Migration Patterns in The Northern Great Plains

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Economic conditions in this nation and throughout the world are imposing external pressures on the Northern Great Plains Region[1] through natural resource development. Development of the coal resources in the area center around strip mining and on-site electrical generation with potential for coal gasification and liquification plants. Population change is a necessary consideration when estimating the overall economic and social impact due to coal development in rural areas. Population estimates are required to forecast the infrastructure adjustments and planning requirements associated with provision of services in communities facing massive development.

This paper reports results and policy implications of two migration models (outmigration and inmigration) estimated for the rural Northern Great Plains Region [Lewis]. The objectives of the model are to estimate flows of people into or out of a State Economic Area (SEA) by source and destination as a function of local economic conditions. When combined, the net change in population due to migration can be calculated. Conversely, the models may be used to estimate the combination of local economic conditions necessary to produce a desired addition to the local labor force.

It is assumed that people move to increase their well-being, which may be expressed as a function of income and amenities (climate, scenery, and social ties are examples). In general the secondary data used in this study do not provide direct measures of amenities. The equations consist principally of variables which affect incomes and job availability. Two migration theories were combined to select the variables hypothesized to influence migration: 1) classical labor mobility theory and 2) human capital theory [Greenwood, Petto, Sjaastad]. Classical labor mobility theory asserts that workers migrate to increase their income streams. Income is assumed to be functionally related to wages and employment opportunities. Furthermore, the human capital theory of migration states that income is directly influenced by investment in education and training. Workers do not have identical preferences for all labor markets, because amenities may differ in each. In addition, the definition and valuation of amenities vary among people. Variables which reflect these influences were incorporated in the model to the extent possible.

Description of the Variables

The migration models relate the volume of gross migration to variables affecting mobility decisions. Migration measures the total number of people five years of age and older who lived in one State Economic Area (SEA) in 1965 but resided in another SEA in 1970. For each of the 17 Plains SEAs there are 48 observations of outmigration (M_{ij}) and inmigration (M_{ji}). Each observation shows the migration volume over a five year time span from (to) an SEA to (from) each state, including the state containing the SEA, but excluding Alaska and Hawaii. Thus, there are 816 observations of inmigration and 816 for outmigration in total. The definitions and sources of these data are presented in table 1.

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[1] The Northern Great Plains (Plains Area) is defined to include the eastern part of Montana, all of North and South Dakota, northeastern Colorado, and roughly the eastern half of Wyoming. This division was made by E.R.S. and closely parallels the Census boundaries for State Economic Areas.

Table 1. Description and Source of Variables for Gross In- and Out-Migration Models

Label and Description		Source
Dependent Variables		
M_{ij}	No. of out-migrants 1965-1970 to each of the 48 states	USDC, Bureau of the Census, *U.S. Census of Population, Migration Between State Economic Areas,* 1970
M_{ji}	No. of in-migrants 1965-1970 from each of the 48 states	USDC, Bureau of the Census, *U.S. Census of Population, Migration Between State Economic Areas,* 1970
Independent Variables		
Income & Jobs		
S_i	Median years education in a Plains SEA, 1970	USDC, Bureau of the Census, *U.S. Census of Population, State Economic Areas,* 1970
I_i	Median income of families and unrelated individuals in a Plains SEA, 1970	USDC, Bureau of the Census, *U.S. Census of Population, State Economic Areas,* 1970
U_i	Male unemployment expressed as a percentage of the male civilian labor force in a Plains SEA, 1970	USDC, Bureau of the Census, *U.S. Census of Population, State Economic Areas,* 1970
E_i	Absolute change in non-agricultural employment in a Plains SEA from 1964-1970	USDC, Bureau of the Census, *County, Business Patterns,* 1964 & 1970
W_i	Average quarterly non-farm wage in a Plains SEA from 1964-1970	USDC, Bureau of the Census, *County, Business Patterns,* 1964 & 1970
U_j	Unemployment expressed as a percentage of the civilian labor force in each of the 48 contiguous states, 1970	USDC, Bureau of the Census, *U.S. Census of Population, Characteristics of the Population, Part I,* 1970
E_j	Absolute change in non-agricultural employment in each of the 48 contiguous states from 1964-1970	USDL, Bureau of Labor Statistics, *Employment and Earnings,* 1932-1972
W_j	Average quarterly non-farm wage in each of the 48 contiguous states from 1964-1970	USDL, Bureau of Labor Statistics, *Employment and Earnings,* 1932-1972
Amenities		
T_j	Percent of population of 48 contiguous states classified as urban, 1970	USDC, Bureau of the Census, *U.S. Census of Population, Characteristics of the Population, Part I,* 1970
K_{ji}	No.of persons living in a Plains SEA in 1970 who were born in a different SEA	USDC, Bureau of the Census, *U.S. Census of Population, State of Birth,* 1970
K_{ij}	No. of persons living in one of the 48 contiguous states in 1970 who were born in a Plains SEA	USDC, Bureau of the Census, *U.S. Census of Population, State of Birth,* 1970
Barriers to Migration		
D_{ij} or D_{ji}	Distance between Plains SEA and each of the 48 contiguous states using state capital as base points	*Rand McNally Road Atlas,* 1970
Correction Factors		
P_i	Population of a Plains SEA	USDC, Bureau of the Census, *U.S. Population, State Economic Areas,* 1970

