THE ECONOMIC VALUE OF RELOCATION OF EXPERTS ON A SHORT-TERM BASIS

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Abstract

Global corporate relocation refers to a phenomenon of the global mobility of experts. Modern industries and services increasingly rely on human expertise to add value to their operations. When this expertise is not available locally, employers frequently import it from abroad. In this article we refer to experts who are being relocated to other countries for a limited period of time, up to two or three years. The relocation of experts' relocation contributes to a country's economy in both the Micro Level and the Macro Level.

The **Micro Level** refers to the immediate and close impact. Experts may have a large effect on the close environment, such as creating new jobs for locals.

We propose some measurement tools to quantify the economic effects. These tools include the quantity of new jobs, which have been created due to the foreign experts and the relocation costs for companies, which serve as the lower bound to the value of the relocation of experts to companies.

An example is a World Bank project in Kyrgyzstan (1998 – 2004), conducted in order to prevent and repair flood damage. 53 foreign experts stayed there for a total of 61 staff weeks. Thanks to those foreign experts, about 3000 local new jobs were created, equal to about 400 man-years of local workers.

According to a research conducted by Salt, Mervin and Shortland, 1993, the average cost of relocation of an English expert is about $131,000.

The **Macro Level** refers to broader effects – how does the whole country benefit and what are long-term effects? A possible quantification tool could be the effect of bringing foreign experts on the unemployment rate.

Singapore, with rules and regulations that encourage the relocation of foreign experts to the country, is an excellent test bed to examine the impact of foreign experts on the local economy.

Based on empirical data, it was found that a 1% increase in the number of foreign skilled workers in Singapore increases the employment rate of local skilled workers 1.9% and unskilled local workers' rate by 0.2%. Furthermore, out of a total of 7.79% average growth per quarter in GDP between the years 1991 – 2000, foreign skilled workers contributed about 37%.

These and additional findings show us the tremendous impact that an open door policy for foreign experts can contribute to local economies.

The Definition of FOREIGN EXPERTS

The relocation of experts refers to the phenomenon of global mobility of experts. In this work, the term EXPERTS refers to top executives, executives, experts or crucially-needed professionals, who are moved from their home country and stationed in another country for a specific mission, for a limited period of time.

There is no agreed concept or definition of 'highly skilled'. It is clear, though, that they do not constitute a homogeneous group, although in broader terms, they may be described as professional, managerial and/or technical specialists. Some researches assume that many experts have a third degree or its equivalent.

The ability to perform in a highly skilled capacity is sometimes linked to previous experience, or to a combination of experience and formal qualification, such as an MBA degree.[1]

Migration – The Phenomena

Migration could be either on a temporary or a permanent basis and is certainly a highly sensitive political issue, which requires careful management.

Temporary immigrant workers are those who come for a limited period of time and when that time ends leave the country. The period of time they come for is usually known in advance, although it can often be extended. Permanent migration is for an unlimited period of time.

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[1] "International movements of the highly skilled" - An OECD report – Directorate for education, employment, labor and social affairs – International migration unit-occasional papers N°3, 1997.

MIGRANTS AS A PERCENTAGE OF POPULATION, 1965–2000

	1965	1975	1985	1990a[2]	1990b	2000
World	2.3	2.1	2.2	2.3	2.9	2.9
Emigrant regions						
Asia	1.7	1.3	1.4	1.4	1.6	1.4
North America	6	6.3	7.8	8.6	9.8	13
Europe	2.2	2.7	3	3.2	6.7	7.7
Oceania	14.4	15.6	16.9	17.8	18	19.1
W. Europe	3.6	4.9	5.8	6.1	8.6	10.3

Source: Hatton and Williamson, 2004b, Table 1.
International economics program IEP BP 05/01, Temporary Immigration: A Viable Policy for Developed Countries, by Paola Subacchi. Chatham House The Royal Institute of International Affairs.

Migration of Experts on a Permanent Basis

Three main reasons for **migration** of highly skilled experts **on a permanent basis** include:

1. Brains who migrate because of the collapse of their sectors. For them the main reasons for migration could be: (a) Poor economic situation of domestic scientific sectors in their home country; (b) Inferior scientific environment and equipment and limited accessibility to knowledge and information.

2. Ethnic or political suppression

3. Students associated with the acquisition of academic education, and skills associated with teaching and research.

Migration of Experts on a Short-Term Basis

In recent years there has been growing recognition of the importance of international recruitment and movement of highly skilled employees. The main cause for migration of experts is economic. Modern industries and services increasingly rely upon the acquisition, deployment, and use of human expertise as the main source of creating value for their operations. When this expertise is not available locally, employers frequently import experts from abroad. In many cases this is on a short-term basis, and takes the form of a limited period assignment, usually up to two or three years.

