*Kingdom of Saudi Arabia*

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**College of**
**Administrative Sciences**
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# LABOUR MOBILITY

**In the Kingdom of Saudi Arabia**

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Contents:

# DATA & SCOPE OF WORK

## 1.1. Scope of Work:

The objective of this study is to investigate, statistically, movements of workers among industries, geographical locations, income groups, and urban and rural areas in the Kingdom of Saudi Arabia.

Our investigation comprises two types of analyses. The first is a short term analysis in which data pertaining to movements among various categories in the period 1977-81 inclusive, is examined for the presence of any specific patterns. In particular, interest is here focused on whether these movements are, in any way, related to such factors as age, educational qualifications ,.. etc.

The second type of analysis is a long term analysis. Here, an attempt is made to predict, through the use of simple and modified Markovian models, future labour mobility in the country. This enables us to find answers to questions of the form: "If a worker is in category i in a given period, what is the probability that he will move to category j after n periods?" Of special interest is the limiting distribution of workers among various categories, if any, as this will give the fractions of workers that will ultimately be in the various categories when the system reaches a steady state.

## 1.2. The Data:

The data on which the study was based , was obtained through a three-stage sample in which stratification was used in the first stage. The sampling fraction amounted to roughly 0.5 per cent of the working population.

For the purpose of studying industrial mobility, industries in the Kingdom are divided into five groups as follows:

| Industrial group | | Abbreviation |
|---|---|---|
| 1. | Transport Communication & Utilities | "Tran.Com. & Ut." |
| 2. | Agriculture | "Agri." |
| 3. | Factories | "Fact." |
| 4. | Trade | "Tra." |
| 5. | Government and Unclassified Labour | "Gov. & Un.L." |

To allow for individuals temporarily out of employment, "Unemployment" is added as a sixth group.

On the other hand, to investigate geographical mobility, the Kingdom is divided into five regions namely:

| Geographical Region | Abbreviation |
|---|---|
| 1. Western Region | W.R. |
| 2. Central Region | C.R. |
| 3. Eastern Region | E.R. |
| 4. Northern Region | N.R. |
| 5. Southern Region | S.R. |

Again, a sixth "region" under the name "outside the Kingdom is included to allow for movements in and out of the Kingdom.

Finally, seven (monthly) income groups are formed in order that movements among them be traced. These groups are

| Income Group |
|---|
| 1. Less than 1000 (S.R.) |
| 2. 1000 - 2000 (S.R.) |
| 3. 2000 - 3000 (S.R.) |
| 4. 3000 - 5000 (S.R.) |
| 5. 5000 - 7000 (S.R.) |
| 6. 7000 - 10000 (S.R.) |
| 7. more than 10000 (S.R.) |

The study covered the period 1977-81 inclusive each of the five years is divided into two halves; the first covering the period extending from the first of January to the 30th of June. Every worker is asked about his industrial group, geographical region, income group, and whether he is in an urban or a rural area in each half. This process is repeated for all 10 halves. Furthermore, the worker is asked about his marital status, educational attainment, age, language and whether he possesses other skills. The original questionaire also included questions on nationality and religion but data on these is ignored after preliminary analysis.

Two points concerning the results of chapter (2) and (3) need to be made. The first deals with the inclusion of many tables in the paper. The reason for this was that data of this type is not, as far as we knew, available any where in the country. We therefore thought it may be helpful to provide potential workers in the field of mobility, who may be interested in this type of information, with as large and varied amount of data as possible. As a matter of fact, the number of tables which came out of the original data amounted to hundreds but we finally settled at the given number.

The second point relates to use of "chi-squares' in chapter (2). It should be noted that owing to the dependency among rows and among columns of the tables to which it is applied, chi-squares is there used merely as a "classification statistics". As a result the term "significance level" does not carry its usual meaning.

Needless to say, our findings and specially those related to future mobility are tentative; awaiting confirmation through further research.

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# SHORT-TERM ANALYSIS OF LABOUR MOBILITY

## 2.1. Introduction

This chapter aims at throwing some light on labour mobility in the Kingdom of Saudi Arabia in the period 1977-81 inclusive. An attempt is made to investigate, in some depth, the way workers move among industries, geographical regions, income groups as well as urban and rural areas. Aspects of interest in this respect include: amount of movement, distribution of destinations of movers and whether movement is, in any way, related to such variables as age, education, ...etc.

