain drain to be restricted to aggregative analyses, which we believe, are based on a simple conflation of HRST and human capital. If human capital is assumed to be embedded in individuals, without connecting its value or potential to the context in which it is mobilized, then calculating human capital can be simply equated to counting individuals. As we have outlined, this has been particularly important due to the influence of economic analyses in framing policy formation. However, these apparent limitations of the mainstream economics approach to the brain drain problematic have also opened space for literature that challenges fundamental neoclassical assumptions about human capital and emphasizes neglected social and connectionist elements. It is to this literature that we now turn.

THE (RE-)CONNECTIVE DIMENSION: DIASPORA NETWORKS

The conceptual limitations of the neoclassical economics of the brain drain have been challenged by Meyer and colleagues in their work on scientific diasporas (see Meyer, 2001, 2003; Meyer and Brown, 1999; Meyer and Charum, 1995). The stated motivation for this work was the failure of policies based on the neoclassical approach – that is, retain, attract, return – to regulate flows of the highly skilled or reduce the negative impacts on developing countries (Meyer, 2001; Meyer and Brown, 1999).

According to these authors, the policy problem follows from a theoretical failure to properly conceptualize human capital in general and, in particular, human capital devoted to scientific and technological activities. Meyer (2001: 95) argues that “brain drain approaches are semantically and historically associated” with “the human capital paradigm”, referring to the theoretical framework described in this paper as the neoclassical economics of the brain drain. This paradigm is characterized by a “substantialist view of skills as a stock of knowledge and/or abilities embedded in the individual” (Meyer, 2001: 95). Human capital is conceived as discrete and accumulated during spe-

cific periods of life (e.g. education), a conception that does not differentiate between human and physical capital (Meyer et al., 2001). The individual is conceived as a mere human capital asset (Meyer and Brown, 1999), technically independent from other economic agents and free to respond to market signals (Meyer, 2001).

Meyer and Charum (1995) stress the unreality of a theoretical world characterized by fundamental homogeneity, instantaneity and isolation of economic agents. Meyer and colleagues draw on science and technology studies that demonstrate the collective and distributed nature of cognitive frameworks, communities of practice and technical skills in highly complex fields such as scientific research and engineering. According to Meyer, “these approaches ... present individuals as being involved in knowledge-intensive activities, deeply rooted in their networks, with their own skills being historically and physically contextualised” (2001: 96).

The basic conceptual shift proposed thus consists of considering the “relational dimension of skills, which is inherent to their development as well as to their application” (Meyer, 2001: 95). Individuals are considered to be embedded in time and space and interconnected in various ways. Hence, the value and effectiveness of human capital depend on the complementarity of the human capital assembled in collectives of skilled individuals, and how it relates to other resources, including infrastructure (physical capital) (Meyer and Brown, 1999) and institutions (Meyer and Wattiaux, 2006). Human capital is therefore (re)defined as contextual and relational/connected. Meyer and colleagues refer to their own approach as being “connective”; we would argue that the underdeveloped significance of their thinking is that it points towards a theory of human capital understood as distributed rather than aggregated.

The reader will detect strong similarities between this approach and the list of “key structuring elements” characterizing the early economic debate on the brain drain in the 1960s. In fact, these authors are reintroducing fundamental ideas concerning the nature of human capital devoted to scientific activities that were already present in the early debate on the brain drain. Let us recall here that, for Boulding, Johnson or Kidd, the contextual, temporal, relational and complementary nature of human capital were the grounds on which they built their arguments regarding the brain drain. In this sense, we may talk of an interesting historical theoretical “loop” concerning the brain drain that has the particularity of being interdisciplinary.

Meyer and colleagues developed their connectionist approach through empirical investigations, notably observations of “scientific diasporas” (Barré et al., 2003) or “diaspora knowledge networks” (DKNs) (Meyer et al., 2001) as a subset of the transnational organization of scientific work. DKNs organized around national or cultural identification, such as Red CALDAS (Columbia), were found to “contribute to the development of their members’ place of origin through their skill input” (Meyer and Wattiaux, 2006: 5). DKNs were observed to be a mechanism for ongoing benefits from national investments in highly skilled human capital, subsequently located offshore, to flow back to the “home” system in various ways. Subsequently, it was argued that the DKNs’ approach “subverts the traditional ‘brain drain’ migration outflow into a ‘brain gain’ skills circulation by converting the loss of human resources into a remote although accessible asset of expanded networks” (Meyer and Wattiaux, 2006: 5).

