

- History of the Microscope. "Anton van Leeuwenhoek: A History of the Compound Microscope." (2010). <http://www.history-of-the-microscope.org/anton-van-leeuwenhoek-microscope-history.php> (Accessed June 2012).
- Kahneman, Daniel and Amos Tversky. "The Psychology of Preferences." *Scientific American* (January 1982).
- Klaes, Matthias. "A Conceptual History of the Emergence of Bounded Rationality." *History of Political Economy*, v.37/1 (2005).
- O'Neal, John R. "The Rationality of Decision Making During International Crises." *Polity*, v.20/4 (1988).
- Selye, Hans. "The General Adaptation Syndrome and the Diseases of Adaptation." *Journal of Clinical Endocrinology and Metabolism*, v.6/2 (1946).
- Simon, Herbert A. "Bounded Rationality." In *The New Palgrave: A Dictionary of Economics*, J. Eatwell, M. Milgate, and P. Newman, eds. Vol. 1. London: Macmillan, 1987.
- White, Mark J. "New Scholarship on the Cuban Missile Crisis." *Diplomatic History*, v.26/1 (2002).
- Zeev, Marov. "A Behavioral Model of Dispute Escalation." *International Interactions*, v.10/3-4 (1983).

Brain Drain

The term *brain drain* refers to the migration of skilled workers and their families to other countries or regions. Human capital flight is primarily from developing countries to industrialized or oil-rich countries, but its effects are also a concern in some industrialized countries. Brain drain can be long term, such as decades of emigration from African nations, or form a rapid crisis such as the emigration from East Germany to West Germany between 1945 and 1961 in which 20 percent of the population, mostly skilled, resettled.

Social Factors Driving Brain Drain

Brain drain is driven by demand for skilled labor. Underlying social factors that motivate brain drain include poverty, economic depression, low pay, currency devaluation, crisis and conflict, political chaos and corruption, crime, falling

educational standards, inadequate infrastructure, services and health care, and environmental collapse. Host countries attract skilled workers with their robust economic outlook, higher salaries, quality schools, strong infrastructure and services, and social stability and mobility. Sixty percent of world migrants move to developed countries; the remainder is between developed countries. There is limited migration from developed countries to developing ones. Ninety percent of highly skilled migrants live in the nations of the Organization for Economic Co-operation and Development; of this population, 85 percent live in the United States, Canada, Australia, the United Kingdom (UK), Germany, and France. Seventy percent of temporary migrants in the United States are highly skilled, whereas they form only 40 percent in the UK and Canada and 15–30 percent in France.

This asymmetrical skill flow is attributed to the lower linguistic adjustment required of migrants moving into countries where the lingua franca English is spoken. Brain drain severely impacts sub-Saharan Africa, Caribbean islands, India, China, Vietnam, Pakistan, Indonesia, and former Soviet states. Key industries damaged by brain drain include health and medicine, business services, banking and finance, computers and information technology, and industrial high tech. Between 1990 and 2000, international migration expanded by 14 percent, and the result was an increase from 154 million to 175 million people living in host nations. The brain drain is more extensive today than two decades ago because skill-selective immigration policies in Australia, New Zealand, Canada, and the United States attract the top workers.

Crisis and Political Influence

Crises or major political shifts encourage brain drain. For example, due to political upheaval between 1989 and 1997, 233,000 South Africans permanently emigrated to the UK, the United States, Canada, Australia, and New Zealand. Due to economic and environmental problems, 80 percent of skilled workers have left the small Caribbean-basin countries of Guyana, Jamaica, Haiti, Grenada, and St. Vincent and the Grenadines, producing one of the most brain-drained regions in the world.

Migration is motivated by the income differential between developing and industrialized countries. Nigerian medical schools and hospitals have lost many of the most talented practitioners because they receive far better salaries in countries like Saudi Arabia. Working conditions and equipment in developing countries are often inadequate, leaving human talent and potential underutilized. Engineers, scientists, and researchers from India, China, and Korea have moved to countries like the United States in great numbers to take advantage of better pay, benefits, and living conditions. Migration networks form and stimulate community migration; a sequential migration chain emerges, with settled migrants housing new arrivals. Generalized reciprocity supports migrants until they are self-sufficient.

Positive Outcomes

Positive effects of migration include an overall improvement in migrant child health outcomes, lower infant mortality, and greater birth weights; however, migrant infants were less likely to be breast-fed and vaccinated. Feedback effects like money remittances stimulate migration, and they represent an important source of income in many developing nations. Remittances form the largest external input on the economy of Haiti, for example. However, most benefits from migration are internalized in the host nation, and money remittances only trickle back. Money remittances are usually spent on consumer goods and not placed in productive investments that act as multipliers. Return migration of individuals with new skills represents potential gains. The establishment of business networks in source and host nations can stimulate trade and the flow of knowledge. Overall, however, the negative effects of brain drain exceed the positive aspects of "brain gain" when one considers how the acquisition of language skills slows the productivity of the newly arrived, especially in non-lingua franca host countries. Plus, many skilled migrants are hired to do menial work for which they are overqualified, resulting in "brain waste." Incomes for brain waste jobs are lower, and educational assets are left fallow.