All variables related to either inmigration or outmigration are listed as independent variables in table 1. Variables which are specific to an SEA in the Plains are designated with a subscript, i. State specific variables are subscripted j. Thus, U_i is the unemployment in one of the 17 SEAs in the Plains while U_j represents unemployment in one of the 48 contiguous states.

Regression analyses were run with all data transformed into common logs. This allows the regression coefficients to be interpreted as elasticities. A regression coefficient of 0.52 implies

that a one percent change in the variable is associated on average with a 0.52 percent change in the migration stream which is being estimated.

Outmigration Model

According to classical labor mobility theory, people tend to migrate to gain higher wages and hence, greater incomes. As such, areas of low median family income (I_i) should have a larger volume of outmigrants than areas of higher median income (an inverse relationship). The Plains SEAs containing people with a higher level of education are hypothesized to show larger outmigration streams than other SEAs. This is based on the assumption that people with formal education have a wider spectrum of jobs available to them, potentially higher wages, and a better chance of getting a job relative to less educated individuals.

Migrants also consider job availability and probability of employment in making their decision to relocate. High unemployment rates in an SEA (U_i) should be positively related to the outmigration stream from that SEA.

Population, the final included variable to reflect local conditions in Plains SEAs, is designed to adjust for population size differences between sending areas. More migration is expected from areas with large populations, ceteris paribus, due simply to the larger number of people involved.

The remaining variables reflect conditions in each potential receiving state. The unemployment rate (U_j) , wage level (W_j), and the change in nonfarm employment (E_j) indicate job availability and income expectations at each state destination.

The urbanization variable (T_j) is entered to account for preferences for urban destinations of migrants from the predominantly rural Plains study area. A direct relationship is expected because urban areas provide cultural, educational, and other amenities which are not available in rural areas.

A direct relationship between K_j (the presence of friends and relatives) and migration flows is hypothesized for two reasons: 1) there would be a much larger flow of job information from these areas back to the sending SEAs and 2) the presence of acquaintances with similar backgrounds lessens the difficulties of transition to new surroundings. Finally, because moving costs increase with distance and because there is greater probability of intervening job opportunities with greater distance, it is hypothesized that the distance variable (D_{ij}) will be inversely related to migration.

The statistical results for the above hypothesized relationships concerning the outmigration model variables are presented in table 2. In general, coefficient signs are as expected and the coefficients are large relative to their standard errors.[2]

Inmigration Model

The selection of included variables for the inmigration model follows the same theoretical considerations as for outmigration with one exception. The inmigration model is concerned with the migrants' choice of location within the Plains once the decision to move has been made. Hence, the economic conditions in the sending area are of no interest. The model is an assessment of which factors make one Plains SEA preferable over another.

It is expected that migrants will gain by moving to SEAs which offer superior income and employment opportunities. Thus, inmigration will vary directly with the non-agricultural wage (AW_i) and migrants will tend to SEAs with a relative abundance of jobs as measured by the change in non-agricultural employment (AE_i).

Population (P_i) is entered to test the hypothesis that migrants move to population centers because of expected broader job opportunities, higher wages, and, to some extent, amenities.

The presence of friends and relatives (K_{ji}) is expected to exert a strong positive influence on inmigration flows. Migration streams tend to follow established patterns for the reasons mentioned previously.

The educational level (E_i) in the respective receiving areas is entered as a surrogate variable to measure the relative social status of an area. Inmigrants are expected to prefer more status to less and so a direct relationship is anticipated. This variable may also indicate the desirability

[2]Multicollinearity is not present among the independent variables in either the outmigration or inmigration models. None of the entries in the simple correlation matrix exceed 0.7. Also, inspection of the $(X'X)^{-1}$ matrix (in correlation form) reveals no collinearity.