This alternative interpretation of mobility has influenced policy programmes in several countries, which have put the stress on the “re-linking”, instead of the return, of expatriate talents in the interests of capturing benefits from human capital (Didou-Aupetit, 2009). Since the 1990s, programmes to encourage the organization of scientific diasporas have proliferated, including RAICES in Argentina, *Chileglobal* in Chile, ANA in Nigeria and ATPER in Thailand.⁷ Despite the apparent proliferation of this type of network, a “diaspora effect” contributing to scientific and technical development in the countries of origin has been put into question (Gaillard and Gaillard, 2003).

From our perspective, there does appear to be a gap between, on the one hand, a critique of the theoretical discourse of standard human capital theory, which points out the relational dimension of skills and rejects the isolationist ontology of self-contained units of human capital bounded by indi-

vidual human bodies and, on the other hand, empirical evidence of connections among individuals and networks of individuals (HRST). The use of “network” in DKN research does seem to fall back into an identification of connections between individuals as constitutive of spaces of communication and circulation. Meanwhile, the notion of human capital as distributed rather than allocated recedes from view. Unlike the conflation of human capital and HRST within the neoclassical economics of the brain drain, the DKN literature separates the two concepts, but then fails to conceive of theoretical implications in the ontological realm of human capital that might have been provoked by delineation of transnational networks of the highly skilled.

This is not to suggest that the DKN literature does not make an important contribution. There are theoretical and pragmatic difficulties inscribed in trying to develop a dialogue between a conception of distributed human capital, characterized by complementarity and context dependence, and the problematic of “gains” and “drains” of HRST between different places – particularly mobility from the developing world to the developed. The key insight that we draw from the DKN literature in relation to the problematic of the brain drain is that the mobility of human resources, in all likelihood (although not necessarily), reconfigures distributions of human capital. That such reconfigurations may be productive or destructive in their effects is contingent and requires empirical investigation, interpretation and analyses within a theoretical framework that remains, as yet, undeveloped.

The DKN literature has been influential nevertheless. Policymakers now seek an optimum combination of the “aggregative” and the “connectionist” in their policy mix (Villanueva, 2009). The EU put stress on the “train, retain, attract” policy approach only some years ago, but has recently incorporated the connectionist policy discourse by recognizing the value of European researchers working in the USA and the need to build links with them (CEC, 2005).⁸ Many of the newly industrialized countries in the Asian region have long recognized the value of “offshore” stocks of human capital (diasporas) (Saxenian, 2005; Song, 1997). Importantly, many policies in the Asian region now target short-term or temporary stays to enable “home” countries to leverage knowledge and learning from their offshore nationals. The freedom to continue to circulate professionally and maintain concurrent commitments overseas has also been a particularly crucial factor in encouraging the contribution of foreign-based scientists in the case of China (Zweig, 2007). The contemporary policy mix thus seeks to combine a competitive “war for talent” (Kapur and McHale, 2005) rationale with a collaborative connectionist approach designed to leverage human capital located offshore. An expansion in the theoretical framing of the brain drain and subsequent diversification of policy design can therefore be discerned.

However, many of the limitations of contemporary approaches remain relatively unchanged since Boulding’s 1960s argument. The concepts of human capital and HRST are largely entangled and interchangeable in discourse. The configuring of human capital by its context, its location within the “matrix of information flows” and hence its potential for adaptation and evolution has been eclipsed by the accounting for stocks and flows of researchers and, more recently, identifying connections between them. The challenge for theory beyond the economics of the brain drain is thus precisely to be able to describe the complex dynamics of human capital mobilization and distribution, without being again seduced by the relatively straightforward visibility and calculability of units and aggregates of human resources.

