Ecological Analyses of Permanent and Temporary Migration Streams in China in the 1990s

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ABSTRACT

Using data from China's Fifth National Census of 2000, this paper analyzes the dynamics of China's inter-provincial permanent and temporary migration streams for the 1995-2000 period. The permanent and temporary migration streams are shown to have similar patterns, but the volume of the temporary migration streams greatly outnumbers that of the permanent streams. A human ecological model of migration is then proposed and tested, and its results are compared with those of a gravity model of migration. Of the various ecological variables examined in the models, investment levels at destination, and being a coastal province at destination, all have strong effects on migration. The effects of the independent variables are more similar than different with regard to predicting the permanent and the temporary migration streams.

INTRODUCTION

Research on Chinese internal migration patterns undertaken in the past two decades has dramatically increased our understanding of migration in China. The research has tended to focus mainly on three topics. First, considerable attention has been directed to analyzing patterns of rural to urban migration. For example, Liang and White (1996) investigated the long-term patterns of migration in China between 1950 and 1988, and found important links between major economic and political events and population movement. Goodkind and West (2002) found a rapidly growing temporary population from rural areas concentrated mainly in urban areas, and this has mainly occurred since the 1980s. Liang and Ma (2004) showed similar patterns of temporary migration up to the year of 2000. Owing to the rise of temporary migration associated with urbanization, Liang characterized the late 1980s and the 1990s as the “age of migration” in China (2001: 499). These studies focused mainly on temporary migration (sometimes referred to as floating migration, *liudong renkou*) from rural to urban areas.

Second, many studies have analyzed the characteristics of permanent and temporary migrants in selected cities and provinces. Yang and Goldstein (1990) compared the direction and volume of both temporary and permanent migration in Zhejiang province. Goldstein and Goldstein (1991) examined the sex, age, and occupational differentials of permanent and temporary migrants in 74 cities and towns of China. Rowland (1992) extended the comparison to migrants’ family characteristics in the same 74 places. It was shown in these and other analyses that permanent and temporary migration in China has been mainly directed toward urban places. But the volume of temporary migration has been larger than that of permanent migration. These analyses have often focused on specific provinces and areas, and many have not included all the provinces of the country.

Third, another main focus of Chinese migration studies explores the causes and determinants of internal migration, at both the individual and aggregate levels (Liang, 2001; Liang & Ma, 2004; Goldstein, Goldstein and Guo, 1991; Li and Zahniser, 2002; Liang, Chen and Gu, 2002; Liang and White, 1997; Poston and Mao, 1998; Yang and Guo, 1999; Zhao, 1999; Zhang, 2006). Most of the models analyzed in this literature have been estimated for temporary migration. Also, many of these studies have been conducted at the micro-level and have focused on demographic characteristics of the migrants. Less attention has been directed to analyses of migration at the provincial-level.

To date, the Chinese migration literature has paid less attention to how provincial-level characteristics have shaped both permanent and temporary migration. This paper endeavors to fill this void. We use internal migration data from China's 2000 census and address two main issues. First, we describe the patterns of the 930 interprovincial permanent and temporary migration streams between China's 31 provinces, municipalities and autonomous regions during the 1995 to 2000 period. Second, we propose and estimate gravity models and ecological models of the provincial-level determinants of these two streams for the same period. We turn now to a discussion of the data and methods we use in our analyses.

DATA, DEFINITIONS AND METHODS

The migration data are taken from two tables in the report of data from China's 2000 census, namely, Table 7-2: Population by Current Residence and Place of Household Registration in Other Places, and Table 7-4: Population by Current Residence and Usual Residence 5 Years Ago (Population Census Office, 2002). In the 2000 census questionnaire, a person was asked if his/her usual residence on November 1, 1995 was in the same province as his/her residence on November 1, 2000, the reference date of the 2000 Census. Persons who answered in the negative and who also stated that their two residences were in different provinces are defined as interprovincial migrants. Among these interprovincial migrants, persons who also moved their household registrations (*hukous*) from the origin provinces to the destination provinces are defined as permanent migrants. "Individuals who have resided at their place of destination for six months without [changing their] local household registration status" are defined as temporary migrants (Liang and Ma, 2004: 470).

We define an interprovincial migration stream as the number of persons moving between province *i* and province *j*. There are 31 provinces, autonomous regions, and municipalities in China, namely the twenty-two provinces of Hebei, Shanxi, Gansu, Liaoning, Jilin, Heilongjiang, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Hunan, Guangdong, Hainan, Sichuan, Guizhou, Yunnan, Shaanxi, and Qinghai, the five autonomous regions of Guangxi, Inner Mongolia (Nei Menggu), Ningxia, Tibet (Xizang), and Xinjiang, and the four central administrative municipalities of Beijing (the capital of China), Tianjin, Shanghai, and Chongqing (see the map in Figure 1). The five autonomous regions and the four municipalities are governmental equivalents of provinces, and will be referred to and treated as provinces in this paper. There are thus 930 separate migration streams (or 31 x's 30) from and to each of the 31 provinces. These 930 migration streams are our units of analysis.

We begin with a description of the permanent and temporary migration streams among China's provinces for the 1995-2000 period. This is followed by a discussion of the main migration model used to predict variation in the two internal migration streams, the human ecological model, which is compared and contrasted, theoretically and empirically, with the gravity model of migration. Then, we estimate ordinary least squares (OLS) regression equations for both models to explore and contrast their effects on the permanent and temporary migration streams.

MIGRATION STREAMS IN CHINA

Our dependent variable is the number of migrants in each of the 930 migration stream for the 1995-00 period to and from each of the 31 provinces of China. The use of the province or province equivalent is not without conceptual difficulty. For one thing, provinces are political, not ecological, units. Thus, they do not possess the ecological integrity of geographical units such as metropolitan areas. They are also heterogeneous in composition and social characteristics so that the values of their variables are often averages of the values for the smaller ecological units (e.g., counties) that comprise them. These problems notwithstanding, we opted to use the province because migration streams between provinces include all the possible interprovincial migration that may occur in the country.

The dependent variable is based on complete-count census data enumerating the number of persons who moved from province i to province j during the period of 1995-2000 (Population Census Office, 2002). We have separate data for permanent migrants and for temporary, i.e., floating migrants (for an illustration of this mover distinction, see Goldstein, White and Goldstein, 1997).

Regarding the measurement of the dependent variable, past research indicates two main ways to measure a migration stream between two areas: an absolute number, and a rate. Some migration stream research has used the absolute number of migrants (Zipf, 1946; Stouffer, 1940; Galle and Taeuber, 1966; Greenwood, 1969, 1971; Poston and Mao, 1998; inter alia), and other research has used rates (Karp and Kelly, 1971; Greenwood and Sweetland, 1972; Poston and

Mao, 1996). There are assets and liabilities involved in both kinds of measures. For one thing, policy decisions and adjustments are more easily determined if the outcome, i.e., the dependent variable, is the absolute number of movers.

