

**Human Capital Investment and Flows:
A Multiperiod Model for China**

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1. Introduction

The international migration of the highly skilled, often referred to as the “brain drain,” has arisen as an issue in most less-developed countries as well as in some developed countries. The traditional literature on this subject has experienced considerable renewal, reflecting changes in the brain drain phenomenon. Conventionally, the term “brain drain” refers to skilled professionals who leave their native lands in order to seek more promising opportunities elsewhere. By this definition, migration of the highly skilled is often considered a one-period or once-and-for-all unidirectional phenomenon. Therefore, it is conventionally argued that sending countries are always suffering a brain drain loss to receiving countries (DeVoretz and Laryea 1998; Broad 1993; DeVoretz and Maki, 1980; Guha 1977).

It has been gradually recognized, however, that migration decisions are reversible. Studies of international migration within the United States indicate that recent migrants have a high probability of returning to their origin or of moving on to other locations (DaVanzo 1983; Fields 1979). Warren and Peck (1980) and Warren and Kraly (1985) estimate that perhaps 30 percent of the foreign-born persons in the United States leave the country within a decade or two after their arrival. Hence, the notion of the brain drain is challenged by concepts of the brain gain, brain circulation, or brain exchange (DeVoretz and Ma 2001; Saxenian 2000; Beine, Docquier and Rapoport 1999; Johnson and Regets 1998; Mountford 1997; Grubel and Scott 1967)

DaVanzo (1983) does not treat migration as a once-and-for-all event, but a repeat move, either on to a new location or back to the country of origin. Within a multiperiod framework, DaVanzo broadens the human capital model of migration to incorporate concepts

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of location-specific capital and information costs. Among her findings, she points out that the less educated are the likeliest to return quickly, however, the most highly educated are the likeliest to move quickly onward.

Based on the fact that large numbers of immigrants choose not to remain in the United States, Borjas and Bratsberg (1996) present a human capital model with the skill sorting mechanism. They conclude that if the immigrant flow is positively selected so that immigrants have above average skills, the return migrants will be the least skilled immigrants. In contrast, if the immigrant flow is negatively selected, the return migrants will be the most skilled immigrants. Thus, multiple moves have a quality dimension.

The international move of the skilled is argued to be motivated by a number of reasons, including lack of employment opportunities in the home country, low pay, and student preference to remain abroad. However, Kwok and Leland (1982), using Taiwan as an example, show that the brain drain may still exist even when students have a preference for returning home (at equal salaries) and employment opportunities exist at comparable average pay. They explain that the reason for the problem is related to the information employers have at the time of hiring. They assume that employers in the native country offer wages that reflect the average productivity of returning workers, but which are not precisely tailored to individual productivities. Under this assumption, they conclude that the productivity of any worker remaining abroad exceeds the productivity of any worker returning home in equilibrium. In other words, imperfections in the home-country labor market owing to information gaps may drive the better students abroad to pursue advanced studies, but when these graduates complete their education, the labor market cannot attract the best of the group to return.

Within the context of China, it has become an increasingly important sending country for the highly skilled. On the one hand, more and more highly skilled Chinese have migrated to developed countries. For example, China has become the top source country for skilled workers admitted to Canada as permanent residents since 1998. The principal applicants alone increased dramatically from 5,945 (17% of total skilled workers to Canada) in 1998 to 10,069 (24%) and 12,760 (25%) in 1999 and 2000 respectively (CIC 2001:96). These numbers are far beyond the second source country, India, by more than doubles.

On the other hand, more Chinese students pursued higher education abroad, mainly in the US, Canada, and other developed countries, and some of them may not return after completion of their studies. The total number of Chinese doctorate recipients in the US reached 18,551 from 1985–96. Ninety five percent of them with permanent visas and 87 percent with temporary visas planned to stay in the US either for employment or for further study (Johnson 1998). In addition, Orleans (1988) provides a comprehensive analysis on the issues of Chinese students and scholars studying in the US and remaining there for the first decade of China's reform period. More recently, Zweig (1997) documented the economic and political motives for the highly skilled Chinese émigrés to remain in the United States.

The theoretical studies just described have some common features: (1) they all use the human capital investment model as their conceptual framework, with some modifications; (2) they recognize that the migration decision is reversible. Therefore, the migration of the highly skilled is not a once-and-for-all phenomenon, but a multiperiod one; (3) they conclude that all migration decisions depend very much upon skill levels, comparing relative returns (benefits) to their skills at home or abroad; and (4) they also recognize that measuring gains and losses through migration has different implications for individuals and society as a whole.

The empirical counterpart to the existing studies, to our knowledge, focuses only on the United States. For the case of China, although it is true that the US is the major destination for Chinese students and scholars studying and remaining abroad, it is by no means the only destination country. Little is known about other destinations, such as Canada, Australia and European countries.

Thus, a general model is required to describe the human capital investment and flow, especially for the case of China. We pose several questions in this context. Why would Chinese households arrive at a different decision on students schooling either at home or abroad? Will they return home or remain abroad in different countries after completion of their studies abroad? If so, who will return home and who will move on, in terms of skill level?