The fundamental sets of data on which the analysis is based is obtained as follows: Each worker was classified according to his category in the first half (hereafter referred to as category of origin) and this classification was compared with his category location in the second half (hereafter referred to as category of destination). This type of comparison is repeated for all pairs of consecutive halves and the results totaled. As a consequence of this procedure, each worker contributes up to nine observations. Furthermore, the summing up of observations will, to some extend, eliminate any seasonal patterns in the data. As a result, it is not possible to carry out any seasonal analysis on this data.

## 2.2. Industrial Mobility:

We first consider movements of workers among the five industrial groups included in this study namely: "Tran. Com. & Ut.", "Agri.", "Fact.", 'Tra." & "Gov. & Un. L." Since the worker may, at some points of time, be unemployed, unemployment is added as a sixth group. The groups are defined in such a way that movements among them are of some practical interest.

The first column of Table (2.1) gives the percentage of observations showing change out of each industrial group when all

Table (2.1)
Percentage of Observations Showing Change Out & Distribution of Destinations for each Industrial Group of Origin (two consecutive halves) ( All workers included)

| Industrial group of origin | Percentage of obs. showing change out of Industrial group of origin | Industrial group of destination Percentage of observations showing change to | | | | | |
|---|---|---|---|---|---|---|---|
| | | Tran.Com. &Ut. | Agri. | Fact. | Tra. | Gov.& Un.L. | Un. |
| Tran.Com.& Ut. | 1.90 | 0.00 | 6.67 | 13.33 | 40.00 | 40.00 | 0.00 |
| Agri. | 7.70 | 16.67 | 0.00 | 16.67 | 33.33 | 23.33 | 0.00 |
| Fact. | 3.40 | 7.14 | 3.57 | 0.00 | 67.87 | 21.43 | 0.00 |
| Tra. | 1.70 | 17.39 | 13.04 | 30.43 | 0.00 | 21.74 | 17.39 |
| Gov.&Un.L. | 2.30 | 19.23 | 3.85 | 15.38 | 46.15 | 0.00 | 15.38 |
| Un. | | 13.64 | 4.55 | 18.18 | 20.45 | 43.18 | 0.00 |

Table (2.2)

Percentage of Observations Showing Change out of Individual Industrial Groups, Regions, Income Groups & Urban & Rural Areas, Between Two Consecutive Halves, for Various Levels of Selected Factors

| Factor Column No. | Level (0) | Industrial Group (1) | Geographical Region (2) | Income Group (3) | Urban Rural Area (4) |
|---|---|---|---|---|---|
| Marital status | Bachelor | 3.11(0.40) | 4.20 | 13.40 | 1.32 |
| | Married(without child) | 2.58(0.00) | 4.10 | 15.20 | 0.70 |
| | Married(with child) | 1.94(0.12) | 3.40 | 14.60 | 0.94 |
| Education | Illiterate | 2.65(0.00) | 4.80 | 13.90 | 1.99 |
| | Read&Write | 3.04(0.21) | 3.80 | 14.70 | 1.66 |
| | Elementary School | 2.45(0.39) | 2.80 | 15.00 | 0.99 |
| | Intermediate | 2.48(0.23) | 4.30 | 16.90 | 1.37 |
| | Secondary | 2.17(0.14) | 4.20 | 14.70 | 0.75 |
| | University | 1.55(0.27) | 3.60 | 12.90 | 0.18 |
| Age | Less than 20 years | 4.04(2.02) | 5.60 | 8.70 | 0.79 |
| | 20 - 35 | 2.61(0.19) | 4.40 | 14.70 | 1.14 |
| | 35 - 55 | 1.78(0.14) | 3.20 | 14.70 | 0.83 |
| | 35 - 65 | 2.86(0.00) | 0.00 | * | 1.17 |
| Language | Speak Arabic | 2.38(0.22) | 3.40 | 15.00 | 0.92 |
| | Does not speak Arabic | 1.37(0.00) | 8.10 | 10.30 | 1.72 |
| Presence of other skills | Present | 3.20(0.29) | 4.20 | 14.2 | 0.86 |
| | Not present | 1.90(1.70) | 3.80 | 14.0 | 1.17 |

* Not enough observations.

workers are considered. It can be seen that movement out of "Agri." exceeds movement out of any other industrial group.