In the early stages of our research we operationalized the migration stream variable in four ways: 1) the absolute number of migrants in the stream in the 1995-2000 period; 2) the number of migrants in the stream in 1995-2000 as a proportion of the population in the receiving province in 1990; 3) the number of migrants in the stream in 1995-2000 as a proportion of the population in the sending province in 1990; and 4) the number of migrants in the stream in 1995-2000 as a proportion of the product of the populations in the sending and receiving areas in 1990 (these three rates follow the suggestion of Greenwood and Sweetland [1972] and others).

Using the 930 migration streams as our units of analysis, we calculated zero-order correlations between each the four migration stream measures, for both permanent and temporary migrants separately, in logged form, so to ascertain their degree of relationship (table not shown, but available from the authors). The four migration stream measures, while conceptually distinct, are highly correlated with each other. Little would be gained by using more than one of the migration stream measures in model estimation. We opted to use the absolute measure, viz., $\mathbf{M_{ij}}$, as our measure of the migration stream.

Our selected measure of interprovincial migration, $\mathbf{M_{ij}}$, is the absolute number of persons in each migration stream moving between province *i* and province *j* in the 1995-00 period; $\mathbf{M_{ij}}$ is calculated separately for permanent migrants and for temporary migrants. Table 1 presents data for the ten largest and ten smallest of the 930 permanent migration streams in China. The largest stream is from Hunan Province to its contiguous province of Guangdong with a total of 252,133 migrants. Remarkably, the destinations of the next five largest permanent migration streams are also Guangdong province. Indeed with 1,150,107 migrants, Guangdong received the largest number of permanent migrants during the 1995 to 2000 period of any of China's provinces. Guangdong Province contains 80 percent of the migrants in the ten largest permanent migration streams and 36 percent of the more than 3.2 million interprovincial permanent migrants in all the migration streams in China. Jiangsu Province, Shanghai, and Zhejiang Province share the remaining one-fifth of the migrants in the ten largest permanent migration streams.

Even though China's migration policies emphasize that population movement to the major municipalities and economic centers on China's east coast, particularly Guangdong Province, is to be discouraged, these areas continue to be the major destinations for permanent migrants. Permanent migrants, holding household registrations issued by the Chinese government, are supposed to be more successfully controlled by migration policies. Nevertheless, in the 1995-2000 period, they tended to move mainly to China's east coast provinces.

In terms of origin provinces, Hunan Province, the province just west of Guangdong Province, is the major origin province of the permanent migrants. Permanent migrants originating in Hunan comprise 22 percent of all permanent migrants moving to Guangdong Province between 1995 and 2000. In fact, over 325 thousand permanent migrants left Hunan Province between 1995 and 2000 and obtained household registrations in other provinces, accounting for ten percent of the total volume of interprovincial permanent migration. This figure is second only to that of Sichuan Province. During the same period, Sichuan sent out almost 440 thousand permanent migrants, or 14 percent of the total volume of interprovincial permanent migration.

Of the ten largest permanent migration streams, only the streams originating in Sichuan, Hubei and Henan Provinces are to destination provinces that are not contiguous to them. Seven of the ten largest permanent migration streams have origin and destination provinces that are contiguous. This reflects the important role that distance plays in determining permanent migration; the closer the destination to the origin, the greater the volume of migration.

Further, the origin provinces of the ten largest permanent migration streams are all areas with low levels of economic development. Sichuan, Guangxi, and Jiangxi all have gross domestic product (GDP) per capita values of less than 5,000 Yuan in 2001. The remaining sending provinces report GDP per capita values of between 5,001-10,000 Yuan (National Bureau of Statistics 2001).

With regard to the ten smallest permanent migration streams, Tibet to Hainan is the smallest, with only two migrants. It is followed by Hainan to Tibet, Guangxi to Qinghai, and Hainan to Qinghai, each with four migrants. Tibet and Hainan are the origin provinces of six of the ten smallest permanent migration streams. Ningxia and Qinghai are the destinations of seven of the ten smallest streams. Except for Hainan, all these provinces are located in the southwest or the northwest, have very low levels of economic development, and have very small populations.

*** TABLE 1 ABOUT HERE ***

We turn next to a description of the ten largest interprovincial temporary migration streams. Compared to the permanent migration streams, there is a very similar overall direction of population movement. The data in Table 2 indicate that of the 930 temporary migration streams, the largest migration stream is from Hunan to Guangdong with over 3.3 million temporary migrants. As a receiving province, Guangdong was the destination of over 15 million temporary migrants between 1995 and 2000, accounting for almost 36 percent of all interprovincial temporary migration in China. This percentage is very close to Guangdong's provincial share of permanent migration. Table 2 also shows that most of the largest temporary migration streams are the same as the largest permanent migration streams.

However, the size of the temporary migration streams is much larger than the size of the permanent migration streams. Considering only the ten largest migration streams, the temporary streams are on average 14 times larger than the permanent streams. Considering all the interprovincial temporary migrants in China between 1995 and 2000, the number of over 42 million temporary migrants is 13 times larger than the total number of permanent migrants. This is one reason why the study of temporary migration draws so much more attention of migration researchers studying China. It also confirms an earlier statement of Goldstein and Goldstein that "temporary movement has become numerically more important than permanent migration" (Goldstein and Goldstein, 1991: 44).

Of the ten smallest temporary migration streams, five are among the ten smallest permanent migration streams, namely, Tibet to Ningxia, Hainan to Tibet, Tibet to Guangxi, Ningxia to Guizhou, and Hainan to Ningxia. Like the situation with permanent migration, the sending and receiving provinces of the ten smallest temporary migration streams are small in population size and among the poorer provinces in the country. We turn next to the development and testing of the ecological model of migration, and compare it with the gravity model.

*** TABLE 2 ABOUT HERE ***

AN ECOLOGICAL MODEL OF MIGRATION

This paper sets forth a human ecological explanation of interprovincial migration streams in China during the 1995-2000 period. We base our theoretical rationale and modeling on prior work in sociological human ecology. However, much of the prior work analyzing migration streams has used gravity models and spatial interaction models, the latter with a heavy focus on economic approaches and variables (for reviews, see Greenwood, 1975; and Jessadachatr, 1989; among many others).

The gravity model was one of the earliest approaches used to analyze migration streams. It was first proposed by Ravenstein (1885) who emphasized the importance of distance and population size at both origin and destination. Large populations were said to promote migration, and long distances between the origins and destinations were said to impede and prevent migration. The gravity model follows this formula:

$$M_{ij} = \frac{P_i P_j}{D_{ij}}$$

where M_{ij} represents the number of migrants between locations i and j, P_i represents the population size at i, P_j stands for the population size at j, and D_{ij} is the distance between the two places. The earliest application of this model was Ravenstein's work more than a century ago (1885; 1889) where he noted that "the great body of migrants only proceed a short distance," and that in estimating migration flows we "must take into account the number of natives of each county which furnishes the migrants, as also the population of the towns or districts which absorb them" (Ravenstein, 1885: 12). In a later analysis, Zipf (1946) found that gross migration between two places varies positively with the product of their sizes, and negatively with the distance separating the two places.