Table 2. Results of the Gross Migration Models[1]

Independent Variables			Regression	Computed
Symbol	Brief Description[2]	Mean	Coefficient	t-value
Outmigration				
S_i	Schooling	11.80	3.4040	5.92
I_i	Income	6250.30	-.3173	.88*
U_i	Unemployment	3.78	.7716	6.86
U_j	Unemployment	4.31	.2782	1.58*
E_j	Nonagricultural employment	150.90	.4126	10.46
W_j	Wages	113.14	-.4480	1.42*
T_j	Urban	64.11	.4487	2.27
K_{ij}	Kinship	23157.90	.5876	19.51
D_{ij}	Distance	1048.60	-.6548	11.18
P_i	Population	136657.00	1.2483	22.07
D Dependent Variable = M_{ij}				
Intercept = -8.657 R^2 = .7836 F-value = 291.4 N = 816				
Inmigration				
E_i	Nonagricultural Employment	5416.3	.2218	2.25
W_i	Wages	1151.8	.5536	1.00*
K_{ji}	Kinship	13375.2	.5655	15.59
S_i	Schooling	11.8	7.6090	10.49
D_{ji}	Distance	1048.6	-.5657	8.65
T_j	Urbanization	64.1	1.2850	7.13
P_i	Population	136647.0	1.2080	10.69
Dependent Variable = M_{ji}				
Intercept = -17.77 R^2 = .7408 F-value = 329.8 N = 816				

[1] The equations are in double-log form. Coefficients are interpreted as elasticities. The regression used pairwise deletion of zero elements, and D_{ij} = 10 for adjacent SEAs.

[2] See table 1 for a complete description of variables.

*Not significant at the 95 percent level of confidence.

of an area because of an existing educational system.

Distance (D_{ji}) should pose a barrier to migration as it did in the outmigration model. Finally, the percent of state populations which are urban (T_j) is entered to account for population size variations in the sending areas.

The regression results of the inmigration model are presented in table 2. Again, the signs on the coefficients, the levels of significance, and the other statistical tests generally substantiate the hypotheses outlined above.

Conclusions and Policy Implications

Migrants to and from communities are definitely influenced by local economic conditions. The number and variety of jobs available and the level of employment are related too (in and out) migrants' decisions to move. It is significant that neither group tended to respond to wage differentials in the various receiving areas. Other researchers [Lansing, Raimon] have reported similar findings for outmigrants. This indicates that migrants view the probability of finding a job as the primary economic factor in choosing a locale. This may be because job information is more visable than wage data or because there is more security in a job than in searching for a high wage.

The signs on the unemployment (U_j) and wage (W_j) coefficients in the outmigration model contradict economic theory and *a priori* reasoning. (Neither variable is statistically significant and the signs may be unreliable). One explanation for the incorrect signs is that migrants' perceptions or information are erroneous. Also, some receiving

areas, such as California, offer apparent job opportunities when in fact the unemployment rate is high and the overall wage is low. The relative sizes of U_j and W_j in the sending and receiving areas offer the most probable explanation to the sign difficulties. For example, a migrant may settle in a receiving area where the unemployment rate is high relative to other possible receiving areas but, at the same time is lower than that of his origin. The migrant has not optimized in his choice, but he has acted rationally in bettering his situation.

Non-market conditions also influence location preference and utility gained by both groups. The presence of acquaintances with similar backgrounds to sponsor newcomers would tend to lessen the difficulties of transition to new surroundings. Also the flow of information from these areas back to the sending areas would be larger.

These models have both descriptive and predictive applications in the policy arena. Descriptively the models can provide information to local officials and other decision makers as to those factors which influence migration flows at the local level in the rural Plains region. It is important that local planners and others understand the motivation behind migrants decisions in order to anticipate what type of people will be moving to their area and what these migrants will be expecting to find. The same is true for outmigration streams. For example, what are the characteristics of those leaving the area and why are they leaving? The outmigration model provides some insights to these questions.

Given a set of circumstances which cause a change in the economic base of a local area, it is possible through the use of the migration models to predict the resultant migration flows.[3] Further, it is possible to examine various mixes of conditions that will produce the expected number of migrants. Again, these considerations will be important as communities impacted by natural resource development attempt to evaluate infrastructure needs and the associated tax base requirements.

[3]The predictive use of both models is constrained by the 1965-1970 data base. Care should be exercised not to extrapolate beyond the range of the data, particularily for the migration variables. This limitation may be problematical when using the models to make predictions in the mid-1970's for areas experiencing rapid growth due to large scale development of natural resources. As with any prediction model, the further from the data means one moves, the less reliable are the estimates. However, since every attempt was made to incorporate structural variables in the models, even in areas of rapid growth they should, at a minimum, reveal tendencies.

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