The remaining columns of Table (2.1) show the way workers, who leave their industry, are distributed among other industrial groups. It is obvious that most of those who leave their industrial group go to "Tra."

2.2.1. Pattern of Overall Movement out of Industrial Groups:

In column (1) of Table (2.2) , the percentage of observations showing change of industrial group between to consecutive halves, is provided for each level of each of the five factors (quantity within parenthesis gives percent of moves to unemployment) For each level, of each factor, this quantity is arrived at by summing up observations reflecting change of industry (between two consecutive halves) and putting the result in the form of a percentage.

A fundamental question here is whether total movement out of industrial groups is, to any degree, influenced by age, education, degree of responsibility, language and the presence of other skills. Inspection of column (1) of Table (2.2) reveals the following:

1- With the exception of age group 55-65, the percentage of observations showing change of industrial group decreases steadily with increase in age and education. This inverse relationship between age and industrial mobility is also confirmed by other studies of mobility, Blumenetal (1956) and El-Beshir & Ahmed (1978). The relatively high tendency for workers in the age group 55-65 to change their industry may be attributed to the fact that this group includes pensioners and people near the retirement age. Such individuals usually tend to exploit their long experience in new fields.

2- The percentage of observations showing change for Arabic speakers is higher than for non-Arabic speakers. Also workers with "other skills" show higher percentage of moves than those with no "other skills".

3- If we regarded being married ( with or without children) as an indication of "responsibility" while being a bachelor as an indication of "less responsibility", we see that the percentage of observations showing change of industrial group is less for workers with more responsibility.

2.2.2. Pattern of movements out of individual groups

It is interesting to see how far the results of the proceeding subsection hold for individual industrial groups of origin. That is, does the pattern of movement from any individual industrial group resembles the overall pattern? Table (2.3) gives the percentage of observations showing change out of each industrial group between two consecutive halves. Inspection of the table shows the following:

1- With the exception of "Factories" & "Trans., Com. & Ut." the percentage of observations showing change out of each industrial group decreases with increase in responsibility thus conforming to the general pattern. The presence of a relation between the degree of responsibility and the leaving of an industrial group is further confirmed by a one percent $\chi^2$ test*. Furthermore, workers in "Agri." show the highest tendency to leave while workers in "Tra." reflect the least tendency.

2- The percentage of observations showing move out of each industrial group tend, ignoring the first age group, to decrease with age , a result similar to that obtained in the analysis of total movement. Furthermore, movement out of "Tran.Com. & Ut." and "Agri." is

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* As pointed out by Blumen etal (1956) , $\chi^2$ should, in this & subsequent tables of this chapter, be used merely as a classification statistics. This is so owing to the dependency between some of the columns (4 rows) resulting from the fact that a worker may contribute more than one observation to the final data.

Table (2.3)

Percentage of Observations Showing Change Out of Individual Group of Origin Between Two Consecutive Halves*