Elaborations of the gravity model, namely, the spatial interaction model and the human ecological model, endeavor to identify the specific features or characteristics of the origin and destination populations, other than the actual size of their populations, that promote or impede migration. In most prior research of migration streams these characteristics have mainly been economic, and the model has been known as the spatial interaction model. The characteristics of the sending and receiving locations used to predict the size of the migration streams have included income levels, per capita government expenditures, and employment rates, among other variables (for examples, see Greenwood and Sweetland, 1972). Spatial interaction models have been used to analyze migration streams in both developed and developing countries, including the United States (Blanco, 1963; Greenwood and Sweetland, 1972), Sweden (Isbell, 1944), India (Greenwood, 1971), the United Kingdom (Flowerdew and Salt, 1979; Fotheringham and O'Kelly 1989), Egypt (Greenwood 1969), and Thailand (Jessadachatr, 1989), among several other countries.

The ecological model we propose and test in this paper goes beyond the strictly economic considerations of the spatial interaction model. A major difference between ecological and economic models is that ecological models include within their purview the entirety of collective life. An economic model, for instance, usually does not “investigate the nonpecuniary aspects of economic relationships. Nor does it treat those subsidiary but contingent relationships which do not find expression in a pricing system, such as occur in the family and between nonprofit institutions” (Hawley, 1950: 73). Or as Gibbs and Martin (1959: 34) have noted, “whereas economists are ordinarily interested in the interrelationships of such variables as supply, demand, cost, and prices within a given sustenance organization, ecologists are concerned with the characteristics of the structure itself" (also see Poston, Hirschl, and Frisbie, 1992; and Poston and Frisbie, 2005). In the next few paragraphs, we focus in more detail on the ecological approach to migration. From the perspective of sociological human ecology, migration is the major mechanism of social change and adaptability for human populations. A knowledge of migration patterns tells us about how "populations ... maintain themselves in particular areas" (Hawley, 1950: 149). The ecological approach asserts that human populations redistribute themselves so to approach an equilibrium between their overall size and the life chances available to them. Migration is viewed as the principal mechanism for effecting this adjustment. It is a demographic response attempting to preserve or attain the best possible living standard by reestablishing a balance between population size and organization (Poston and Frisbie, 2005: 604-606).

The theoretical foundation of sociological human ecology is based on the interdependence of the four conceptual rubrics of population, organization, environment, and technology. The interrelationships among and between these dimensions inform one's understanding of migration patterns, as follows: all populations must necessarily adapt to their environments, and these adaptations vary among populations on the basis of their social and sustenance organization, their technology, and the size, composition, and distribution of their population. The environment per se is comprised of both social and physical factors which tend to set constraints on the population and the form and characteristics of its organization. The technology that the population has at its disposal sets in an important way the boundaries for the form and type of environmental adaptation the population may assume. These may well change, however, as new and/or different technologies are introduced, allowing its relationship with the environment to change, and resulting also in changes or adjustments in the population's organization, and in its population size. Human ecology posits that, of the three demographic processes, migration is by far the most efficient agent for returning the human ecosystem to a state of equilibrium or balance between its size and organization (Poston and Frisbie, 2005). We turn now to the variables of our paper and the hypotheses to be tested.

VARIABLES AND HYPOTHESES

As already noted, the dependent variable is the total volume of migration between every pair of provinces in the 1995-2000 period and is operationalized as the absolute number of migrants.

Regarding the independent variables, we first estimate a gravity model and use the three variables of population size at origin and at destination, and distance between origin and destination.

We now discuss the ecological variables according to each of the four ecological rubrics. Of the four rubrics, it is not an overstatement to note that organization is the most fundamental; indeed a major aim of this paper is to ascertain how characteristics of a population's organization act as a catalyst for migration. We have thus selected the percent investments in non-state-owned units, and an index of the division of labor, as two independent variables to represent the sustenance organization of the population. The greater the investment at destination, the larger the migration stream; the greater the investment at origin, the smaller the migration stream. The greater the division of labor at destination, the larger the migration stream; the greater the division of labor at origin, the smaller the migration stream.

In sociological human ecology, the environment is defined as "whatever is external to and potentially or actually influential on the phenomenon under investigation" (Hawley, 1968: 330). According to this definition, the environment includes not only the biotic or physical characteristics of an area, but also the "influences that emanate from other organized populations in the same and in other areas; (indeed, the latter may well) acquire a more critical importance than the former" (Hawley, 1981: 9). The variables we have selected to address this ecological dimension are whether the province is located on China's east coast, and whether the two provinces in the migration stream are contiguous. If the origin province is located on China's east coast, the migration stream will be smaller than if the origin province is located elsewhere. The opposite is expected if the destination province is located on the east coast. If the two provinces are contiguous, the migration stream will be larger than if they are not contiguous. We also include a climate variable to represent the physical aspects of the environment. The better the climate at origin, the smaller the migration stream; the better the climate at destination, the larger the migration stream.

Technology has been argued by some scholars as very critical for the adaptation of human populations. It has been defined by Lenski (1970: 37) as "the information, techniques, and tools by means of which men utilize the material resources of their environment." However, a problem with applying these dimensions to national sub-areas such as provinces is that they have been conceived at the societal level of analysis. So one could argue that it is difficult to contend that the level of technology varies in any significant way at the sub-societal level. One way of getting beyond this quagmire is to focus on the information component of technology and to choose as an independent variable the educational level of the population, a variable that indeed varies among sub-societal units. This is at best an imperfect solution. Nonetheless, we have selected the percentage of the population aged 25 years and over with a college degree. The higher the education level at origin, the smaller the migration stream; the higher the education level at destination, the larger the stream.

Finally, we have chosen the independent variable of the sex ratio of persons aged 20 to 49 to represent the population rubric. The ages of 20-49 are the key ages of interprovincial migrants, and migrants tend more to be male than female. Thus the larger the sex ratio of persons aged 20-49 at origin, the larger the migration stream; the larger the sex ratio at destination, the smaller the stream.

All of the above independent variables have been shown to be important and significant predictors of migration in the ecological and spatial interaction studies cited previously.

Table 3 shows descriptive statistics for all the variables, expressed in their raw versions. When we use these variables later to test the hypotheses, they will all (except for the contiguity and coastal location variables – see below) be transformed with natural logarithms. The mean and standard deviation data for the independent variables, except for the distance variable and the contiguity variable, as shown in Table 3, are reported for these variables as measured in the origin province. Since all 930 migration streams are included in the analysis, the mean and the standard deviation for each of these predictor variables in the origin province are identical to the mean and standard deviation in the destination province.