Our work is focused on this segment.

The flow of highly skilled workers today reflects the global expansion of world trade, the international expansion of multi-national corporations, and the activities of

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[2]There are differences of definition in the figures for 1965-90a and 1990b-2000. The most important difference is due to the break-up of the Soviet Union.

institutions, such as governments and international recruitment agencies. Increasingly, the highly skilled are moving more freely, as work permit systems have changed to accommodate the global search for expertise. In most countries, apart from a few countries which encourage the migration of experts, usually several ministries and government agencies are responsible and deal with the experts' migration issues. Decisions are taken by different elements in the governmental apparatus, with different ministries responsible for different considerations in selection, leading to difficulties in coordination.

The immigration of non-EU highly skilled staff to the UK, for example, may involve three Government departments: Home Office, Foreign and Commonwealth Office, Department for Education and Employment.[3]

To maximize the benefits from the relocation of experts, governments must put a greater emphasis on this issue.

Quantifying the Economic Value of the Relocation of Experts on a Short-Term Basis

Multi-national companies and governments are relocating experts on a short-term basis. It is assumed that the decisions and actions of these entities are based on economic assessment. The consequences of their decisions and actions are supposed to create some economic value and as such, and can be evaluated by applying economic quantifying methods.

In many cases, bringing experts from abroad is crucial, since these experts have specific knowledge and know-how, and without it, projects might take longer, cost more, or even be canceled.

The economic contribution of these experts is reflected in specific projects – at the **Micro Level** and at a national level – the **Macro Level**. The following part of our work will describe proposed methods for quantifying the economic benefits resulting from using foreign experts on a short-term basis.

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[3]International movements of the highly skilled" - An OECD report – Directorate for education, employment, labor and social affairs – International migration unit-occasional papers N°3, 1997.

1.   The Micro Level - The Project / Company Level

The Micro Level is the economic impact of a project on the close environment.

A proposed quantifiable indicator could be the creation of new jobs that are attributable to the activity and contribution of a foreign expert to the project. The selection of this quantifier is based on an assumption that the participation of the foreign expert is crucial to the project, and without him or her, the project might take much longer, will cost more, or even be canceled.

An example could be taken from a recent World Bank flood prevention emergency project, conducted in Kyrgyzstan during the years 1998-2004[4].

In the early summer of 1998, several major rivers in southern Kyrgyzstan experienced their greatest flood levels since 1927, when recording flood levels began.   The objective was "to improve and secure the sustainability of infrastructure facilities, which, if unattended, could lead to loss of human life and economic losses". For this emergency the project was to rehabilitate or reconstruct damaged flood protection infrastructure along rivers and irrigation infrastructure to prevent losses expected from a river changing its course and eroding inhabited river banks during another flood.

The government of Kyrgyzstan led the project. IDA[5] assisted by modifying the allocation of funds under its ongoing IRP[6] to provide up to US $4 million for post-flood works to reconstruct the most severely damaged levee sections along the Kugart River and clean the Kugart River of sediment close to Suzak. In addition, IRP funds allowed the repair of head works of four irrigation schemes. About US $3 million IRP funds were used.

Supervision missions were regular, normally conducted in association with supervision and/or preparation missions for IRP and/or OIP[7]. The missions were small, typically with 2-4 members and lasted about 2 weeks in general. The project involved **53 experts**, who **spent a total of 61 staff weeks**. Many of the contractor's staff and management gained experience in good standards of construction work as well. Additional benefits of the project for the local population in the settlements where project works were carried out were that an estimated **3,000 local laborers**

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[4]Implementation completion report on a credit to the Kyrgys republic for a flood emergency project, September 16, 2004. (report No: 29944 KG)
[5]IDA - International Development Association
[6] IRP - irrigation Rehabilitation Project
[7]OIP - On-farm irrigation project

were involved for extended periods during construction, and the local employment for construction works under the project was estimated at **about 400 man-years**.

We can conclude if we take 53 experts who spent 61 weeks on the project, equivalent to 1.17 man-years of a foreign expert that **one man-year of a foreign expert's work** created or was a catalyst for **341 man-years of** local workers.

Another quantifiable indicator of a value created by international experts is **the amount of money that employers are ready to invest on relocation**. It is assumed that the employer will invest in the costly relocation of an expert only if the economic benefits resulting from such relocation are greater than the cost of the relocation. Therefore**, the cost of relocation for an expert could serve as the lower bound** for the economic benefit.