In order to answer some of these questions, if not all, this paper will develop a general model to describe the sequence of an individual's decision concerning human capital

investment and flow within a multiperiod framework. We will analyze in particular the following issues related to their decisions:

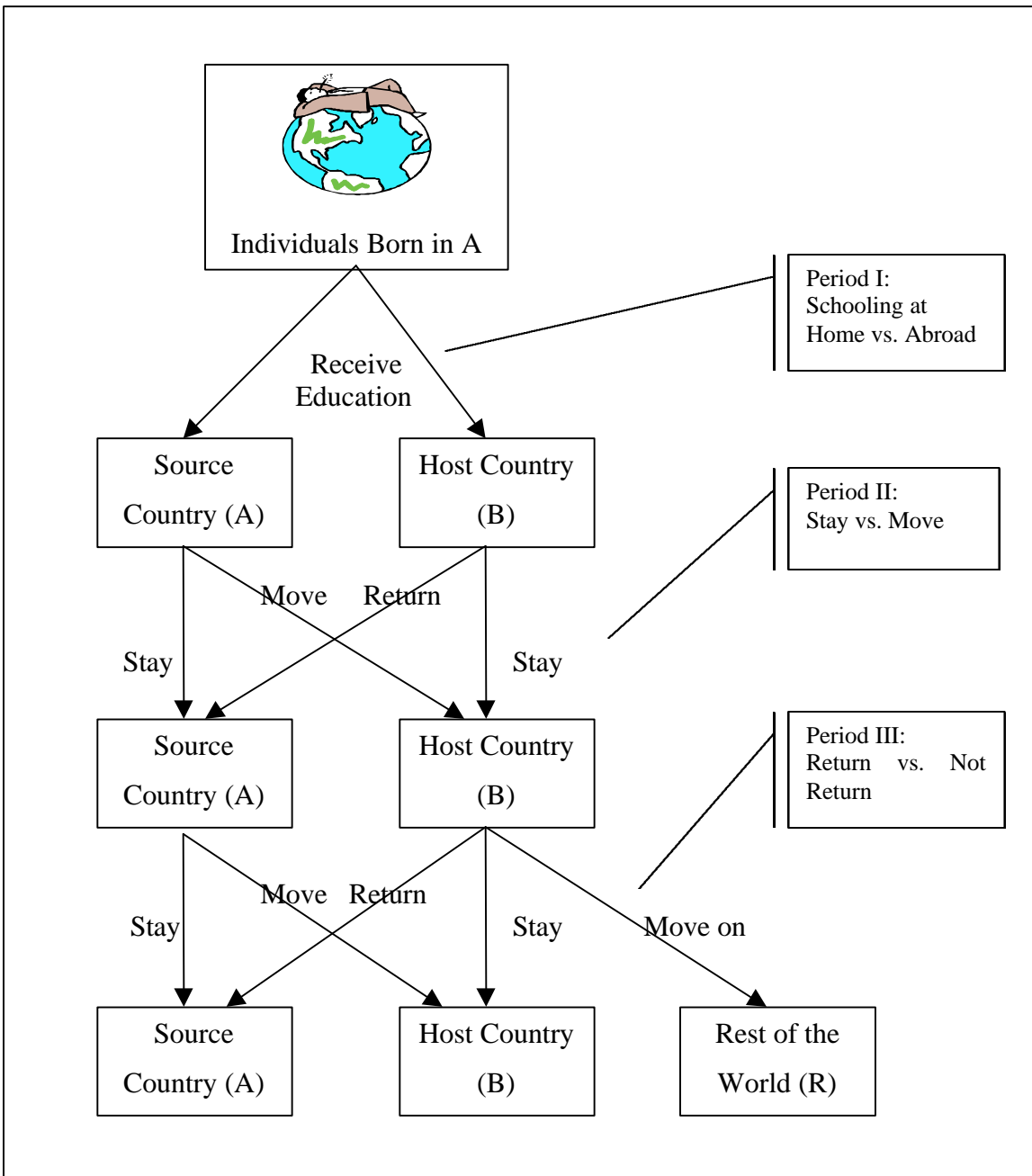
1. Incentive effect: schooling at home or abroad?
2. Winner – loser: who stays, who returns and who moves on?
3. Why?

The rest of the paper is organized as follows. Section 2 sets up the general model describing the sequence of human capital investment and flows. Section 3 will present some empirical evidence from China, and section 4 adds some concluding comments.

2. The Model

Bowman and Myers (1967) present analytical models for five possible migration sequences. We develop it further with more comprehensive modeling of these sequences. Before discussing details of our models, we first present a diagram to illustrate the sequential nature of decisions for human capital investment and migration.