TABLE 3 ABOUT HERE

As already noted, the dependent variable, the **migration flow** between the 930 pairs of provinces, is measured with regard to **permanent migration** and **temporary migration**. Across the 930 permanent migration streams, the permanent stream has an average value of 3,471 persons, with a standard deviation of over 14 thousand. We have already shown in Table 1 that the permanent stream with the smallest number of persons, from Tibet to Hainan, has only 2 persons; that with the largest number of persons, from Hunan to Guangdong, has over 252 thousand persons.

The temporary (floating) migration stream has a mean value among the 930 streams of 45,611 migrants, with a standard deviation of nearly 199 thousand. The smallest floating migration stream is between Tibet and Heilongjiang, and between Tibet and Ningxia, and numbers 12 persons. The largest floating migration stream consists of over 3.2 million migrants and is the stream between Hunan and Guangdong.

The main sources of data for the gravity and ecological independent variables are the two volumes of the *China Statistical Yearbook 1989* and *1993* (State Statistical Bureau of China 1989 and 1994) and refer to data for time periods before 1995. Since the dependent variables, the two migration streams, are measured with data for the time period between 1995 and 2000, it is theoretically appropriate to position temporally the independent variables before the onset of the dependent variable.

The first gravity variable, **population size** in 1990, ranges from a low of 2.1 million in Tibet to a high of 106 million in Sichuan. The other gravity variable, **distance**, was calculated by hand-measuring the straight line distance between every pair of provincial capitals from a map of China. Distance has an average value among the 930 migration streams of 1,360 kilometers. The smallest value, a distance of only 110 kilometers, is for the stream between Beijing and Tianjin. The largest distance of 3,620 kilometers is for the stream between Tibet and Heilongjiang; the second longest distance is between Xinjiang and Hainan (3,448 km.).

The first ecological independent variable, the **sex ratio of the population aged 20 to 49** in 1990 has an average value among the provinces of 107.2 males per 100 females. The highest sex ratio value is almost 113 in Guangxi, and the lowest is 103 in Xinjiang.

Percent investment in the province is the percentage in the province of all investment in fixed assets (in Yuan) in China. It has an average value among the provinces of 3.2 percent, and ranges from a high of 9.0 percent in Guangdong to a low of 0.2 percent in Tibet.

The **division of labor** is a measure of the province's degree of industrial differentiation, as indicated by **M1** (Gibbs and Poston, 1975; Poston and Mao, 1998), according to this formula:

$$\mathbf{M1} = 1 - \Sigma X^2/(\Sigma X)^2,$$

where X is the number of workers in any one industry.

Data on twelve industries are used in the calculation of **M1** for each province. The highest possible value of **M1** is 1.0, and the lowest possible value approaches zero and would occur when all workers are in the same industry. The higher the **M1** value, the more so the labor force is diversified in the industries, and, thus, the greater the degree of the division of labor. Beijing has the highest **M1** value, 0.81, and Jiangxi and Hubei have the next highest values, all above 0.80. The southwestern provinces of Tibet, Guizhou, Yunnan and Guangxi have the lowest **M1** scores, all below .4, with Tibet having the lowest value of 0.33.

The **climate index** is the average daily temperature in January in the capital city of the province divided by the average daily temperature in July in the capital city; these temperatures are 30 year averages covering the years 1951 to 1980 and are calculated in Centigrade units. The index is based on the assumption that most persons prefer to avoid exposure to bitter and cold winters, and excessively hot and humid summers. The resulting index is lowered if it is cold in the winter or hot in the summer. This index is certainly an imperfect measure for at least two reasons: first, it does not include in its computation other important aspects of climate, e.g., rainfall (Karp and Kelly, 1971: 26); second, we have based the value of the index for any one province on the value of the index in the capital city of the province; we opted for this strategy instead, say, of developing an index for all the cities and areas in the province and then calculating an average index (weighted by population size) across all the cities and areas. Not only would this latter approach be very cumbersome to compute, but, moreover, detailed data for the cities and areas of each of China's province are not available. Indeed, for most provinces, 30 year average temperature data are available for only one, or at best two cities.

The climate index has an average score among the provinces of -0.051; the lowest value, i.e., the least favorable climate, is in Heilongjiang in the far Northeast, with an index score of about -0.85; the highest index value, or the most favorable climate, is in Hainan, with a score of 0.65. This means that in Hainan the average January temperature is more than two-thirds of the average July temperature. Since the climate variable is measured in Centigrade units, many of the provinces (those with average January values less than 0^{o}) have negative index values. When we estimate the regression models, since we use natural logarithms, we have added a constant of 1.0 to the climate index values for all the provinces, thus enabling us to be able to transform this value logarithmically. The climate data shown in Table 3, however, have not been incremented by the constant of 1.0.

The **coastal** variable is a dummy variable, scored 1 if the province is on China's east coast, the area with the country's greatest amount of economic activity (see the map in Figure 1). Almost 39 percent of China's provinces are on its coast. The **contiguity** variable is measured for each of the 930 migration streams, and is scored 1 if the origin and destination provinces are contiguous to one another. Almost 15 percent of the 930 migration streams are between contiguous provinces.

The **education** variable is the percentage of the population 25 years and over with a college degree. It has an average value among the provinces of 1.5 percent and ranges from a high of 8.9 percent in Beijing to a low of 0.5 percent in Tibet.

The hypotheses may now be summarized. The first two deal with the gravity model:

1. The larger the population size at both origin i and destination j, the larger the migration stream from i, and the larger the migration stream to j.

2. The shorter the distance between i and j, the larger the migration stream from i to j.

The remaining hypotheses pertain to the ecological model:

3. The higher the sex ratio of the population aged 20-49 at i, the larger the migration stream from i; the higher the sex ratio of the population aged 20-49 at j, the smaller the migration stream to j.

4. The higher the percentage investments in the province at i, the smaller the migration flow from i; the higher the percentage investments in the province at j, the larger the migration flow to j.

5. The higher the index of the division of labor at i, the smaller the migration flow from i; the higher the index of the division of labor at j, the larger the migration flow to j.

6. The higher the value of the climate variable, i.e., the more favorable the climate, at i, the smaller the migration flow from i; the higher the value of the climate variable at j, the larger the migration flow to j.

7. If the origin province is located on the coast, the migration flow from i will be smaller than if the origin province were not located on the coast; if the destination province is located on the coast, the migration flow to j will be larger than if the destination province were not located on the coast.

8. If the origin and destination provinces are contiguous the migration stream between them will be larger than if they are not contiguous.

9. The higher the level of education at i, the smaller the migration flow from i; the higher the level of education at j, the larger the migration flow to j.

The expected signs of the independent variables at origin and at destination with the dependent variable of migration flow are shown in Table 4. We expect the impacts of the independent variables on migration to work the same way for permanent migration as for temporary migration.

*** TABLE 4 ABOUT HERE***

ECOLOGICAL DETERMINANTS OF PERMANENT AND TEMPORARY MIGRATION STREAMS

In our investigations of interprovincial permanent and temporary migration streams in China we use ecological variables to model the interprovincial migration patterns. And we compare the results of the ecological models with those produced in the classic gravity models. In this section, we first discuss the structure of the multivariate equations. We then present the regression results.