According to a study by Salt, Mervin and Shortland, 1993, it is estimated that the average net overseas cost per English executive was about **£87 500 (US$ 131,250)** per year. Based on this estimate, companies in the UK spend about £4.2 billion (US$ 6.3 billion) per year on moving their highly skilled staff.

Information on the magnitude of corporate transfer activity carried out by US companies is available from a survey of a sample of 180 of its members done by the US Employee Relocation Council[8], 1993. In 1992 respondent companies transferred an average of 18 employees out of the US and repatriated 15. The average length of assignment was 18 months, with 40% being abroad for 2-3 years. The average number of employees out on assignment was 68 per company. Assuming similar costs as for UK, the annual expatriation cost per US company who participated in this survey would be about US $9 million.

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[8] The Employee Relocation Council (E-R-C) is a professional membership association of organizations concerned with domestic and international employee transfer. Current membership includes 1,200 representatives from corporations that relocate their employees, as well as nearly 11,000 individuals and companies from the relocation industry such as real estate appraisers and brokers, area and personal counseling services, consulting services, etc.

Inflows of Professional/Managerial and Manual/Clerical Migrants to the UK 1980-1994

	Professional and Managerial		Manual and Clerical		Total	
	Thousands	%	Thousands	%	Thousands	%
1980	44.5	57.9	32.4	42.1	76.9	100
1981	45.2	65.8	23.5	34.2	68.7	100
1982	43.7	53.6	37.8	46.4	81.5	100
1983	55.3	60.6	36	39.4	91.3	100
1984	55.8	65	31.7	35	90.5	100
1985	65.4	66.9	32.4	33.1	97.8	100
1986	76.2	62.3	46.1	37.7	122.3	100
1987	63.1	56.5	48.6	43.5	111.7	100
1988	66.7	60.4	43.8	39.6	110.5	100
1989	75.5	60.7	48.8	39.3	124.3	100
1990	93.1	63.7	53.2	36.3	146.3	100
1991	80.5	58.9	56.1	41.1	136.6	100
1992	60.6	58.5	44.4	41.5	107	100
1993	64.2	60.3	42.3	39.7	106.5	100
1994	81.7	59.2	56.3	40.8	138	100

Source: OECD report – International movements of the highly skilled

The significance of these economic quantification tools is twofold. First, they give us some idea of the levels of benefits that companies feel they derive from the international transfer of expertise. It is a reasonable assumption that these costs are justified by making available the expertise where it is needed. In these terms, therefore, the costs of relocation provide an indication to the lower bound of the economic value of the international relocation of high level skills. That value is clearly very high.

Second, the costs involved in corporate relocation are extremely high when compared with the resources made available for other forms of migration. The migration of high level skills may not be great numerically, but it is financially[9].

Relocation in Sports

Expert relocation in sports is frequent, specifically in team sports like football or basketball. It is very common for a sports team to have foreign strengthening.

It is almost impossible to find a first league football or basket ball team in Europe that does not have at least one foreign player. These players might not fall into the

[9]International Movements of the Highly Skilled. OECD report – Directorate for education, employment, labor and social affairs – International migration unit-occasional papers N°3, 1997

straightforward definition of an expert but are wanted and needed for their natural talents. The demand for foreign players only grows as markets open, for instance, the Bosman law in Europe 1995[10], [11].

 An example of a multinational team and the impact of foreign players is the European Basketball champion for the last 2 years – Maccabi Tel-Aviv.

4 out of the 5 starting players for Maccabi are foreigners, and last year Maccabi employed 5 non-Israeli players. Coming from an only average league and from a country that finished only in the 9-12 places in the last European championship it is almost impossible to believe that they could repeat their accomplishments without the foreign players.

Another example is the NBA champions – the San Antonio Spurs, which have 2-3 foreign players in their starting line-up.

For sports, a quantifying indicator could be revenue generated from selling tickets and advertisement prior and after the employment of the foreign players.

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[10]Case c-415/93, European court reports 1995 page I-04921. http://europa.eu.int

[11] The Bosman ruling, football, transfers and foreign footballers University of Leicester; Center of the sociology of sport, August 2002.

2. Quantification of the Economic Impact of the Relocation of Experts - the Macro Level

We refer to the broader effects of the utilization of foreign experts and how the whole country benefits and what are the long-term effects. As for the micro level, our aim is to identify quantifiable criteria to measure the impact.

A Proposed Methodology for Measuring the Influence of a Single Project on the Country's Welfare

Countries, provinces, and states offer subsidies and tax exemptions to companies in order to lure them to position their premises within their jurisdictions. In order to establish new production plants there is usually a need to bring from abroad some experts for short periods of time. Such experts could be either employees of a mother company or vendors who supply machinery and equipment. Those experts are crucial in the establishment of work places.