| Factor | Level | Percent of observations showing change out of Tran.Com. Ut. | Agri. | Fact. | Tra. | Gov.&Un.L. |
|---|---|---|---|---|---|---|
| Marital status | Bachelor | 1.51 | 15.07 | 2.08 | 2.63(0.33) | 2.94(0.77) |
| | Married(without child) | 3.15 | 11.77 | 2.71 | 1.52 | 1.60 |
| | Married(with child) | 1.73 | 4.31 | 3.31 | 1.02(0.34) | 1.55(0.08) |
| Education | Illiterate | 2.22 | 5.59 | 2.52 | 1.77 | 2.29 |
| | Read&write | 1.01 | 7.87 | 3.66 | 2.33(0.26) | 1.69(0.57) |
| | Elementary school | 3.81 | 7.41 | 6.41 | 0.62(0.61) | 1.34(0.53) |
| | Intermediate | 5.81 | 7.69 | 2.66 | 0.41 | 2.22(0.64) |
| | Secondary | 0.53 | 23.53 | 1.69 | 1.28(0.32) | 2.8 (.18) |
| | University | 1.31 | 500 | 3.64 | -.62 (.62) | 1.34 (.34) |
| | Less than 20 years | 0.00 | 0.00 | 0.00 | 11.76 | 3.23 |
| | 20 - 35 | 2.21 | 9.66 | 2.71 | 1.59 | 2.39 |
| | 35 - 55 | 1.80 | 6.31 | 3.34 | 0.65(0.48) | 0.86 |
| Language | Speaks Arjabic | 2.16 | 7.39 | 3.59 | 1.30 | 1.83 |
| | Does not speak Arabic | 0.00 | 3.85 | 0.00 | 2.27 | 2.86 |
| Presence of other skills | Present | 3.04 | 10.99 | 3.65 | 2.15(0.20) | 2.79(0.66) |
| | No present | 1.04 | 6.45 | 3.20 | 0.88 | 1.50 |

* Quantity within parenthesis refers to movement to unemployment.

maximum in the age group 20-35, out of "Fact." in the age group 35-55 while out of "Tra." & "Gov. & Un.L." in the age group "less than 20"

3- For all individual industrial groups, workers with "other skills" tend to leave their group more than workers with no "other skills". However, they show the least tendency if they are in "Tra." and the maximum tendency if they are in "Agri.".

4- With the exception of "Tra." & "Gov. & Un. L.", the percentage of observations showing move out of each industrial group is higher for Arabic speakers.

5- Also, apart from holders of university degrees, and the case of workers less than 20 years of age, it is obvious that for all levels of all factors workers in "Agri." show the highest tendency to move.

2.2.3. Pattern of overall movements to indistrial groups:

We now attempt to see whether the distribution of desinations of workers who leave their industrial group is influenced by factors such as age, education. ... etc. Table (2.4) give the percentage of observations showing change to each of the six industrial groups (unemployment" being considered as a group) between two consecutive halves, among those who left their group of origin. Inspection of this table shows that

1- Workers who leave their industrial group tend, most, to go to "Tra." followed by "Gov. & Un.L." then "Fact.". Their movement is least to "Agri." with minor exceptions, this is so far all levels of all factors.

2- Percentage of observations reflecting change to "Tra." increases with increase in responsiblity. Also, the $X^2$ test leads to a rejection, at the one percent level, of the hypothesis that the distribution of workers who leave their industrial group between two consecutive halves is the same for all levels of responsibility.

Table (2.4)

Percentage of Observations showing change to the Indicated industrial Group Between Two Consecutive Halves (various levels of factors)

| Factor | Level | Percentage of Observations showing Tran.Com. & Ut. | Agri. | Fact. | Tra. | Gov.& Un.L. | Un. |
|---|---|---|---|---|---|---|---|
| Marital status | Bachelor | 17 | 3 | 19 | 32 | 21 | 8 |
| | Married(without children) | 23 | 3 | 23 | 33 | 17 | 0 |
| | Married(with children) | 9 | 7 | 14 | 40 | 25 | 5 |
| Education | Illiterate | 11 | 16 | 21 | 42 | 11 | 0 |
| | REad&write | 24 | 9 | 9 | 33 | 18 | 6 |
| | Elementary school | 19 | 0 | 7 | 22 | 41 | 11 |
| | Intermediate | 9 | 6 | 14 | 43 | 23 | 5 |
| | Secondary | 2 | 0 | 27 | 35 | 13 | 4 |
| | University | 3 | 3 | 19 | 32 | 32 | 10 |
| Age | Less than 20 years | 25 | 0 | 0 | 38 | 12 | 25 |
| | 20-35 | 15 | 3 | 21 | 32 | 24 | 5 |
| | 35-55 | 11 | 9 | 11 | 43 | 20 | 7 |
| | 55-65 | 0 | 33 | 0 | 33 | 33 | 0 |
| Language | Speak Arabic | 15 | 5 | 16 | 35 | 22 | 7 |
| | Does not speak Arabic | 8 | 8 | 31 | 38 | 15 | 0 |
| Presence of other skills | Present | 10 | 6 | 22 | 31 | 23 | 7 |
| | Not present | 20 | 2 | 14 | 35 | 23 | 0 |

3- Percentage of observations showing change to "Agri." & "Tran. Com. & Ut.", generally, declines with increase in the level of education. A $\chi^2$ test, (with columns & corresponding to "Agri." & "Uni", ignored for lack of insufficient observations), rejects with one percent level, the hypothesis that the distribution of workers among industrial groups of destination is the same for all levels of education.