Prior studies of migration streams have shown that the relationships are best calibrated into a linear function by taking the natural logarithms of the variables on both sides of the equation. We have hence transformed logarithmically all the variables used in the equations, except for the contiguity and coastal variables, which are dummy variables. These transformations were undertaken because many of the variables are skewed. Moreover, our inspection of their scatter-plots with each of the migration stream dependent variables indicated that the bi-variate relationships are not always linear. The transformations correct these problems of nonlinearity and skewness.

The linear function for the classic gravity model is as follows:

$\mathbf{M_{ij} = (P_i * P_j) / D_{ij}}$, or using natural logarithms, $\mathbf{lnM_{ij} = lnP_i + lnP_j - lnD_{ij}}$,

where $\mathbf{lnM_{ij}}$ is the natural logarithm of the absolute value of the migration flow between province$_i$ and province$_j$; $\mathbf{lnP_i}$ and $\mathbf{lnP_i}$ are the natural logarithms of population size in province$_i$ and province$_j$, respectively; and $\mathbf{lnD_{ij}}$ is the natural logarithm of the distance in kilometers between **p**rovince$_i$ and province$_j$. This model is estimated twice, namely, when $\mathbf{M_{ij}}$ is measured as the number of permanent migrants in the stream, and when $\mathbf{M_{ij}}$ is measured as the number of temporary (floating) migrants in the interprovincial stream.

The results from the multiple regression analysis estimating a classic gravity equation of permanent migration are shown in the first panel of Table 5, and the regression results of the gravity model equation estimating temporary migration are shown in the first panel of Table 6. The units of analysis are all of the 930 migration streams between each of the 31 x 30 pairs of provinces. Multiple regression analysis is used, and the metric and standardized regression coefficients (***b*** and **β**) are reported to indicate the effects of the independent variables. As already noted, the gravity equation contains only the three independent variables, logarithmically transformed, of population size at origin and destination, and the distance between the origin and destination provinces.

TABLES 5 AND 6 ABOUT HERE

This classic gravity model works exactly as predicted. In both regression equations, the population size variables of the origin and destination provinces are statistically and positively associated with the volume of the permanent, and the temporary, interprovincial migration streams. The independent variable measuring distance in kilometers between the origin and destination provinces is also statistically significant in both of the equations, and as expected, its association is negative. The shorter the distance between the origin and destination provinces, the larger the permanent migration flow, and the larger the temporary migration flow, from origin to destination. Standardized coefficients (β's) inform us that in the permanent migration equation (Table 5), the distance variable has the largest relative effect, followed closely by population size at origin (β's = -.42 and .39, respectively). In the temporary migration equation (Table 6), population size at origin has the largest effect, followed by distance (β's = .46 and -.40, respectively). These three gravity variables together explain 49 percent of the variation in permanent migration, and 50 percent of the variation in temporary migration stream.

We turn now to the ecological equations of interprovincial migration, and compare and contrast their results with those of the gravity equations. The ecological equation uses all 13 independent variables, and is the following:

$$\mathbf{lnM_{ij} = lnSexRatio_i + lnSexRatio_j + lnInvest_i + lnInvest_j + lnDOL_i + lnDOL_j + lnClimate_i + lnClimate_j + Coast_i + Coast_j + Contiguity_{ij} + lnEduc_i + lnEduc_j.}$$

The above equation is estimated for both permanent migration (Table 5) and temporary migration (Table 6). The metric and standardized regression coefficients are shown in the second panel of the two tables. The tolerances of the ecological variables range from .35 to .97, with an average tolerance for the thirteen variables of .50. Eleven of the variables have tolerances greater than .43. Multicollinearity of the independent variables is not a serious issue of concern (Chatterjee et al., 2000).

Ecological theory expects that the variables of investments, division of labor, climate, coastal location, and education should be negatively associated at origin with the volume of the migration flow, but at destination their associations should be positive (see Table 4). And ecological theory expects that the sex ratio variable should be positively associated with the migration stream at origin, but negative at destination. Also, the contiguity variable should be positively associated with the size of the migration stream; if the origin province is contiguous to the destination province, the size of the stream should be larger than would be the case if the provinces were not contiguous.

Of the thirteen slope coefficients in the equation predicting permanent migration (Table 5), eleven are statistically significant; but only seven of the statistically significant coefficients have the signs predicted by ecological theory; these are investment at destination, climate at destination, coastal location at both origin and destination, contiguity, and education at both origin and destination. The most influential of these seven ecological variables is investment at destination, with a standardized slope coefficient (β) of .45. The next most influential variables are contiguity, coastal location at origin, climate at destination, and education at origin, with β values of .32, -.28, .16, and -.16 respectively.

Regarding the effects of the ecological variables in this equation predicting temporary migration (Table 6), the results are rather similar to those just reported predicting permanent migration. Ten of the slope coefficients are statistically significant, and seven of these are signed according to the expectations of ecological theory. These are the same statistically significant and correctly signed coefficients in the permanent migration equation, namely, investment at destination, climate at destination, coastal location at both origin and destination, contiguity, and education at both origin and destination.

Several of the variables that are the most influential in the permanent migration equation are the most influential in the temporary migration equation. The most influential variables are investment at destination and contiguity, both with standardized slope coefficients (β) of .32. Coastal location at origin, education at origin, coastal location at destination, and climate at destination are the next most influential ecological variables with β values of -.31, -.21, .15, and .10, respectively.

The independent variables in the ecological equation predicting permanent migration account for over two-thirds of the variance in migration; the adjusted R^2 is .67. The corresponding adjusted R^2 value for the ecological equation predicting temporary migration is .65. These may be compared with the adjusted R^2 values of .49 and .50, respectively, for the gravity models predicting permanent migration and temporary migration (see the bottom rows of Tables 5 and 6).

We have shown above that in the gravity and ecological models the effects of the independent variables are similar when predicting permanent migration compared to temporary migration. We may examine these comparisons more formally using z-tests.

Paternoster and colleagues (1998) have recommended the following formula for contrasting the effects of two regression coefficients:

$$Z = \frac{b_1 - b_2}{\sqrt{SEb_1^2 + SEb_2^2}} \qquad (2)$$

where b_1 is the regression coefficient of independent variable X for group 1 (the permanent migration equation), b_2 is the regression coefficient of the same variable X for group 2 (the temporary migration equation), and SEb_1 and SEb_2 are the coefficient variances associated with the first and second groups respectively.