When looking at the process from a national point of view, such new plants usually generate jobs and improve the local economy, as the associated subsidies and tax exemptions are costly. Are the benefits of attracting a new plant greater than the costs? Does the welfare of countries that successfully attract new plants increase or decrease?[12] The paper discusses the case of a new Mercedes-Benz plant located in Vance County, Alabama, which would employ about 1,500 workers.

In addition, there are many other potential gains. Wages in the county may increase, additional, indirect jobs might be created, such as new services, and the value of local real estate may increase. Looking at property values is particularly important, since the main source of income for many counties is property taxes. It is therefore necessary to take into account all the potential sources of increased value.

Conclusions

- The results indicate that a new plant increases the wage bill of the county by about 1.5% in the new plant's industry; weaker, but positive, effects are detected in other industries and in neighboring counties.
- Property values also increase by about 0.8%.

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[12] "Bidding for Industrial Plants: Does Winning 'Million Dollar Plant' Increase Welfare?" A working paper by Michael Greenstone (MIT, American bar foundation and NBER) Enrico Moretti (University of California, Berkeley and NBER).

- The authors also investigate whether new plants are associated with a decrease in services such as education. The result is negative.

- The main conclusion is that, on average, **attracting a new plant is a good bargain**.

The Singapore Experience

Singapore is an example of a country that encourages experts migrating for limited periods of time and benefits. Singapore is a small country, with an economy based mostly on international trade, and positioned as a regional economic center for Southeast Asia. As part of the implementation of this vision, the Singaporean government launched encouragement plans for multi-national corporations to open their Asian headquarters and branches in Singapore. More than 6,000 international companies have invested in Singapore and are engaged in a myriad of activities, such as R&D, manufacturing, services regional headquarters and more[13]. The influence foreign companies have on the Singapore economy increases each year and foreign companies control over 50% of the country's total assets, with control growing from $ 1201 billion in 1999 to $ 1476 billion in 2003[14]. In some cases the government assists companies in opening a local branch or office with the condition that the companies will station a foreign representative in Singapore! Singapore also tries to attract foreign scientists to conduct their research in the country and thus let local scientists be in close contact to cutting edge research and technologies[15].

The results: The unemployment rate in Singapore was only 4% in 2003 and 3.4% in 2004[16]. This figure is the highest in many years but still lower than most of the western world.

	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992
Unemployment rate Annual Avarage	/	3.4	4	3.6	2.7	2.7	2.8	2.5	1.4	1.7	1.8	1.7	1.7	1.8

Source: Singapore Ministry of manpower www.mom.gov.sg

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[13] The Infocomm development authority of Singapore (IDA).
[14] Key indicators on Singapore's corporate sector 1992-2003.
[15] Economic revue for 2002, Israeli economic attaché In Singapore.
[16] Singapore Ministry of manpower - www.mom.gov.sg

We can identify two quantifiable indicators and apply them to Singaporean economy:

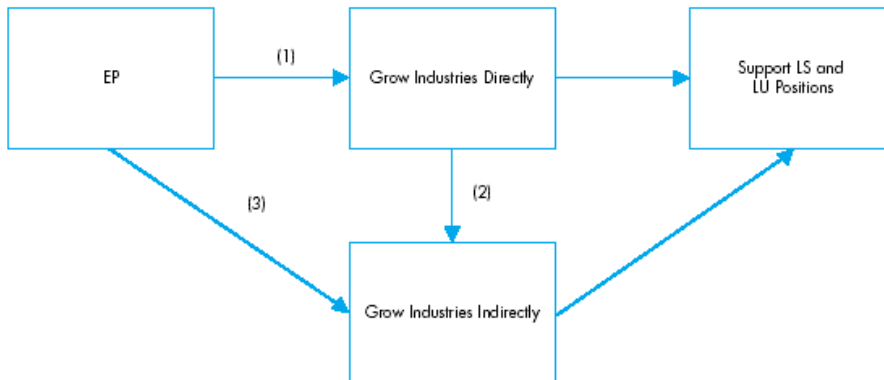**How Foreign Experts Affect the Local Employment Rate**

Economic studies in Singapore[17] suggest that foreign workers are complements to local workers at the macroeconomic level. The findings further suggest that

- 1% change in EP (foreign skilled workers) supports employment for 1.9% LS (local skilled)
- 1% change in EP supports employment for 0.2% LU (local unskilled)

As the numbers above are derived from a long run aggregate model, it would include direct incremental local job creation, spillover of local employment benefits arising from foreign participation, and the implicit opportunity cost in terms of local jobs that would have been lost if foreigners had not been allowed in.

EP supports local employment via their role in enterprise development.