4- Percentage of observations showing change to "Tran. Com. & Ut." & Fact." generally, decrease with increase in age while that showing change to "Agri." increases with increase in age.

5- Workers possessing "other skills" show less tendency to go to "Tra." & "Tran. Com. & Ut." than workers without "other skills". The converse is true if movement to "Agri" & "Fact." is considered.

2.2.4. Movement among industrial groups

It is illuminating to consider the way in which workers who leave an industrial group are distributed among the other groups. Due to the fact that this study includes several factors, each at several levels, it is not possible to reproduce all relevant tables. As a result, only one table, namely Table (A1) of Appendix (A), is given. It gives the distribution of destinations by industrial group of origin for workers in the age group 20-35. A (modified) $\chi^2$ test leads to a rejection of the hypothesis that the distribution of workers among the various groups is the same for all groups of origin at one percent level.

2.3. Geographical Mobility

In this section, the movements of workers among the six regions: Western Region, "W.R.", Eastern Region "E.R.", Northern Region "N.R.", Southern Region "S.R." and outside the Kingdom, "O.K." is investigated. An approach similar to that used in industrial mobility is used.

The tendency of workers to leave various regions, when all workers are included, can be deduced from the first column of Table (2.5) which also gives the distribution of destinations for movers. It is obvious that the least tendency to leave is for workers in the "Central Region" C.R." and the most tendency to move is for workers in the Southern Region "S.R." The distribution of destinations show that almost all movers go to either the C.R. or E.R. or W.R.

2.3.1. Pattern of Overall movements out of Geographical Regions

We again refer to Table (2.2) . Column (2) gives the percentage of observations showing change of region between two consecutive halves for each level of each factor. Important relationships that appear are as follows:

1- Percentage of observations showing a change in region is less for workers with more responsibility.

2- Percentage of observations showing a change in region is maximum for illiterate workers. It declines with increase in education, rises for holders of intermediate certificates, to decline again with rise in the level of education.

3- Percentage of observations showing change of region declines with advance in age.

4- Arabic speakers show less tendency to change their region.

5- Workers with "other skills" are more mobile.

2.3.2. Pattern of Movements out of individual regions

Again, to see whether the overall pattern applies to individual regions of origin we inspect Table (2.6). This leads us to conclude the following:

Table (2.5)

Percentage of Observations showing change out and distribution of destinations for each geographical region of origin (Between two consecutive halves), all workers included

| Region of Origin | Percentage of observations showing change out of region of origin | Regions of Destinations Percentage of observations showing change to W.R. | C.R. | E.R. | N.R. | S.R. | O.K. |
|---|---|---|---|---|---|---|---|
| W.R. | 10.00 | 0.00 | 67.23 | 11.49 | 5.53 | 5.59 | 9.79 |
| C.R. | 0.80 | 46.97 | 0.00 | 34.87 | 5.47 | 3.75 | 8.93 |
| E.R. | 2.10 | 50.71 | 26.42 | 0.00 | 0.00 | 12.14 | 10.71 |
| N.R. | 4.60 | 18.75 | 39.58 | 39.58 | 0.00 | 0.00 | 2.08 |
| S.R. | 20.00 | 10.87 | 69.57 | 19.46 | 0.00 | 0.00 | 0.00 |
| O.K. | 17.90 | 18.06 | 50.00 | 28.47 | 2.78 | 0.060 | 0.00 |

Table (2.6)