The calculated Z test values for all independent variables in the two gravity models and the two ecological models are presented in Table 7. If the value of Z for any one variable is less than 1.96, this indicates that we accept the null hypothesis that the coefficient in the permanent migration model is the same as the coefficient in the temporary migration model. If the Z test value is greater than 1.96, the null hypothesis is rejected, signifying that the coefficient in the equation predicting one of the migration streams is significantly greater than the coefficient in the equation predicting the other migration stream. A rejection of the null hypothesis for a particular independent variable that its coefficients are the same in the temporary and permanent migration models is also indicated by "No" followed by, in parentheses, an abbreviation noting in which model the coefficient was significantly larger. An acceptance of the null hypothesis that the coefficients are the same is indicated by "Yes."

It is shown in Table 7 that in the gravity model, population size at origin is significantly larger in the temporary migration equation than in the permanent migration equation. The other two gravity variables are not significantly different in magnitude in the two equations. Of the thirteen independent variables in the two ecological equations, ten of their coefficients are not significantly different in magnitude in the two equations. Only the variables of investment at origin and coastal location at origin and at destination are of a larger magnitude in one of the equations. In all three instances, the coefficient is significantly larger in the temporary migration equation than in the permanent migration equation.

The Z-values in Table indicate that for the most part the gravity and ecological variables have effects on permanent migration that are not different from their effects on temporary migration. In the gravity model, population size at origin plays a more important role predicting temporary migration. And in the human ecological model, investment at origin and coastal location at both origin and destination have greater effects in the temporary migration model compared to the permanent migration model. Overall the effects of the gravity and ecological variables on permanent and temporary migration are much more similar than they are different. This suggests that in China, provincial-level characteristics determine permanent migration and temporary migration similarly. Those variables that are weakly associated with one kind of migration are weakly associated with the other type of migration. And the same may be said for most of the variables that are strongly associated with interprovincial migration. Despite the much larger magnitude of the temporary migration streams compared to the permanent migration streams (recall that on average the temporary streams are fifteen times larger than the permanent streams -- see Table 3), the gravity and ecological variables account for about the same amount of variation in permanent and temporary migration; and the effects of the independent variables predicting temporary migration and permanent migration are far more similar than they are different.

CONCLUSION AND DISCUSSION

We began this article with a review of the literature on internal migration, both permanent and temporary, in China. We next described the patterns of the interprovincial permanent and temporary migration streams for the 1995 to 2000 period. We noted that the provinces on the east coast, such as Guangdong, Jiangsu, Shanghai and Zhejiang are the destinations of the largest permanent and temporary migration streams. In contrast, other provinces such as Tibet, Ningxia and Guangxi are the destination provinces with the smallest numbers of permanent and temporary migrants. Although these patterns were shown to be similar for both permanent and temporary migration, there were major differences in the size of the permanent and temporary migration streams. Temporary migration greatly outnumbers permanent migration; there were over 42 million temporary interprovincial migrants in China in the 1995-2000 period compared to 3.2 million permanent interprovincial migrants.

In order to better understand the dynamics of interprovincial migration in China, we next estimated regression equations of the provincial-level determinants of the two types of migration streams. One set of equations used independent variables based on the classic gravity model; and another set of equations used independent variables to represent an ecological model. The gravity variables are simple and straightforward, i.e., consisting of population size at the origin and destination provinces, and the distance between the origin and destination. The ecological model is grounded in the rich theory of human ecology and thus introduces substantive and theoretical meaning into the "bare bones" gravity model. The ecological variables add considerably to an explanation of Chinese interprovincial migration patterns based only on gravity variables. When ecological variables are introduced in the regression equations, the amount of explained variance increases to between 65 and 67 percent. This indicates that a substantial amount of the variance in the migration streams is explained by the ecological variables, and this is an amount over and above that explained by the gravity variables.

Second, although the three gravity variables performed well, this should not come as that much of a surprise. Recall that our regression equations used gross flows as the dependent variable; hence the gravity models contained the independent variables of population size at both origin and destination on the right-hand side as predictors. In such a situation high associations of population size with gross migration flows should occur automatically.

So, we ask, what do these associations between population size and migration flows really mean? How do they advance our understanding of the predictors of the volume of the migration flow? Other than telling us that the stream will be large (or small) if the populations at the origin and destination provinces are large (or small), they tell us little. Karp and Kelly (1971: 21) have written "that the size of an (area) ... acts as a force of attraction for migrants, (but) it is difficult to specify exactly what this attraction consists of."

This critique, however, may not be leveled against the ecological variables. The anticipated relationships of the ecological variables with migration flows are grounded in a rich body of theory that treats the occurrence of migration as a response to an imbalance in an equilibrium relationship between the population size of an area and its level of living. The relationships reported here between the ecological variables and migration contribute considerably more to our understanding of the theoretical determinants of the permanent and temporary migration flows in China than do those between population size and migration.

What do our results have to say about the applicability of the ecological theory of migration? Before responding to this question, we should note that the ecological theory of migration is an extremely complex and subtle one. We have endeavored here to operationalize its main concepts in terms of only a few selected variables. We have likely not done justice to the nuances of the theory. Nevertheless, the regression results indicate that the ecological variables increase considerably our understanding of the determinants of interprovincial permanent and temporary migration. For instance, the ecological theory of migration appears to be somewhat more relevant in explaining the variation in the volume of migration flows when its variables refer to characteristics of the destinations, rather than of the origins. Of the seven ecological variables with statistically significant coefficients in the permanent migration and the temporary migration equations, four of them referred to characteristics of the destination (investment level, climate, coastal location, and education level), and two referred to characteristics of the origin province (coastal location and education level). The seventh significant independent variable was that measuring contiguity. An ecological force such as investment levels tends to be more effective as a "pull" than as a "push" mechanism. Future investigations of the ecological theory of migration will need to pay closer attention to the different ways ecological factors effect the volume of the migration stream.

According to ecological theory, some of the variables did not work as hypothesized. Investment at origin was hypothesized according to ecological theory to be negatively related with the size of the migration stream from the origin. The larger the relative volume of investment at origin, the smaller the size of the migration stream from the origin. But in both the permanent migration equation (Table 5) and the temporary migration equation (Table 6), this variable had a positive effect on the magnitude of the migration stream. Indeed in each of the two equations, its standardized effect (β) was the largest of the β values of any of the thirteen independent variables. The larger the amount of investment at origin, the larger the migration stream from the origin. Ecological theory predicts the opposite.

Another ecological variable, the division of labor, specifically, industrial differentiation, was hypothesized to be negatively associated with migration flow at origin, but positively at destination. Ecological theory suggests that migration tends to flow more toward areas that are more socioeconomically developed than toward those that are not; and industrial differentiation is an important indicator of development (Poston and Frisbie, 1998: 29-30). Accordingly, we expected that the higher the industrial differentiation at origin, the smaller the size of the out-migration stream, and the higher at destination, the larger the in-migration flow. Our results indicate that the effect of the division of labor at destination is positive as expected, but not significant; however, at origin, the variable, unexpectedly, is also positive, not negative. Its unexpected behavior may have something to do with the unique industrial structure in many provinces of China that is so heavily influenced by the single category of agriculture. Perhaps if we were to calculate for each province an index of nonagricultural division of labor, it would more closely tap the level of development of the province. It may well be, however, that the division of labor simply does not work in China as it does in most Western countries, a fact about which Durkheim himself was cognizant. For although he stipulated that “the division of labor varies in direct ratio with the volume and density of societies” (Durkheim 1933 [1893]: 262), he treated China as a special case. Also, recent research supports this view (Mao, 1998).