TOWARDS A SOCIO-ECONOMICS OF DISTRIBUTED HUMAN CAPITAL

Our major undertaking in this paper was a review of contributions made by the early thinkers on the brain drain. We have pointed out that fundamental elements of the early debate, specifically the complementarity and context dependency of human capital, were subsequently lost. This allowed the economics of the brain drain to become enclosed for almost four decades within the legacy of

mechanical thinking (Dopfer, 2005). The mechanistic paradigm, by assuming the independence of economic agents, treats the contribution of human capital – and therefore its economic value – as almost constant regardless of the context in which it is applied and of the other entities to which it relates. Only the concept of externalities allows a very limited consideration of its social effects. Accumulation of human capital is then *the* dynamic that matters.

We pointed out the conflation of the category of HRST and the concept of human capital, enabling economic calculations in which individuals and human capital are effectively equivalent units. The subsequent emergence of technically sophisticated models and calculations that characterize mainstream economic analyses of the brain drain then demonstrates the utility of the approach. By measuring the dynamics of the allocation of human capital using the proxy of movements of persons across national frontiers, a calculable object is forged, entrenching the power and persuasiveness of a particular analytical paradigm. We would argue that the seductiveness of complex calculations in buttressing the mechanistic paradigm has much to do with the way in which the brain drain problematic has been framed and “managed” in recent decades.

Such an approach could perhaps be justified if it was explicitly argued that human resources and human capital were interchangeable, and that no “extra-individual” attributions could be attached to human capital. However, quite the opposite is the case. Our review of the early debate in economics and of Meyer and colleagues’ arguments suggest an alternative formulation of the contribution of human capital to social and economic development, in which both the complementarity of heterogeneous human capital and the contexts of its use are emphasized. Human capital would be addressed from a systemic perspective that considers its interdependencies with other production factors and its changing and dynamic role in economic and social structures. Human capital should not be conceptualized as an aggregate (like HRST) but as distributed across heterogeneous structures embedded in time and space; variably context dependent and therefore not automatically transferable; and complementary to other assets that make it valuable. A theory built around these fundamentals would reframe the study of HRST mobility by focusing on the alteration of human capital structures it may induce, without assuming *a priori* any aggregative or loss effects.

Understood this way, the exercise of calculating national allocations of highly skilled HRST is of only limited use in understanding the dynamics of mobilization of human capital for scientific research and socio-economic development; activities that are complex, collective and organized across and beyond national frontiers. Crucially, the utility of human capital for any potential beneficiary is not necessarily delimited by the geographical location of individuals, collectives or parts thereof. However, whilst it has been relatively straightforward to calculate national stocks and net flows of human resources as if they were the outcome of consistent market processes, it appears extremely challenging to map distributions of human capital mobilized for the production and/or use of knowledge, to understand how these structures are reconfigured by HRST mobility, and to calculate what impact these reconfigurations have from the perspectives of interested parties.

The diaspora studies that we reviewed earlier foregrounded the distributed nature of productive collectives and the relational dimensions of skills and human capital. These are fundamentals that are important for renewed brain drain studies. However, the diaspora approach was also limited by its own reinscribing of homogeneity – of culture and/or national interest – within its networks. This is in contrast to wider diaspora scholarship, which is more likely to conceptualize diaspora “in terms of hybridity, *métissage* or heterogeneity” (Braziel and Mannur, 2003: 6). Thinking about distributed human capital in such terms refers us to spatially unbounded processes of creativity, emergence, (re-)combination and *bricolage*. Hybridity and heterogeneity – of objectives, interests, organization and people – replace simple dichotomies of home/abroad, national/international and loss/gain. Vectors of change forged by the dynamics of human capital, which mobilize knowledge,

skill, learning and investment across particular material and institutional contexts, ultimately underpin emergent socio-economic innovation and development.