The impact of EP on local employment is reflected in three channels:

Source: The complementary role of foreign labor in Singapore

First, EP directly helps to grow industries in cases where special expertise and skills are lacking locally. In certain high technology clusters, a critical mass of talents is required to sustain its growth. For instance, there are insufficient local PhD holders to kick-start a biomedical cluster. With only a small group of Singaporean PhD holders, the local talent pool falls short of the critical mass needed. If EP does not fill this

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[17] The complementary role of foreign labor in Singapore (Published in the Economic survey of Singapore, first quarter 2004)

shortfall the industry would remain dormant and employment of Singaporean PhD holders in the biomedical cluster would not be supported.

Second, when industries such as finance and biomedical grow beyond the constraints of the indigenous talent pool with the help of EP, their supporting industries also grow indirectly, especially if there are strong backward linkages. Consequently, local employment opportunities in such supporting industries will be supported.

The findings suggest that this indirect employment effect can be just as significant as the direct employment effect, especially for certain industries like chemicals, financial services, and biomedical.

Third, foreign expertise helps to grow industries indirectly by increasing the rate of technology adoption and generating strong externalities on local human capital development. Recent studies have shown that allowing skilled foreign workers into the domestic economy increases the returns on new technologies and allows domestic firms to adopt the new technologies faster (Chander and Thangavelu, 2003).

The Effect of the Presence of Foreign Experts on Domestic Education

Studies have suggested that there are strong complementary effects on local investment in education if there is a larger pool of skilled and educated foreign workers[18].

EP's role in enterprise development and growth also has a long term effect, as they help to breed innovation and entrepreneurship. The presence of EP enhances social diversity, thus attracting foreign talents. These foreigners stimulate the domestic economy and consumption by opening up sectors that locals do not have the know-how and experience to develop.
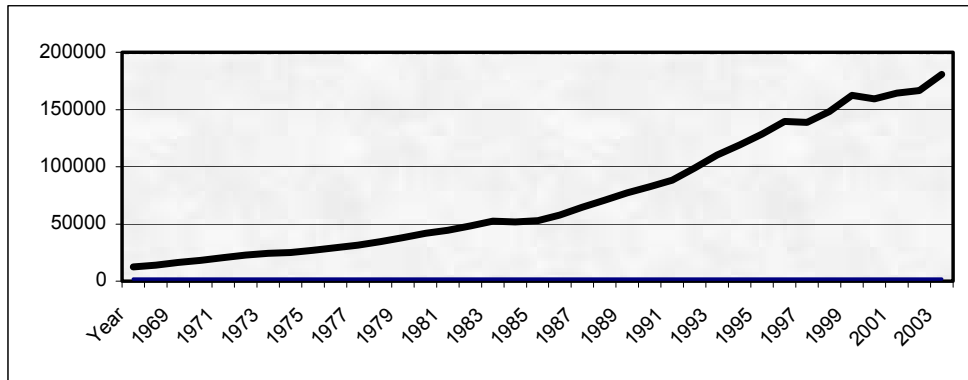
Foreign participation in the Singaporean food and beverage services segment has been increasing over the years. The segment also provides employment for 58,922 workers in 2001 (an increase of 17.7 % over 2000); the majority of those employed in this segment are locals.

The Effect on GDP

Another indicator that provides evidence of the importance of foreign labor to Singapore is the contribution to the local GDP. According to a survey made for the

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[18]Chander and Thangavelu, 2003

Singaporean government[19], on a year-to-year basis, between Q1 1991 and Q4 2000 the GDP grew at an average rate of 7.79 % per quarter:

From this 7.79 % quarterly growth, the foreign skilled workers are estimated to have contribute 2.87 percentage points, which were much higher than the contributions of local labor (1.10 percentage point) and work-permit holders (0.30 percentage point). We can observe that the estimated contribution of foreign skilled workers skyrocketed from 5.3 % in Q1 1986 – Q4 1990 to 36.9 % during Q1 1991 – Q4 2000.

Growth Contribution (percentage share)

Period	GDP	Capital stock	Numbers of local labour	Numbers of foreign workers on employment pass	Numbers of foreign workers on work permit	Total Factor Productivity
Q1 1986 - Q4 1990	100	13	15.4	**5.3**	1.9	64.4
Q1 1991 - Q4 2000	100	26.5	14.1	**36.9**	3.8	18.8
Q1 1986 - Q2 2001	100	22.3	15.1	**27.5**	3.2	31.9