Our findings regarding the significant pull impacts of the investment rate at destination on migration flows appear to confirm Banister's (1987) observation that "much interprovincial migration has been initiated and paid for by the government." Investment may well be a prerequisite for large scale job assignment. However, the investments are much higher in the coastal provinces than in the interior. It would appear therefore that China's migration policy and its economic development policy are not well coordinated with each other. The economic policy favors high government investments in major urban centers on the east coast, particularly in the so-called Special Economic Zones. But the migration policy encourages population movement to the less densely populated areas in the interior, where investment is still very low, and the areas are characterized by low levels of economic growth and development. Our results show clearly that between 1995 and 2000, people tended to move to provinces where the investment rates were high. Accordingly, if the Chinese government wishes to encourage population mobility from the highly dense provinces to those with low population density, much more investment needs be made in these low density, interior provinces.

In a sense, we would hold that in at least one way, free migration exists in China. Current migration policy specifically prohibits permanent migration to Beijing, Shanghai and Tianjin. However, of the 3.2 million interprovincial migrants in China between 1995 and 2000, 454 thousand of them (or almost 14 percent) moved to Beijing, Shanghai or Tianjin. Current policy also prohibits permanent migration to major areas of economic development on the east coast, as in Guangdong Province. But between 1995 and 2000, almost 1.2 million Chinese moved permanently from other provinces to Guangdong Province, or almost 36 percent of all the permanent migrants.

The situation with regard to floating migration is very similar, but the absolute numbers of migrants moving to these places are much larger. Of the over 42 million temporary migrants, 6.3 million of them, or 15 percent of all temporary migrants, moved to Beijing, Shanghai and Tianjin. Over 15 million temporary migrants, or almost 36 percent of all floating migrants, moved to Guangdong Province. Chinese migration policy does not allow persons to move to the large cities and areas of high investment. Therefore, many of the migrants get around the policy by moving as "floaters," that is, without changing their *hukous*. It is in this sense that migration in China is free. People are free to move to wherever they wish; if they are not able to move with the status of permanent migrant, that is, if they cannot bring with them a transfer of their *hukous*, they move as floaters.

In sum, among our major findings are the following: interprovincial migration in China during the period of 1995-2000 is highly responsive to three gravity variables, especially population size at origin. Distance appears to be a major deterrent to migration. The investment rate is a very significant pull factor at destination. Coastal location at both origin and destination has an important effect. For the most part, our results indicate that Western migration theories, as conceptualized with a classic gravity model and a more comprehensive ecological model, are appropriate for analyzing and understanding interprovincial migration flows in China.

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Table 1. Largest and Smallest Permanent Migration Streams in China, 1995-2000

Origin	**Destination**	**Number of Migrants**
Ten Largest Migration Streams		
Hunan	Guangdong	252,133
Sichuan	Guangdong	192,993
Guangxi	Guangdong	161,212
Jiangxi	Guangdong	122,664
Hubei	Guangdong	118,670
Henan	Guangdong	82,015
Anhui	Jiangsu	71,801
Anhui	Shanghai	66,866
Jiangxi	Zhejiang	58,907
Anhui	Zhejiang	53,627
Ten Smallest Migration Streams		
Tibet	Hainan	2
Hainan	Tibet	4
Guangxi	Qinghai	4
Hainan	Qinghai	4
Tibet	Ningxia	4
Ningxia	Guizhou	5
Hainan	Ningxia	5
Guangxi	Ningxia	6
Tibet	Guangxi	7
Yunnan	Ningxia	7

Source: China's Fifth National Census: Table 7-2. Population by Current Residence and Usual Residence Five Years Ago.

Table 2. Largest and Smallest Temporary (Floating) Migration Streams in China, 1995-2000

Origin	Destination	Number of Migrants
Ten Largest Migration Streams		
Hunan	Guangdong	3,328,873
Sichuan	Guangdong	2,843,660
Guangxi	Guangdong	2,213,417
Jiangxi	Guangdong	1,611,252
Hubei	Guangdong	1,463,704
Anhui	Jiangsu	1,121,326
Anhui	Shanghai	1,028,508
Henan	Guangdong	1,005,219
Jiangxi	Zhejiang	840,574
Anhui	Zhejiang	781,887
Ten Smallest Migration Streams		
Tibet	Heilongjiang	12
Tibet	Ningxia	12
Tibet	Jilin	21
Hainan	Tibet	27
Tibet	Guangxi	42
Ningxia	Guizhou	42
Guangxi	Tibet	42
Tibet	Liaoning	43
Tianjin	Tibet	43
Hainan	Ningxia	43

Source: China's Fifth National Census: Table 7-2. Population by Current Residence and Place of Household Registration in Other Places.

Table 3. Descriptive Statistics of Dependent and Independent Variables for 930 Migration Streams, China: 1995-2000 (n =930)

Variable	Mean	Standard Deviation	Minimum Value	Maximum Value
Permanent migration stream	3,471	14,427	2	252,133
Temporary migration stream	45,611	198,904	12	3,328,873
Under gravity model:				
Population size (million)	35.2	25.5	2.1	106.0
Distance (km)	1,359.7	722.1	110.0	3,620.0
Under human ecological model:				
Sex ratio (population 20 to 49)	107.2	2.7	103.2	112.8
Percent investment in the province	3.2	2.4	0.2	9.0
Division of labor	0.6	0.1	0.3	0.8
Climate	-0.1	0.4	-0.9	0.7
Coastal	0.4	0.5	0	1
Contiguity	0.1	0.4	0	1
Percent with college degree (population 25+)	1.5	1.6	0.5	8.9

Source: China Statistical Yearbooks 1989, 1993 & 1998

* GDP per capita is measured for the year of 1992; the other independent variables are measured for 1988 or 1990.