NOTES

1. See, for example, the discussions and references in the “brain drain” section of the Science and Development Network website, at <http://www.scidev.net>
2. Boulding made his early contributions to the brain drain debate in the 1960s, but it was not until the 1980s that he fully elaborated his evolutionary theory of economics. Evolutionary economics emerged in the decade of the 1980s as an alternative to the dominant neoclassical paradigm, particularly in relation to the study of the economic dynamics induced by innovation processes and technical change. For example, Dopfer (2005: 17) reviews the main empirical axioms of what he calls “an evolutionary ontology”. Among these axioms are: “the recognition of relations and connections”, that generate “associations” and therefore “structures”, and the recognition of “existences as process”; a process is conceived as “structure in time”.
3. Bhagwati and Hamada (1974) point out that if finite instead of infinitesimal shifts of labour are considered, emigration will cause a loss to those left behind. However, depending of the size of the emigration and the nature of the production function, this loss may still be very small.
4. Despite the acknowledgement of external effects, in the neoclassical tradition human capital units remain fundamentally unrelated. The connection among them is only partially captured through the concept of externalities. This concept simply reflects the idea that the market is not able to fully capture the value generated through social interactions, but does not permit us to address the nature of those interactions and of the social value created.
5. According to Becker (1993 [1964]: 346), this explains why the brain drain of educated and skilled persons almost invariably occurs from poorer to richer countries.
6. Grubel and Scott’s 1966 paper encouraged some critical reactions from scientists, published in a letters section on the “Brain Drain Dilemma” in *Science*, 154(3752).
7. See <http://www.raices.mincyt.gov.ar>, <http://www.chileglobal.org>, <http://www.ananet.org> and <http://www.apter.org>. For a thorough review of the DKNs operating at the end of the 1990s, see Barré et al. (2003).
8. Global initiatives have also emerged, such as Transfer of Knowledge through Expatriate Nationals (TOK-TEN), from the United Nations Development Programme.

ACKNOWLEDGEMENTS

Preliminary versions of this paper were presented at the International Workshop “Mobility, Science and Culture” (Braga, February 2010), the 8th GLOBELICS International Conference (Kuala Lumpur, November 2010) and the Macquarie University Skilled Labour and Migration Group (Sydney, November 2010). The authors would like to thank the colleagues and discussants that provided feedback in these fora. In particular, they are grateful to Claudia de Fuentes and to Jordi Molas for their careful reading of the draft and their useful comments. The authors were grateful recipients of funding from the International Science Linkages Program of the Academy of the Social Sciences in Australia and the Australian Department of Industry, Science and Research, which directly supported this work.

REFERENCES

- Ackers, L.
2009 *Moving People and Knowledge: Scientific Mobility in an Enlarging European Union*, Edward Elgar, Cheltenham, UK.
- Barré, R., V. Hernandez, J-B. Meyer and D. Vinck (Eds)
2003 *Scientific Diasporas*, IRD Editions, Paris.