Source: Economic survey of Singapore, third quarter 2001

Such phenomena could be attributed to the fact that in the late 1980s, employment-pass holders constituted a very small percentage of the total workforce. The proportion was too small to make a significant impact on the economy's throughput. In addition, at that time Singapore was still a relatively low-tech manufacturing economy. The human capital aspect of foreign talent might not have been efficiently used. However, as Singapore's manufacturing and services sectors moved up their value-chains, the impact of foreign talent became more apparent. By the decade of the 1990s, employment-pass holders' participation rate in Singapore's total workforce had risen substantially. Hence, the sharp rise in employment-pass holders' percentage

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[19]Has foreign talent contributed to Singapore's economic growth? An empirical assessment. (Published in Economic survey of Singapore, third quarter 2001)

share contribution (36.9 %) to quarterly GDP growth contrasted markedly with the local labor and work-permit holders who contributed relatively smaller proportions of 14.1 % and 3.8 % respectively. Foreign skilled workers have the most significant impact on local GDP.

In addition, it is a fallacy to assume that replacing foreign talent by unemployed local labor would increase the percentage share in local labor's contribution to GDP growth. This is because in reality, there cannot be a perfect one-to-one substitution as the demands of job and skill profiles between local workers and foreign talent could be different. The methodology used is explained in Appendix B.

APPENDIX A

A Wide Spectrum of the Highly Skilled[20]

Few systematic attempts have been made to categorize the highly skilled and their patterns of mobility. Gould (1988) developed a typology of skilled international migration based on the types of movement associated with levels of economic development. A similar approach was proposed by Logan (1992) who emphasized the geographical direction of migration between and within more- and less-developed countries. What is needed, however, is a typology which accommodates the diversity of the group, the sub-categories of which may have very different compositions and patterns of mobility.

The scheme below attempts to identify the most important categories of temporary highly skilled migrants. Although it attempts to distinguish groups that are conceptually different, it is impossible to avoid some overlap between them. For example, several of the types identified may move within employers' ILMs. Although their existence is acknowledged, not all of the types listed below are treated in detail in the body of this paper. Permanent landed immigrants and business travelers are not included, nor are those that moved into occupations involving marked deskilling.

a) Corporate transferees. These people move internationally within the ILMs of large Employing organizations. Their moves are for a wide range of reasons, and for varying time periods. Frequently, moves are related to career development and training, but they may also be production, marketing or research specialists. Their moves generally reflect the organizational structure of their employers.

b) Technicians/visiting firemen. These are people whose movements reflect the particular occupational skills they have, and they may occur within the ILMs of trans-national corporations (TNCs). Moves may be related to specific project developments. Moves may be unpredictable, responding to crisis management needs.

c) Professionals, frequently working in the health or educational sectors, and often employed by non-governmental organizations (NGOs). Recruitment is frequently on an individual level, and for fixed term contracts abroad. With some NGOs, employment overseas may become permanent.

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[20]"International Movements of the Highly Skilled". OECD report – Directorate for education, employment, labor and social affairs – International migration unit-occasional papers N°3, 1997

d) Project specialists. Their migrations are related to specific overseas projects, often in construction. Moves may technically occur within corporate ILMs, although often they are recruited through the ELM for a limited contractual period.

e) Consultant specialists. Increasingly employing organizations are using specialist consultancies for a range of business services. Locations are worldwide, depending on the clients' organizational structures. Consultancy firms are themselves increasingly transnational in their own organization.

f) Private career development and training. Many people seek opportunities through the ELM for career development and training, involving periods abroad of varying lengths. The group includes many nurses and also young people in the very early stages of their careers seeking experience in overseas environments. It also includes those in later career stages whose moves may be seen in the context of "chasing the dollar".

g) Clergy and missionaries. Religious and quasi-religious orders traditionally post their adherents abroad, for varying lengths of time. Those staff involved may overlap with other types of expatriates, especially health care and educational professionals.

h) Entertainers, sportspeople and artists. This is a very varied group, frequently moving internationally, often for short periods. Others may, in effect, become permanent migrants.

i) Business people and the independently wealthy. This group may be entrepreneurial, perhaps over several generations, or be investors settling abroad for personal (including tax) reasons.

j) Academics, including researchers and students, in institutions of higher education. There is a substantial exchange of academics and researchers from universities and similar institutions, for varying periods of time. Some moves are relatively short-term, perhaps for an academic session, others are more permanent (the classic brain drain phenomenon). An increasing number of young people take up study abroad, both at first and higher degree level.

k) Military personnel. These are normally excluded from consideration as migrants, and most members of the armed forces would probably not be regarded as highly skilled. However, substantial numbers of officers and specialists would undoubtedly come into a definition of the highly skilled that included the military. Periods spent abroad in the armed forces may influence subsequent civilian migrations.

l) Spouses and children of the above might reasonably included in any assessment of the total migration associated with the highly skilled, although in strict labor market terms their inclusion could be questioned.