Table 4. Independent Variables and Their Hypothesized Relationships, at Origin and Destination, With the Volume of the Migration Flow from Origin Province (i) to Destination Province (j)

Independent Variables	Hypothesized Relationship of Origin Variables with Migration Stream	Hypothesized Relationship of Destination Variables with Migration Stream
Under gravity model:		
Population size (million)	+	+
Distance between provinces *i* and *j* (km)	-	-
Under human ecological model:		
Sex ratio (population 20 to 49)	+	-
Percent investment in the province	-	+
Division of labor index	-	+
Climate index	-	+
Coastal	-	+
Contiguity	+	+
Percent with college degree	-	+

Figure 1

The 31 Provinces, Autonomous Regions, and Municipalities of China

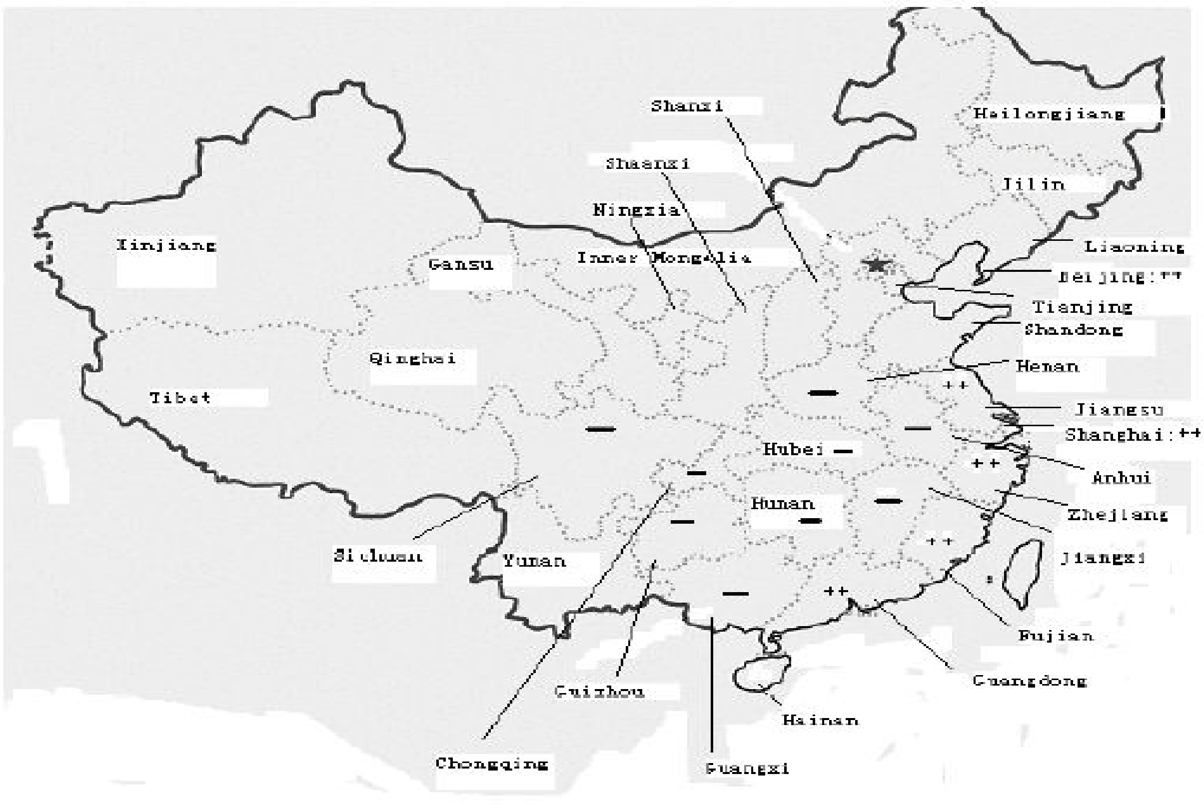

Table 5. OLS Metric (b) and Standardized (β) Regression Coefficients: 930 Interprovincial Permanent Migration Streams, China, 1995-2000

	Regression 1			Regression 2		
	(Classic Gravity Model)			(Human Ecological Model)		
Independent Variables	b	β	Std. Err.	b	β	Std. Err.
Gravity variables						
Population						
Origin	0.68***	0.39	0.04			
Destination	0.47***	0.27	0.04			
Distance	-1.21***	-0.42	0.07			
Human ecological variables						
Sex ratio						
Origin				-0.74	-0.01	1.75
Destination				-3.73*	-0.05	1.75
Percent investment						
Origin				0.93***	0.48	0.05
Destination				0.86***	0.45	0.05
Division of labor						
Origin				0.67**	0.09	0.24
Destination				0.18	0.02	0.24
Climate						
Origin				0.45***	0.14	0.09
Destination				0.54***	0.16	0.09
Coastal						
Origin				-1.00***	-0.28	0.09
Destination				0.26**	0.07	0.09
Contiguity				1.60***	0.32	0.10
Percent with college degree						
Origin				-0.43***	-0.16	0.07
Destination				0.26***	0.10	0.07
Constant	-4.54***		1.24	26.63*		11.79
R^2	0.49			0.67		
df	926			916		

Note: *<0.05, **<0.01, ***<0.001 (Two-tailed Test)

Table 6. OLS Metric (b) and Standardized (β) Regression Coefficients: 930 Interprovincial Temporary (Floating) Migration Streams: China, 1995-2000

	Regression 1 (Classic Gravity Model)			Regression 2 (Human Ecological Model)		
Independent Variables	b	β	Std. Err.	b	β	Std. Err.
Gravity variables						
Population						
Origin	0.92***	0.46	0.05			
Destination	0.38***	0.19	0.05			
Distance	-1.33***	-0.40	0.08			
Human ecological variables						
Sex ratio						
Origin				-0.74	-0.01	2.08
Destination				-1.38	-0.02	2.08
Percent investment						
Origin				1.16***	0.53	0.06
Destination				0.71***	0.32	0.06
Division of labor						
Origin				1.06***	0.12	0.27
Destination				0.11	0.01	0.27
Climate						
Origin				0.62***	0.16	0.11
Destination				0.38***	0.10	0.11
Coastal						
Origin				-1.28***	-0.31	0.10
Destination				0.63***	0.15	0.10
Contiguity				1.82***	0.32	0.11
Percent with college degree						
Origin				-0.65***	-0.21	0.09
Destination				0.24**	0.08	0.09
Constant	-4.07**		1.42	17.89		13.99
Adj. R^2	0.50			0.65		
df	926			916		

Note: *<0.05, **<0.01, ***<0.001 (Two-tailed Test)

Table 7. Z -Tests to Determine if Regression Coefficient for One Migration Stream is Significantly Larger than Coefficient for the Other Migration Stream: 930 Interprovincial Permanent and Temporary Migration Streams: China, 1995-2000

	Regression 1 (Classic Gravity Model)		Regression 2 (Human Ecological Model)	
Independent Variables	Z Value	$b_1=b_2$ (Coefs are the same)	Z Value	$b_1=b_2$ (Coefs are the same)
Gravity variables				
Population				
Origin	3.75	No		
Destination	1.41	Yes		
Distance	1.13	Yes		
Human ecological variables				
Sex ratio				
Origin			0.00	Yes
Destination			0.86	Yes
Percent investment				
Origin			2.94	No
Destination			1.92	Yes
Division of labor				
Origin			1.08	Yes
Destination			0.19	Yes
Climate				
Origin			1.20	Yes
Destination			1.13	Yes
Coastal				
Origin			2.08	No
Destination			2.75	No
Contiguity			1.48	Yes
Percent with college degree				
Origin			1.93	Yes
Destination			0.18	Yes
N = 930				

Note: H_0: b_1 for permanent migration = b_2 for temporary migration