Figure 1: Human Capital Investment and Flows: A Multiperiod Model



As shown by the above diagram, we should distinguish the possible circumstances at each period, giving its present value of future income stream. The following notation is used in the model:

- a - Age at the first decision point relating to migration
- b - Date of actual or intended out-migration

- m - Age at return from residence abroad, or move further to another destination
- n - Retirement age
- R_t - Expected earnings in the year t at the place of origin prior to (or in the absence of) any migration
- D_t^B - Expected earnings abroad (in host country B) in the year t
- D_t^R - Expected earnings abroad (in the Rest of the world R) in the year t
- Y_t - Expected earnings in the year t at the place of origin for migrant returnees ($t > m - a$)
- C_t - Direct cost in the year t of schooling or training in the area of origin
- K_t - Direct cost in the year t of schooling or training abroad
- Z_t^o - Direct cost of out-migration incurred in year t
- Z_t^h - Direct cost of return migration incurred in year t
- Z_t^R - Direct cost of moving further to R incurred in year t
- r - Discount rate
- V - Present value of future income streams
- j - Superscript denoting a particular race, age, sex, school attainment, and occupation (if any) at time a

Also, we assume that there are following relations exist between some variables:

- (1) $D_t^R > D_t^B > Y_t > R_t$ - Higher expected earnings abroad than at place of origin.
- (2) $K_t > C_t$ - Higher cost of schooling or training abroad than in the area of origin.
- (3) $\frac{D}{K} > \frac{Y}{K} > \frac{R}{C}$ - Higher return to schooling abroad than in the area of origin.

Obviously, the decision-making in each period has a different focus. For example, in period I, the decision concerns the location of schooling. In period II, the decision becomes whether to stay or to move, and in period III it involves the choice to stay, return or move on to another destination.

Period I

In period I, there are only two choices:²

- 1.1 Those born in A and schooled in A. ($C > 0, K = 0$)
- 1.2 Those born in A and schooled in B. ($C = 0, K > 0$)

What is the incentive effect determining the choice of location of schooling? In other words, why do some people decide to study at domestic schools and others to study abroad? First, the choice of location of schooling is primarily due to differences in school quality. Bowman and Myers (1967:882) suggest that despite large within-area differences in quality of schools, there are also large and significant differences between schools in one region as opposed to another. It is safe to assume that the average quality of local schooling in less developed countries is lower than that of foreign schooling in developed countries. Therefore, to choose higher quality schooling abroad is rational, since one expects a higher return for acquiring a skill. However, this is just one side of the coin. On the other, the cost of schooling abroad is obviously higher than local schooling. At this stage, it is hard to compare the net gain of higher expected returns with higher cost schooling abroad and lower expected returns with lower cost schooling locally.³

Second, people choosing foreign education and foreign working experience believe they will receive some sort of signal of their superior productivity (Spence 1973). It is based on an assumption that the return on their foreign training would be higher than on their local training at the source economy only when they return home. However, this economic return should not exceed that achieved abroad. Nevertheless, Kwok and Leland (1982) challenge this assumption by arguing that, (1) some welfare is lost by the fact that people must remain abroad for some time if the signal is to be valid; and (2) the longer a person remains abroad, the more likely he will become comfortable living there, and the greater the relocation costs of returning. Eventually, people may not return home after a certain length of stay abroad.

² There is also another possibility that both $C > 0, K > 0$. For simplicity, we focus only on two extremes in the model. Actually, if we define the starting point of human capital investment, i.e. for post-secondary education only, C will approach to 0.

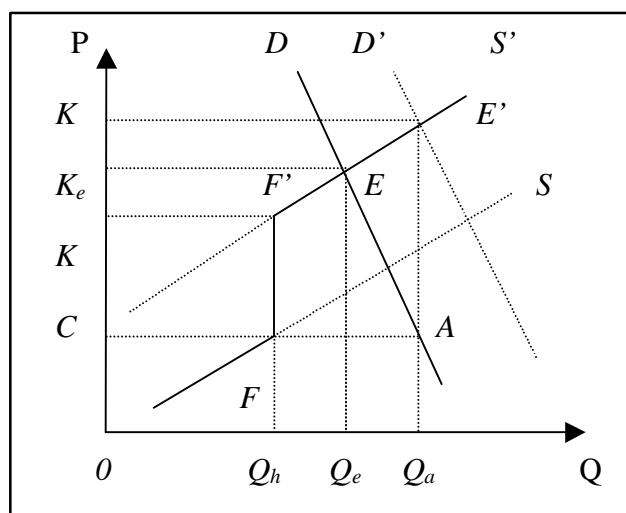
³ See DeVoretz and Maki (1980), EDCC

Third, the location decision of schooling is based on the higher demand relative to limited domestic supply for higher education. Let's consider the following market situation (as shown by Figure 2). There is an inelastic demand for higher education, and the current quantity of demand is Q_a at price C . Due to limited resources, the domestic supply S cannot fully meet the demand at Q_a , but only supply at Q_h with a price at C . Therefore, there is a shortage of supply ($Q_a - Q_h$).

If there is no possibility to study abroad, first Q_h students will pass the entry exam and enroll in domestic universities or alike. These students always represent the best of the peer group and need only to pay the cost up to C for the higher education. The rest of the group ($Q_a - Q_h$) will spread to the local labor market, or attend vocational training or other trade schools.