The motives behind the migrations of each of these types vary. For a majority of them moves reflect the priorities employers use in allocating their staff resources internationally. In other cases moves reflect the incidence of overseas projects and the need to employ contract staff for limited periods. For some people, motivation reflects their individual decisions and aspirations, for example entertainers and those moving for private career development and training purposes. Some highly skilled may also be selected by government entry and permit policies for particular treatment, for example entrepreneurs and the independently wealthy.

APPENDIX B

Methodological and Theoretical Formulation of Foreign Labor Impact on GDP in Singapore[21]

A production function specifies that the output of an economy, measured by the GDP, is dependent on factor inputs: capital, labor and technological competence. For the purpose of this study, the labor input is sub-divided into local labor, foreign workers with employment pass and foreign workers with work permits. In general, foreign workers with employment pass are professionals and skilled labor. The Cobb-Douglas Production Function is thus written as:

$$GDP_t = A_t(CAP_t)b1(NLOC_t)b2(NEP_t)b3(NWP_t)b4 \qquad \textbf{[EQ1]}$$

Note:

CAP = Capital stock

NLOC = Numbers of local labor

NEP = Numbers of foreign workers on employment pass

NWP = Numbers of foreign workers on work permit

The technological parameter 'At' is specified to include both exogenous and endogenous growth:

$$A_t = A * \exp[\lambda t + \phi\{CAP_t / NTOT_t\} * \{SEP_t / (1-SEP_t)\}]$$

exogenous   endogenous

Note:

NTOT = NLOC+NEP+NWP

SEP = NEP/NTOT

ASSUMPTIONS

• The rate of technological progress is assumed to grow at an exogenous rate (.t), as well as being dependent on the existing capital-labor ratio modified by the share of employment-pass holders (SEP_t) to non-employment-pass holders ($1-SEP_t$).

• Such specification puts the production function in the class of transcendental production function whereby the elasticity of substitution between the factors of

[21]Has foreign talent contributed to Singapore's economic growth? An empirical assessment. (Published in Economic survey of Singapore, third quarter 2001)

production is no longer confined to the value of unity as in the traditional Cobb-Douglas production function. It can be shown that the elasticity of substitution between factors will be greater (less) than unity when the parameter, $\hat{O}$, is positive (negative).

• Constant returns to scale is also assumed, thus making the summation of the coefficients for the variables to be equal to one i.e. (b1+b2+b3+b4 = 1).

ESTIMATION AND DERIVATION3

The Henry's 'general to specific' approach is adopted in estimating the production function and the estimated Autoregressive Distributed Lag (ADL) form of the above production function is as follows:

$$\text{LGDPK}_t = -1.38 + 0.5565 \text{ LGDPK}_{t-1} + 0.2067 \text{ LDK}_t + 0.0909 \text{ LEK}_{t-3}$$
$$+ 0.5842 \text{ LWK}_t - 0.57 \text{ LWK}_{t-1} + 0.0048 \text{ TIME}$$
$$-22.6673 \left[\{\text{CAP}_{t-4}/\text{NTOT}_{t-4}\} * \{\text{SEP}_{t-4}/(1-\text{SEP}_{t-4})\} \right] \quad \textbf{[EQ2]}$$

R-squared = 0.9847

D.W. statistics = 1.8781

Note: LGDPK = logGDP-logCAP

       LDK = logNLOC-logCAP

       LEK = logNEP-logCAP

       LWK = logNWP-logCAP

LS // Dependent Variable is $LGDPK_t$

Sample(adjusted): 1984:1 2001:2

Included observations: 70 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	−1.3800	0.4132	−3.3400	0.0014
$\{CAP_{t-4}/NTOT_{t-4}\}*\{SEP_{t-4}/(1-SEP_{t-4})\}$	−22.6673	5.7078	−3.9713	0.0002
LDK_t	0.2067	0.1333	1.5504	0.1263
LEK_{t-3}	0.0909	0.0338	2.6884	0.0093
LWK_t	0.5842	0.0851	6.8632	0.0000
LWK_{t-1}	−0.5700	0.0812	−7.0197	0.0000
TIME	0.0048	0.0012	3.9183	0.0002
$LGDPK_{t-1}$	0.5565	0.0830	6.7041	0.0000
D92Q1[4]	−0.0430	0.0171	−2.5064	0.0149
D98Q1	−0.0555	0.0178	−3.1185	0.0028
R-squared	0.9847	Mean dependent var		−2.6088
Adjusted R-squared	0.9824	S.D. dependent var		0.1246
S.E. of regression	0.0165	Akaike info criterion		−5.2365
Sum squared resid	0.0164	Schwarz criterion		−4.9153
Log likelihood	193.2781	F-statistic		428.9452
Durbin-Watson stat	1.8781	Prob(F-statistic)		0.0000