Percentage of Observations showing change out of the
Indicated Region Between Two Consecutive Halves( all levels of factors)

| Factor | Level | Percentage observtions reflecting change out of W.R. | C.R. | E.R. | N.R. | S.R. | O.K. |
|---|---|---|---|---|---|---|---|
| Marital status | Bachelor | 13 | 1 | 2 | 8 | 15 | 18 |
| | Married(with out children) | 11 | 1 | 4 | 8 | 8 | 18 |
| | Married(with children) | 9 | 1 | 2 | 3 | 24 | 18 |
| Education | Illiterate | 22 | 1 | 1 | 6 | 0 | 19 |
| | Read and write | 5 | 0 | 2 | 1 | 27 | 17 |
| | Elementary school | 9 | 1 | 2 | 8 | 13 | 18 |
| | Intermediate | 10 | 2 | 4 | 5 | 5 | 17 |
| | Secondary | 14 | 1 | 3 | 1 | 20 | 20 |
| | University | 10 | 1 | 1 | 5 | 0 | 17 |
| Age | Less than 20 years | 50 | 0.0 | 0.0 | 0.0 | 13 | 25 |
| | 20-35 | 11 | 1 | 2 | 4 | 21 | 18 |
| | 35-55 | 8 | 1 | 2 | 7 | 10 | 19 |
| | 55-65 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Language | Speaks Arabic | 11 | 1 | 2 | 5 | 14 | 18 |
| | Does not speak Arabic | 0.0 | 1 | 2 | 0.0 | 0.0 | 18 |
| Presence of other skills | Present | 10 | 1 | 1 | 2 | 17 | 20 |
| | Not present | 10 | 1 | 3 | 7 | 22 | 17 |

1- Ignoring the age group "less than 20", the tendency to change a region generally declines with increase in age.

2- Workers in the Middle Region show the least tendency to leave followed by those in the Eastern and Western regions.

3- Working "outside the country" show the highest tendency to leave.

2.3.3. Pattern of overall movements to individual regions

As to the destinations of those who leave their regions and their relations to various factors we observe from Table (2.7) the following:

1- For all levels of all factors the highest percentage of movers go to the "Central Region" followed by the "Western Region" and "Eastern Region".

2- For all levels of all factors the lowest percentage of movers go to the "Southern Region".

3- Use of $X^2$ test leads us to reject the hypothesis that the distribution of moves among the various regions is independent of the degree of responsibility at the one percent level. A similar conclusion is arrived at when education is considered (in performing the test for the latter case the last two columns and the row corresponding to "illiterate workers" are excluded).

2.3.4. Movement among geographical regions

In Appendix (A), Table (A 2) gives the distribution of destinations by region of origin for workers in the age group 20-35. It is difficult to attempt to discern any trends by mere eye inspection of the table. Use of a modified $X^2$ test leads to a rejection of the hypothesis that the distribution of destinations of movers is the same for all regions, at the one percent level, (here, again, rows & columns corresponding to S.R. & O.K. are excluded)

Table (2.7)

Percentage of observations hshowing change to the Indicated Region between two consecutive halves (for various levels of factors)

| Factor | Level | Percentage of observations showing change to | | | | | |
|---|---|---|---|---|---|---|---|
| | | W.R. | C.R. | E.R. | N.R. | S.R. | O.K. |
| Marital status | Bachelor | 9.09 | 71.43 | 7.79 | 7.79 | 1.30 | 2.60 |
| | Married(without children) | 4.88 | 70.73 | 12.20 | 7.32 | 0 | 4.88 |
| | Married(with children) | 27.99 | 31.34 | 24.07 | 4.10 | 5.4 | 7.09 |
| Education | Illiterate | 5.56 | 83.33 | 0.00 | 5.56 | 0.00 | 5.56 |
| | Read and write | 5.56 | 72.22 | 8.33 | 13.89 | 0.00 | 0.00 |
| | Elementary school | 14.29 | 61.90 | 19.05 | 4.76 | 0.00 | 0.00 |
| | Intermediate | 31.25 | 33.85 | 18.75 | 3.65 | 3.65 | 8.85 |
| | Secondary | 8.20 | 63.93 | 19.67 | 4.92 | 1.64 | 1.64 |
| | University | 2.44 | 73.17 | 12.20 | 9.76 | 0.00 | 2.44 |
| Age | Less than 20 years | 28.57 | 57.14 | 0.00 | 0.00 | 0.00 | 14.29 |
| | 20-35 | 8.33 | 69.64 | 10.71 | 8.33 | 0.60 | 2.40 |
| | 35-55 | 27.94 | 29.84 | 23.49 | 5;08 | 5..40 | 8.25 |
| | 55-65 * | | | | | | |
| Language | Speak Arabic | 28.68 | 31.97 | 23.24 | 4.08 | 4.65 | 7.37 |
| | Does not speak Arabic | 4 | 78 | 8 | 10 | 0.00 | 0.00 |
| Presence of other skills | Present | 4.65 | 67.44 | 10.47 | 11.63 | 0.00 | 5.81 |
| | Not present | 28.38 | 33.44 | 22.51 | 4.57 | 3.59 | 7.50 |