With the possibility of studying abroad, the quantity of supply increases beyond Q_h along the supply curve S' , with a significant rise in cost. Price $K - C$ represents the cost of migration (moving), and any cost beyond K is the direct cost of studying abroad. S' cuts the demand curve at E , with the equilibrium price K_e . The total number of students who will receive higher education increases from Q_h to Q_e . However, if the demand for higher education is either rigid or increased with the possible studying abroad, the demand curve may shift to the right to D' . The new equilibrium status is reached at E' with price at K . In this case, the total number of demand for higher education is clear and reaches Q_a .

Figure 2: Supply and Demand of Higher Education: China



To sum up, there are three sorts of people in this market:

- (1) Stayer (Q_h) – people who study domestically;
- (2) Mover ($Q_e - Q_h$) – people who study abroad with rational costs up to equilibrium price; and
- (3) Mover ($Q_a - Q_e$) – people who study abroad with extra costs above the equilibrium price.

In the latter two cases, the total human capital formation is greater than the former one. In other words, with the possibility of migration (studying abroad), the total formation of human capital at the sending country increased.⁴

Finally, people choosing to receive foreign-education also believe that skills acquired from domestic or abroad have different transferability, which is as important as the quality difference. Bowman and Myers note early that:

There is a strong presumption that knowledge of the location in which men have acquired their work experience will improve statistical predictions of their competencies. How far a migrant's previous experiential learning may be transferable to his new setting is another matter. Undoubtedly there is selectivity in such transferability; he can move into the new environment carrying his experience with him only to the extent that the new environment gives scope for its use (1967:883).

Borjas and Bratsberg (1996) also include a variable reflecting ability or skills that are transferable across countries into their earning distribution model. They use it to measure deviations from mean incomes.

In short, we denote T^A and T^B as measures for the transferability of a skill (or location-specific skill) that has been acquired at home country (A) or abroad (B) respectively. We further assume $T \in (0,1)$, $T^A < T^B$ ⁵. Thus, individuals pursue schooling and training abroad to insure a higher transferability of the acquired skill. In other words, the greater the transferability of skills, the lower the risk of the expected higher future income stream.

⁴ For a more detailed and specific model, see Vidal, 1998.

⁵ One extreme is $T^A = T^B = 1$ if one has worked in the same place where he/she received his/her education.

Altogether, an expected higher return, labor market signaling, excess demand for education and a need for greater transferability of skills, leads to a large set of incentives to seek higher quality schooling abroad. The consequences of these incentives are twofold. First, many students go abroad to seek foreign training with a high risk of non-return (brain drain). On the other hand, it may increase average levels of human capital and productivity of the remaining population in the source economy (Mountford 1997; Beine et al. 1999).

Period II

The incentive effect plays a role not only at period I, but also at period II. In this period, there are again two options arising from each circumstance in period I:

2.1 Those in category 1.1, and who have worked only in A (non-migrants).

$$V_{2.1}^j = \sum_{t=a}^n \frac{R_t - C_t}{(1+r)^{t-a}} \quad (1)$$

2.2 Those in category 1.1, but who migrated to B as soon as their formal schooling was completed and who have worked only in B.

$$V_{2.2}^j = \sum_{t=a}^n \frac{T^A D_t^B - C_t - Z_t^o}{(1+r)^{t-a}} \quad (2)$$

2.3 Those in category 1.2, and who have worked only in B.

$$V_{2.3}^j = \sum_{t=a}^n \frac{D_t^B - K_t - Z_t^o}{(1+r)^{t-a}} \quad (3)$$

2.4 Those in category 1.2, but who return to A as soon as their formal schooling was completed and who have worked only in A.

$$V_{2.4}^j = \sum_{t=m}^n \frac{T^B Y_t - K_t - Z_t^o - Z_t^h}{(1+r)^{t-m}} \quad (4)$$

In order to make the decision of whether to stay or to move, potential migrants must compare the net gain among $V_{2.1}^j$ to $V_{2.4}^j$. DeVoretz and Iturralde (2001) provide a life-cycle model to estimate the probability of staying in Canada and moving to the US. By comparing actual and expected incomes if a Canadian stays or moves, they argue that the probability of staying in Canada depends on the size of this income gain, which varies systematically with age, and major lifetime events. Given the opportunity cost of staying, they conclude that only a large gain in income will induce movement to the United States.

The economic arguments in our model are slightly different from that of DeVoretz and Iturralde. In addition to the expected income gain, costs of human capital investment, and moving, I take the transferability of skill (T) into account. I suggest that transferability of skill is significant when individuals invest their human capital and receive a return of this investment in different economies. Their expected incomes will also depend on the transferability of skill, which acts as a risk parameters. By comparing the net gain among these sequences, under the migration possibility, we assume the following results:

(1) Stayer:

a. Stay at home, if

$$\sum_{t=a}^n \frac{R_t - C_t}{(1+r)^{t-a}} \geq \sum_{t=a}^n \frac{T^A D_t^B - C_t - Z_t^o}{(1+r)^{t-a}}$$

b. Stay abroad, if

$$\sum_{t=a}^n \frac{D_t^B - K_t - Z_t^o}{(1+r)^{t-a}} \geq \sum_{t=m}^n \frac{T^B Y_t - K_t - Z_t^o - Z_t^h}{(1+r)^{t-m}}$$