Recognizing that a production function is a long run equilibrium relationship between output and inputs whereby short run deviations from this long run relationship can exist, a mechanism is needed to correct for short run dis-equilibrium. Hence, an Error Correction Model (ECM) is deemed as an appropriate framework to model and estimate the long run equation. Therefore, the ADL as shown in EQ2 is first used to derive the ECM. Subsequently the ECM is used to estimate the long run equation (EQ5) which can be expressed as:

Log GDPt = −3.1116 + 0.2907 log CAPt + 0.4661 log NLOCt +

0.2049 log NEPt + 0.0320 log NWPt + 0.0107 TIME

−51.109 [{CAPt/NTOTt}*{SEPt/(1-SEPt)}]   **[EQ5]**

Derivation for the Long Run Equation (EQ5)

We start by having the estimated ADL equation:

$$LGDPK_t = -1.38 + 0.5565\, LGDPK_{t-1} + 0.2067\, LDK_t + 0.0909\, LEK_{t-3}$$
$$+ 0.5842\, LWK_t - 0.57\, LWK_{t-1} + 0.0048\, TIME$$
$$- 22.6673\, [\{CAP_{t-4}/NTOT_{t-4}\}*\{SEP_{t-4}/(1-SEP_{t-4})\}] \qquad [EQ2]$$

EQ2 can also be written as:

$$LGDPK_t = c + a_0 LGDPK_{t-1} + b_1 LDK_t + b_2 LEK_{t-3}$$
$$+ b_3 LWK_t + b_4 LWK_{t-1} + \lambda.TIME$$
$$+ \phi.[\{CAP_{t-4}/NTOT_{t-4}\}*\{SEP_{t-4}/(1-SEP_{t-4})\}] \qquad [EQ2']$$

Expressing EQ2' in its corresponding Error Correction Model (ECM):

$$\Delta LGDPK_t = c - (1- a_0)LGDPK_{t-1} + b_1 \Delta LDK_t + b_1 LDK_{t-1} + b_2 LEK_{t-1}$$
$$- b_2\,[\Delta LEK_{t-1} + \Delta LEK_{t-2}] + b_3 \Delta LWK_t$$
$$+ (b_3 + b_4)LWK_{t-1} + \lambda.TIME$$
$$+ \phi.[\{CAP_{t-4}/NTOT_{t-4}\}*\{SEP_{t-4}/(1-SEP_{t-4})\}] \qquad [EQ3]$$

Rearranging EQ3:

$$\Delta LGDPK_t = b_1 \Delta LDK_t - b_2\,[\Delta LEK_{t-1} + \Delta LEK_{t-2}] + b_3 \Delta LWK_t$$
$$- (1- a_0)LGDPK_{t-1} + c + b_1 LDK_{t-1} + b_2 LEK_{t-1}$$
$$+ (b_3 + b_4)LWK_{t-1} + \lambda.TIME$$
$$+ \phi.[\{CAP_{t-4}/NTOT_{t-4}\}*\{SEP_{t-4}/(1-SEP_{t-4})\}] \qquad [EQ3']$$

The long run equation derived from EQ3' is thus:

$$LGDPK_t = c/(1-a_0) + [b_1/(1-a_0)]LDK_t + [b_2/(1-a_0)]LEK_t$$
$$+ [(b_3 + b_4)/(1-a_0)]LWK_t + [\lambda/(1-a_0)]TIME$$
$$+ [\phi/(1-a_0)]\{CAP_t/NTOT_t\}*\{SEP_t/(1-SEP_t)\} \qquad [EQ4]$$

Substituting the relevant value for the coefficients into EQ4, the equation can be further expressed as:

$$Log(GDP_t/CAP_t) = -3.1116 + 0.4661 \log (NLOC_t/CAP_t)$$
$$+ 0.2049 \log (NEP_t/CAP_t) + 0.0320 \log (NWP_t/CAP_t)$$
$$+ 0.0107\, Time$$
$$- 51.109\, [\{CAP_t/NTOT_t\}*\{SEP_t/(1-SEP_t)\}] \qquad [EQ4']$$

Alternatively, the long run equation is derived as:

$$\log GDP_t = -3.1116 + 0.2907 \log CAP_t + 0.4661 \log NLOC_t$$
$$+ 0.2049 \log NEP_t + 0.0320 \log NWP_t$$
$$+ 0.0107\, TIME - 51.109\, [\{CAP_t/NTOT_t\}*\{SEP_t/(1-SEP_t)\}] \qquad [EQ5]$$