- Becker, G.
1993 [1964] *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, National Bureau of Economic Research, New York.
- Beine, M., F. Docquier, and H. Rapoport
2001 “Brain drain and economic growth: theory and evidence”, *Journal of Development Economics*, 64: 275–289.
2008 “Brain drain and human capital formation in developing countries: winners and losers”, *The Economic Journal*, 118(April): 631–652.
- Bhagwati, J.N.
1979 “International migration of the highly skilled: economics, ethics and taxes”, *Third World Quarterly*, 1(3): 17–30.
- Bhagwati, J., and W. Dellalgar
1973 “The brain drain and income taxation”, *World Development*, 1: 94–100.
- Bhagwati, J., and C. Rodríguez
1975 “Welfare theoretical analyses of the brain drain”, *Journal of Development Economics*, 2: 195–221.
- Bhagwati, J., and K. Hamada
1974 “The brain drain, international integration of markets for professionals and unemployment: a theoretical analysis”, *Journal of Development Economics*, 1(1): 19–42.
- Boulding, K.E.
1966 “The economics of knowledge and the knowledge of economics”, *Richard T. Ely Lecture, American Economic Review*, 56(1/2): 1–13.
1968 “The ‘National’ importance of human capital”, in W. Adams (Ed.), *The Brain Drain*, Macmillan, New York, Chapter 7: 109–119.
1973 [1956] *The Image*, The University of Michigan Press, Ann Arbor, MI.
1981 *Evolutionary Economics*, SAGE Publications, Beverly Hills, CA.
1991 “What is evolutionary economics?” *Journal of Evolutionary Economics*, 1: 9–17.
- Braziel, J.E., and A. Mannur (Eds)
2003 *Theorizing Diaspora*, Blackwell, Oxford.
- CEC
2000 “Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions: towards a European Research Area”, *COM* (2000)6, 8 January, Commission of the European Communities, Brussels.
2005 “Commission staff working document: Implementation Report 2004 on “A mobility strategy for the European Research Area” and “Researchers in the ERA: one profession, multiple careers”, *SEC* (2005)474, 6 April 2004, Commission of the European Communities, Brussels.
2007 “Green paper. The European Research Area: new perspectives”, *COM*(2007)161 final, 4 April, Commission of the European Communities, Brussels.
- Di Maria, C., and P. Stryszowski
2009 “Migration, human capital and economic development”, *Journal of Development Economics*, 90: 306–313.
- Didou-Aupetit, S.
2009 “¿Pérdida de cerebros y ganancia de saberes?: la movilidad internacional de recursos humanos altamente calificados en América Latina y el Caribe”, in S. Didou-Aupetit and E. Gérard (Eds), *Fuga de cerebros, movilidad académica, redes científicas: perspectivas latinoamericanas*, IESALC–CINVESTAV–IRD, Mexico: 25–62.
- Dopfer, K.
2005 “Evolutionary economics: a theoretical framework”, In K. Dopfer (Ed.), *The Evolutionary Foundations of Economics*, Cambridge University Press, Cambridge, UK: 3–55.
- Easterly, W., and Y. Nyarko
2008 “Is the brain drain good for Africa?” *Global Economy and Development Working Paper* no. 19, Brookings Global Economy and Development, the Brookings Institution, Washington, DC.
- Favell, A., M. Feldman, and M. Smith
2007 “The human face of global mobility: a research agenda”, *Social Science and Modern Society*, 44 (2): 15–25.

- Gaillard, A.M., and J. Gaillard
2003 "Can the scientific diaspora save African science?" Opinions. Science and Development Network, 22 May, <http://www.scidev.net> (accessed 19 October 2011).
- Glytsos, N.P.
2009 "Theoretical considerations and empirical evidence on the brain drain grounding the review of Albania's and Bulgaria's experience", *International Migration*, 48(3): 108–130.
- Grubel, H.B., and A.D. Scott
1966 "The international flow of human capital", *The American Economic Review*, 56(1/2): 268–274.
- Hart, D.M.
2007 "Understanding immigration in a national systems of innovation framework", *Science and Public Policy*, 34(1): 45–53.
- Hayek, F.
1945 "The use of knowledge in society", *American Economic Review*, XXXV(4): 519–530.
- Johnson, H.G.
1965 "The economics of the 'brain drain': the Canadian case", *Minerva*, 3(3): 299–311.
1968 "An 'Internationalist model'", in W. Adams (Ed.), *The Brain Drain*, Macmillan, New York, Chapter 5: 69–91.
- Kapur, D., and D. McHale
2005 *Give Me Your Best and Your Brightest*, Center for Global Development, Washington, DC.
- Kidd, C.V.
1965 "The economics of the brain drain", *Minerva, Correspondence*, 4(1): 105–107.
- Krishna, V.V., and B. Khadria
1997 "Phasing scientific migration in the context of brain gain and brain drain in India", *Science, Technology and Society*, 2(2): 348–385.
- Loasby, B.J.
2008 "Los microfundamentos de las capacidades organizativas", in C. Cañibano, M.I. Encinar and F. Muñoz (Eds), *Economía del conocimiento y la innovación: nuevas aproximaciones a una relación compleja*, Pirámide, Madrid: 35–58.
- Meyer, J-B.
2001 "Network approaches versus brain drain lessons from the diaspora", *International Migration*, 39(5), Special Issue 1: 91–110.
2003 "Policy implications of the brain drain's changing face", Policy Briefs, Science and Innovation Policy, Science and Development Network, 1 May, <http://www.scidev.net> (accessed 19 October 2011).
- Meyer, J-B., and M. Brown
1999 "Scientific diasporas: a new approach to the brain drain", MOST Discussion Paper No. 41, <http://www.unesco.org/most/meyer.htm> (accessed 19 October 2011).
- Meyer, J-B., and J. Charum
1995 "La 'fuite des cerveaux' est-elle épuisée? Paradigme perdu et nouvelles perspectives", *Cahiers des Sciences Humaines*, 31(4): 1003–1017.
- Meyer, J-B., and J-P. Wattiaux
2006 "Diaspora knowledge networks: vanishing doubts and increasing evidence", *International Journal of Multicultural Societies*, 8(1): 4–24.
- Meyer, J-B., D. Kaplan, and J. Charum
2001 "Scientific nomadism and the new geopolitics of knowledge", *International Social Science Journal*, 53(168): 309–321.
- Morano-Foadi, S.
2006 "Key issues and causes of the Italian brain drain", *Innovation: The European Journal of Social Sciences*, 19(2): 209–223.
- Mountford, A.
1997 "Can a brain drain be good for growth in the source economy?" *Journal of Development Economics*, 53: 287–303.
- Patinkin, D.
1968 "A 'Nationalist' model", in W. Adams (Ed.), *The Brain Drain*, Macmillan, New York: Chapter 6, 92–108.