(2) Mover:

a. Move to abroad, if

$$\sum_{t=a}^n \frac{R_t - C_t}{(1+r)^{t-a}} < \sum_{t=a}^n \frac{T^A D_t^B - C_t - Z_t^o}{(1+r)^{t-a}}$$

b. Move to home, if

$$\sum_{t=a}^n \frac{D_t^B - K_t - Z_t^o}{(1+r)^{t-a}} < \sum_{t=m}^n \frac{T^B Y_t - K_t - Z_t^o - Z_t^h}{(1+r)^{t-m}}$$

Period III

In this period, there are more possibilities conditional on each circumstance in the previous period:

3.1 Those in category 2.1 and 2.4, and who have worked only in A.

$$V_{3.1}^j = \begin{cases} \sum_{t=a}^n \frac{R_t - C_t}{(1+r)^{t-a}} & \text{if } C > 0, K = 0 \\ \sum_{t=a}^n \frac{T^B Y_t - K_t - Z_t^O - Z_t^h}{(1+r)^{t-a}} & \text{if } C = 0, K > 0 \end{cases} \quad (5)$$

3.2 Those in category 2.1 and 2.4, and who remained to work for some time in A, but moved to B or R at age $b_{3.2}$ and continued to work in B or R thereafter.

$$V_{3.2}^j = \begin{cases} \sum_{t=a}^{b-1} \frac{R_t - C_t}{(1+r)^{t-a}} + \sum_{t=b}^n \frac{T^A D_t^{B,R} - Z_t^O}{(1+r)^{t-a}} & \text{if } C > 0, K = 0 \\ \sum_{t=a}^{b-1} \frac{T^B R_t - K_t - Z_t^h}{(1+r)^{t-a}} + \sum_{t=b}^n \frac{T^B D_t^{B,R} - Z_t^O}{(1+r)^{t-a}} & \text{if } C = 0, K > 0 \end{cases} \quad (6)$$

3.3 Those in category 2.2 and 2.3, and who have worked only in B.

$$V_{3.3}^j = \begin{cases} \sum_{t=a}^n \frac{T^A D_t^B - C_t - Z_t^O}{(1+r)^{t-a}} & \text{if } C > 0, K = 0 \\ \sum_{t=a}^n \frac{D_t^B - K_t - Z_t^O}{(1+r)^{t-a}} & \text{if } C = 0, K > 0 \end{cases} \quad (7)$$

3.4 Those in category 2.2 and 2.3, and who stayed to work for some time in B, but return to A at age $m_{3.4}$ and continued to work in A thereafter.

$$V_{3.4}^j = \begin{cases} \sum_{t=a}^{m-1} \frac{T^A D_t^B - C_t - Z_t^o}{(1+r)^{t-a}} + \sum_{t=m}^n \frac{Y_t - Z_t^h}{(1+r)^{t-a}} & \text{if } C > 0, K = 0 \\ \sum_{t=a}^{m-1} \frac{D_t^B - K_t - Z_t^o}{(1+r)^{t-a}} + \sum_{t=m}^n \frac{T^B Y_t - Z_t^h}{(1+r)^{t-a}} & \text{if } C = 0, K > 0 \end{cases} \quad (8)$$

3.5 Those in category 2.2 and 2.3, and who stayed to work for some time in B, but moved further to R at age $m_{3.5}$ and continued to work in R thereafter.

$$V_{3.5}^j = \begin{cases} \sum_{t=a}^{m-1} \frac{T^A D_t^B - C_t - Z_t^o}{(1+r)^{t-a}} + \sum_{t=m}^n \frac{T^A D_t^R - Z_t^R}{(1+r)^{t-a}} & \text{if } C > 0, K = 0 \\ \sum_{t=a}^{m-1} \frac{D_t^B - K_t - Z_t^o}{(1+r)^{t-a}} + \sum_{t=m}^n \frac{T^B D_t^R - Z_t^R}{(1+r)^{t-a}} & \text{if } C = 0, K > 0 \end{cases} \quad (9)$$

The interest of this period centers on the $V_{3.3}^j, V_{3.4}^j$, and $V_{3.5}^j$, for each represents the stayer, returnee, and further-mover. The questions arise here: (1) who will stay, and who will return or move further? (2) Why does someone stay and the others return or move further? And (3) what are the economic and policy implications of this pattern of movement? Obviously, we cannot give explicit answers to these questions unless we have concrete data on these issues.⁶ However, previous studies do provide some answers to these questions, and a summary of this literature is provided below.

DaVanzo (1983) finds that: (1) the farther the initial move, the likelier is a following repeat move; (2) initial moves apparently pressured by unemployment (and possibly based on inferior information) tend to be followed by return moves; (3) very young household heads

⁶ For this reason, this paper calls for further empirical study.

are especially prone to return within a year or so of leaving; and (4) the less educated are the likeliest to return quickly, however (5) the most highly educated are the likeliest to move quickly onward. This study also affirms that location-specific capital accumulated by recent arrivals in a new location deters further migration.