Negative Outcomes

The brain drain has negative impacts in source countries. Economic costs include government

spending on training individuals who migrate with skills acquired at taxpayer expense. Middle- and low-income countries are left with a smaller number of workers possessing a tertiary education compared to high-income countries. The loss of creative and entrepreneurial professionals slows job creation and impedes efficiency. When parents emigrate and leave their children behind, the children's educational attainment is lower. Brain drain also diverts attention away from domestic problems and investment because professionals orient their skills and resources to other nations. The departure of skilled professionals results in the loss of international recognition in institutions, the overworking of those who remain, the use of under- or less-qualified replacement workers, weaker modeling in the workplace, and the erosion of morale in postgraduate education, and, in the context of health care, has negative implications for the health of the citizenry. The brain drain results in the loss of present and future savings, collected taxes, taxpayer investment in education, and sources of leadership.

Mitigation of Brain Drain

Various methods can mitigate the stresses caused by brain drain. Governments may increase the net incomes of the highly skilled and decrease the redistributive taxation that operates at their expense. If governments want to keep the highly skilled and the system of redistributive taxation, education and public discourse need to persuade citizens that taxation is beneficial for the common good. Proactive policies that recruit skilled foreigners can help turn brain drain into brain gain. While it may be desirable to offset brain drain losses with open immigration policies, in many states this incites nationalist anti-immigration sentiments. Government bureaus that only handle skilled personnel may offset this hostility.

Host countries can support education in source countries with money and expertise in critical areas so that individuals need not settle abroad for education. Source enterprises can upgrade human resources by offering training. Host and source countries can also require temporary migration with circulation back to the source country. Governments can produce more high-skills graduates and improve living conditions through security and economic opportunity. As women have lower

migration potential than men, affirmative action on the basis of gender may be considered. Placing limits on the amount of currency that can be taken out of a country may also diminish the attractiveness of migrating.

Strengthening loyalty can be accomplished by cultivating community bonds and breaking the culture of anonymity so that there is an emotional cost to emigration. Citizens will stay if they are proud of their nation's political, legal, economic, educational, and social institutions. Another policy that may slow brain drain outside the Anglophone world is the affirmation of linguistic territoriality wherein the national language is prioritized over the English lingua franca. Governments can assert the dominance of the territorial languages throughout public education. Host governments can impose compulsory education in the national language and culture to encourage assimilation.

Corruption, nepotism, and the lack of accountability need to diminish just as law, order, meritocracy, and justice need to increase in the source country. To stem the loss of health care professionals in developing countries, providers need to be better remunerated, restrictions on private practice lifted, a stable currency exchange rate adopted, interest rates on loans regulated downward, budgetary allocations for health care increased, and more scientific research projects funded; medical education should shift its emphasis from curative to preventative medicine to increase regional relevance and decrease advantages on the international market. The government can also regulate professionals who seek international opportunities in order to negotiate the migrant's length of stay abroad, and temporary or permanent returnees should be encouraged to share their skills and knowledge.

Benjamin Hebblethwaite
University of Florida

See Also: Immigration; Interdependence; Mutual Aid and Assistance; Poverty; Scenario Planning.

Further Readings

Crush, Jonathan, David McDonald, and Vincent Williams. *Losing Our Minds: Skills Migration and the South African Brain Drain*. Cape Town, South Africa: Idasa, 2000.

Docquier, Frédéric and Abdeslam Marfouk.

"International Migration by Education Attainment, 1990–2000." In *International Migration, Remittances and the Brain Drain*, Çağlar Özden and Maurice Schiff, eds. Washington, DC: World Bank and Palgrave Macmillan, 2006.

Dodson, Belinda. *Gender and the Brain Drain From South Africa*. Cape Town, South Africa: Idasa, 2002.

Lien, Donald and Yan Wang. "Brain Drain or Brain Gain: A Revisit." *Journal of Population Economics*, v.18/1 (2005).

Mbanefoh, Nkechi. *Dimensions of Brain Drain in Nigeria*. Ibadan, Nigeria: Nigerian Institute of Social and Economic Research, 1992.

Stepick, Alex. *Pride Against Prejudice: Haitians in the United States*. Needham Heights, MA: Allyn & Bacon, 1998.

Tapsoba, J. M. S., ed. *Brain Drain and Capacity Building in Africa*. Addis Ababa: United Nations Economic Commission for Africa, 2000.

Bridges

Bridges are essential engineered and constructed structures that support elevated roadways for transporting vehicles, trains, and foot traffic over waterways, roads, valleys, and transportation obstacles such as cities and railway yards. The safety of bridges is often taken for granted by the public, and bridge failures that result in mass casualties have been rare until the last decade. Bridges in many parts of the world are aging and have outlived their engineered life spans and need to be replaced or retrofitted. Thousands of obsolete bridges remain in use. Obsolete bridges are often structures that were constructed over a century ago; they may not be unstable but they are not capable of sustaining the weight loads of today's vehicles, nor can they provide the multiple lanes needed to support the increasing volume of traffic. Bridges also provide terrorists with targets of opportunity.

Recent Bridge Engineering Research Findings

In 2009, the American Society of Civil Engineers (ASCE) issued findings on the safety of critical