- Pieretti, P., and B. Zou
2009 "Brain drain and factor complementarity", *Economic Modelling*, 26: 404–413.
- Portillo, Z.
2010 "Científicos lamentan el estado de la ciencia en Perú", Noticias, Science and Development Network, 15 January, <http://www.scidev.net> (accessed 19 October 2011).
- Saxenian, A.
2005 "Brain circulation and capitalist dynamics: Chinese chipmaking and the Silicon Valley–Hsinchu–Shanghai triangle", in V. Nee and R. Swedberg (Eds), *The Economic Sociology of Capitalism*, Princeton University Press, Princeton, NJ.
- Schultz, T.
1961 "Investment in human capital", *The American Economic Review*, 51(1): 1–17.
1963 *The Economic Value of Education*, Columbia University Press, New York.
- Skeldon, R.
2009 "Of skilled migration, brain drains and policy responses", *International Migration*, 47(4): 3–29.
- Solimanos, A.
2008 *The International Mobility of Talent*, Oxford University Press, Oxford.
- Song, H.
1997 "From brain drain to reverse brain drain: three decades of Korean experience", *Science, Technology and Society*, 2(2): 317–345.
- Stark, O.
2004 "Rethinking the brain drain", *World Development*, 32(1): 15–22.
- Stark, O., C. Helmenstein, and A. Prskawetz
1998 "Human capital depletion, human capital formation, and migration: a blessing or a 'curse'?" *Economic Letters*, 60: 363–367.
- Tuirán, R.
2009 "Prefacio", in S. Didou-Aupetit and E. Gérard (Eds), *Fuga de cerebros, movilidad académica, redes científicas: perspectivas latinoamericanas*, IESALC–CINVESTAV–IRD, Mexico: 11–14.
- US House of Representatives, Committee on International Relations
1977 "Brain drain: a study of the persistent issue of international scientific mobility", in *Science, Technology, and American Diplomacy, three volumes*, US Government Printing Office, Washington, DC: Chapter 13, 1037–1318.
- Villanueva, E.
2009 "Conclusiones", in S. Didou-Aupetit and E. Gérard (Eds), *Fuga de cerebros, movilidad académica, redes científicas: perspectivas latinoamericanas*, IESALC–CINVESTAV–IRD, Mexico: 233–243.
- Williams, A.M.
2007 "International labour migration and tacit knowledge transactions: a multi-level perspective", *Global Networks*, 7(1): 29–50.
- Wong, K., and C.K. Yip
1999 "Education, economic growth and brain drain", *Journal of Economic Dynamics and Control*, 23: 699–726.
- Zweig, D.
2007 "To return or not to return? Politics vs. economics in China's brain drain", *Studies in Comparative International Development*, 32(1): 92–125.