Borjas and Bratsberg's study (1996) on US data find that various source country characteristics, including the source country's per-capita GNP; the country's distance from the United States; whether the country has a communist regime; whether the country has recently experienced a coup or a revolution; and a measure of inequality in the source country's income distribution, are the major determinants of the out-migration rate. They suggest that the per-capita GNP in the source country is a key variable determining the out-migration rate. Immigrants tend to return to rich countries, not to poor countries. A doubling of per-capita GNP increases the out-migration rate by 4.9 percentage points. The distance has a strong negative impact on the out-migration rate. Every 1000-mile increase in distance between the United States and the source country reduces the out-migration rate by 1.2 percentage points. The presence of a communist regime in the source country has a strong negative impact on the out-migration rate. Holding other factors constant, the return migration rate to communist countries is about 18 percentage points lower than that to other countries. The most interesting one is that the out-migration rate first increases and then decreases with the income inequality measure in the source country. It fits their theoretical model's prediction that the relationship between the out-migration rate and the rate of return to skills should have an inverse-U shape with the peak occurring at the US rate of return.

DeVoretz and Iturralde (2001) focus on the question of why do highly skilled Canadians stay in Canada. They surmise that education, marriage, divorce, previous moves, and the presence or not of children all affect the probability of staying in Canada. These events usually occur in a predictable sequence in a person's life, and they imply that the probability that a person will stay will first rise and then fall with age. Their study also indicates that Canadians' "staying power" in the face of large prospective gains in income is extraordinary. In 1991, highly trained Canadians would forego \$C75,000 in lifetime income gains before moving to the United States; in 1996 this figure was \$C46,000.

More recently, DeVoretz and Ma (2001) propose a new triangular model of human capital flows and argue that human capital transfers are part of a general equilibrium system – globalization – which transfers human capital from sending countries, India-China (including the SAR); to entrepôt countries (Canada and Europe) and then on to the rest of the world (USA). In particular, they argue that Canada is an excellent entrepôt example given its unique immigration and integration policies and its strategic geographical location. They argue that there is a joint investment decision involved in this trilateral movement. The first act of investment takes place prior to movement as the person acquires human capital in their place of origin. The second act of investment occurs when the immigrant moves to exploit this advantage by gaining complementary human capital at the entrepôt destination. Therefore, such a triangular movement is a strategic behavior.

The existing literature strongly indicates that the movement of the highly skilled at this period is more diversified. The choice of further destination is obviously not a random selection. Thus, we assume here the followings:

(1) Stayer

$$V_{3.3}^j > V_{3.4}^j \text{ and } V_{3.3}^j > V_{3.5}^j$$

(2) Returnee

$$V_{3.4}^j > V_{3.3}^j \text{ and } V_{3.4}^j > V_{3.5}^j$$

(3) Further-mover

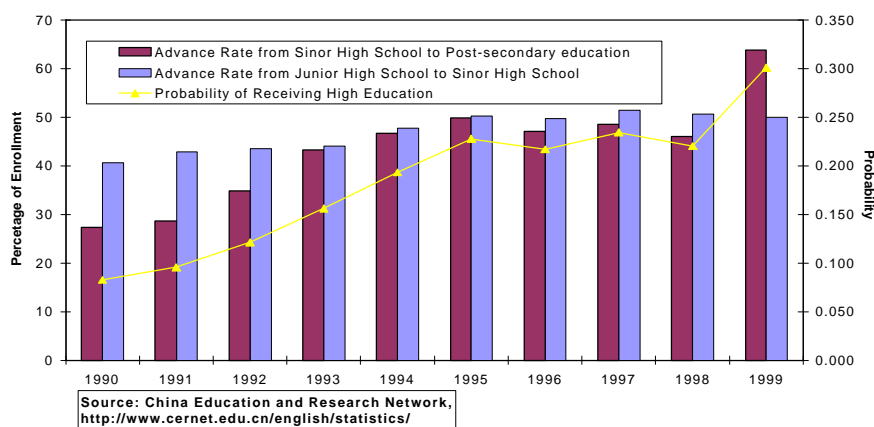
$$V_{3.5}^j > V_{3.3}^j \text{ and } V_{3.5}^j > V_{3.4}^j$$

3. Some Empirical Evidence from China

To our knowledge, there are no systematic data available to test our model and its assumptions. Nevertheless, some available data from different sources provide some stylized facts to compare with our model's implications.

From the supply angle, the domestic school facilities at the higher education level are obviously insufficient. Based on the rate of school enrollment at each level, the estimated probability of receiving higher education in China in the 1990s varies from 0.08 to 0.30 (see figure 3). Although the probability has been increasing rapidly, it is still unlikely for most Chinese youths to enroll in higher education institutions.

Figure 3: Probability of Receiving Higher Education in China:1990-1999



On the demand side, because of insufficient domestic school facilities, there is an increasing desire to continue higher education abroad. A recent survey shows that Chinese families spend more on education than on housing as parents send their children abroad to acquire expensive university education (March 2000, *Beijing Cheng Bao-Beijing Morning Post*). It is estimated that 25,000 Chinese students go abroad to study at their own expense each year.⁷

As Chinese students fulfill their dream of studying abroad, huge amounts of money are flowing out of China to foreign educational institutions. It is roughly estimated that each student spends RMB 6,000 (US\$726) a year if he/she is enrolled in a Chinese post-secondary institution. The counterpart spends at least RMB 140,000-180,000 (US\$ 16,929-21,765) a year if he/she enrolls in a post-secondary institution abroad. The 25,000 Chinese students

⁷ For a detailed description of different types of sponsorship of Chinese students studying abroad, see Orleans 1988.

make up a total of RMB 4 billion (US\$ 483.7 million) in non-governmental education investment flowing abroad.

What is the return rate of such an amount of investment in human capital? At this stage, we cannot provide an estimate of different rates of return to schooling at domestic schools or abroad due to the unavailability of data. Therefore, we have no evidence to show the importance of transferability of skills acquired from different locations. Nevertheless, many studies have indicated that the return rate is lower in China and higher abroad, which reverses the findings of higher return in developing countries than in advanced countries by Psacharopoulos (1985). Table 1 summarizes the rates of return to education both in China and to Chinese abroad. These findings in the literature imply that the difference of return to education between the labor market in China and abroad may induce more Chinese families to send their children to study abroad.

Table 1: Summary of Studies on Return to Education in China or to Chinese Abroad

Author(s)	Data	Rate of Return to Education (%)	
		In China	Chinese Abroad
Chiswick (1988)	1970 US census of population, 5% and 15% questionnaires		6.7 for US-born Chinese in US.
Jamison & Van Der Gaag (1987)	1985 household survey (Hui County, Gansu Province)	4.5 for urban male; 5.5 for urban female	
Gelb (1990)	1986 workers survey questionnaire (WSQ) of "Township, village and private (TVP) enterprises sample survey" (4 counties)	Statistically insignificant for most educational dummies, and negative sign for college dummy	
Knight & Song (1991)	1986 household data	Varies 0.5 ~ 2.9 for different education levels	
Gregory & Meng (1995)	Subset of same data as Gelb's for male only	4.0 for market group; 0 for non-market group	
Xie & Hannum (1996)	1988 Chinese Household Income Project (CHIP)	3.1	
Meng & Kidd (1997)	1981 enterprise-based worker survey	2.5 for male in state-owned sector	
Maurer-Fazio (1999)	1988 CHIP & 1992 Chinese Labor Market Research Project (CLMRP)	=>2.9 for male, 4.5 for female; =>3.7 for male, 4.9 for female	

What happens after completion of their studies abroad? It is estimated that the total number of Chinese students studying abroad reached approximately 300,000 in the period 1978–1997, with 34 percent of them returning. There are 103 countries involved (See Table

2). If taking the US as an example of destination country,⁸ we find that the probability of those planning to remain in the US increased dramatically in the period of 1985–1996. The probability of a planned move, including returning home and moving further to other non-US destinations, dropped sharply. It is interesting to note that this changing trend is strongly associated with an increasing share of permanent visas and personal sources of support for their studies (See Figure 4). This suggests that the existing legal legislation allowing to stay at host countries, and tightness of link with home countries in terms of sources of supporting determine the decision of stay or return.

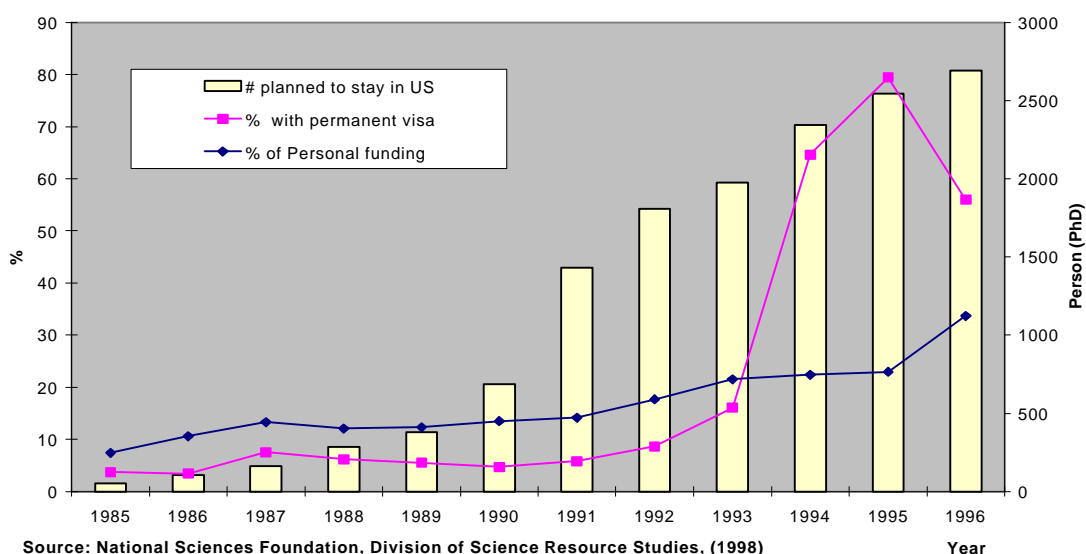
Table 2: Data on Study Abroad in the Period of 1978-1997

Aggregate Number of Chinese Students Studying Abroad (in 10 thousand)	29.2
Of which: sent by the government	9.15
sent by units	15.34
self-supporting	9.85
Number of countries & regions involved	103
Aggregate number of returnees	9.85
Rate of return from abroad (%)	33.7

Source: China Education and Research Network, 2001, Table 8: Data on Study Abroad in the period 1978-1997, available at: http://www.cernet.edu.cn/zhong_guo_jiao_yu/shu_zi/tubiao/005.php

⁸ Little is known in the literature about Chinese students in other countries, such as Canada.

Figure 4: Number of Chinese PhDs Who Planned to Stay in US after Completion of Study (1985-1996)



Source: National Sciences Foundation, Division of Science Resource Studies, (1998) Survey of Earned Doctorates, available at http://srsstats.sbe.nsf.gov/dataaccess_java.html

In addition, the last point to be noted is the estimate of the net human capital gain and loss in accordance with China's current emigration pattern. If we just take the students into account,⁹ China has experienced a dramatic loss of human capital, i.e. brain drain. The total value of human capital loss for China reached US\$ 4-5 billion for the period 1978–1997 (See Table 3). This is more than 10 percent of the annual total of foreign direct investment (US\$ 38.8 billion¹⁰) in China in 1999.

Table 3: Aggregative Estimate of Human Capital Gain and Loss for China: 1952-1998

	Number Migrating (Person)		Present Value ³ (Per Migrant) (in 1999 US\$)	Total Value (US\$ Millions)		Net Human Capital Gain and Loss (US\$ Millions)	
	1952-77 ¹	1978-97 ²		1952-77	1978-97	1952-77	1978-97
Out Migration	1,573	292,000	20,520 ⁴	32.28	5,991.84	-	-
In Migration: a. Valued at destination	1,712	98,500	20,520 ⁴	35.13	2,021.22	2.85	-3,970.62

⁹ Since we have no precise data on other types of Chinese emigrant to the rest of the world.

¹⁰ World Bank, 2001, which is available at <http://www.worldbank.org/data/countrydata/countrydata.html>

b. Valued at origin	1,712	98,500	3,550 ⁵	6.08	349.68	-26.2	-5,642.16
c. Valued at origin adjusted	1,712	98,500	4,861 ⁶	8.32	478.81	-23.96	-5,513.03

Notes and sources:

¹ China Education and Research Network, 2000, Postgraduates and Students Studying Abroad, http://www.cernet.edu.cn/english/statistics/edu/edu_99_06.php

² China Education and Research Network, 2001, Table 8: Data on Study Abroad in the period of 1978-1997, http://www.cernet.edu.cn/zhong_guo_jiao_yu_shu_zi/tubiao/005.php

³ Population Reference Bureau, 2001, PRB 2001 World Population Data Sheet, <http://www.prb.org/pubs/wpds2110/>. The present value per migrant uses the Gross National Income in Purchasing Power Parity (GNI PPP) per capital (US\$). It provides an indicator of the welfare of people that is comparable across countries free of price and exchange rate distortions.

⁴ It takes the average GNI PPP per capital for More Developed Countries.

⁵ It takes the average GNI PPP per capital for China, excluding Hong Kong SAR, Macao SAR, and Taiwan.

⁶ It is adjusted according to same ratio of the average annual income of skilled professionals in Scientific Research and Polytechnic Services relative to the total average in 1998 (i.e. RMB10241:7479, China National Bureau of Statistics, <http://www.stats.gov.cn/yearbook/1999/>). The reason for this adjustment is to reflect the present value more precisely for those returnees who are most likely fill in this job category. However, as indicated by Bowman and Myers (1967:880) that raising or lowering per-migrant present values or varying the ratio between destination and origin would only change the numbers but not the argument.

Conclusions:

This paper presents a general model to describe the sequences of an individual's decision concerning human capital investment and flows within a multiperiod framework. The model links the flow of the highly skilled to the location choice of human capital investment. It also considers the more extensive geographic coverage beyond some specific destination countries such as the US.

The multiperiod model suggests that: (1) the human capital flow starts as early as its formation period. The location of schooling determines, to a large extent, the quality of schooling and transferability of skills, which in turn affect further mobility. (2) The migration decisions of the highly skilled are not only reversible, but also extendible. In other words, people may initially face a choice to move or stay, and later end up by returning home, staying abroad or moving on. Therefore, the conventional concept of brain drain deviates from the current pattern of such highly skilled mobility. (3) This repeated migration decision is not a random one. It is affected by many factors, such as the possibility of higher education acquisition, relative rate of return to education, existing legislation allowing the stay in host

countries, and strength of the link with home countries and so forth, that all determine the value of future income stream.

Due to the unavailability of reliable data to test the model empirically, some indirect data on China and Chinese emigration provide similar implications as argued in the model. Finally, this paper also calls for further investigation to obtain solid evidence for the current highly skilled migration in the world that this paper tries to model.

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