* Data not available.

## 2.4. Income Mobility

In a fastly developing, wealthy country like the Kingdom of Saudi Arabia it is interesting to try to trace the pattern of movements, if any, among various income levels and the magnitude of this movement. Seven monthly income groups are constructed; these are the groups (in S.R): less than 1000, 1000-2000, 2000-3000, 3000-5000, 5000-7000, 7000-10,000 and 10,000 and more.

It can be seen from table (2.8) that movement out of an income group, generally, declines with increase in income level. Furthermore, and as expected, most movers go to the immediately higher income group and the possibility of movement to other groups declines as the distance between the groups widens.

### 2.4.1. Pattern of overall movement out of income groups

Column (3) of Table (2.2) give sthe percentage of workers who leave their income group between two consecutive halves for each level of each factor. We can see the following relationships:

1- The percentage of observations showing move out of income group first increases with the level of education, reaches a maximum for holders of intermediate certificate, then declines with more education.

2- The percentage of observations showing change out of income group is least for the age group "less than 20 ys" increase for the group (20-35) and then stablizes.

3- Arabic speakers tend to change their income group more than non-Arabic speakers while workers with "other skills" change their groups more than workers without.

### 2.4.2. Pattern of movements out of individual income groups

As we did for other types of mobility, we now consider the movements of workers out of individual income groups.Table(2.9) shows that

Table (2.8)

Percentage of observations showing Move out and distribution of destinations for each income group of origin between two consecutive halves (all workers included)

| Income group of origin | Percentage of observations showing change out | Income gorup of Destination Percentage of observations showing change to the group | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | <1000 | 1000-2000 | 2000-3000 | 3000-5000 | 5000-7000 | 7000-10000 | >10000 |
| <1000 | 18.84 | 0.00 | 65.85 | 22.93 | 9.76 | 1.46 | 0.00 | 0.00 |
| 1000-2000 | 16.14 | 3.18 | 0.00 | 82.27 | 14.55 | 0.00 | 0.00 | 0.00 |
| 2000-3000 | 15.29 | 2.81 | 4.22 | 0.00 | 84.98 | 5.63 | 1.40 | 0.90 |
| 3000-5000 | 11.27 | 0.78 | 3.90 | 3.90 | 0.00 | 80.69 | 10.16 | 0.78 |
| 5000-7000 | 9.35 | 0.00 | 0.00 | 1.75 | 1.75 | 0.00 | 87.72 | 8.77 |
| 7000-10000 | 13.33 | 0.00 | 0.00 | 1.75 | 1.75 | 0.00 | 87.72 | 8.77 |
| >10000 | 1.92 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 0.00 |

Table (2.9)

Percentage of observations showing Move out of Indicated Income Group between two consecutive halves (for various levels of factors)

| Factor | Level | Percentage of workers moving out of income Group | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | <1000 | 1000-2000 | 2000-3000 | 3000-5000 | 5000-7000 | 7000-10000 | >10000 |
| Marital status | Bachelor | 15 | 16 | 14 | 9 | 6 | 14 | 0.00 |
| | Married(wt.child) | 24 | 19 | 19 | 11 | 5 | 21 | 0.00 |
| | Married(w.child) | 22 | 16 | 16 | 12 | 13 | 14 | 1 |
| Education | Illiterate | 19 | 13 | 14 | 11 | 13 | 8 | 0.00 |
| | read and write | 21 | 14 | 12 | 11 | 20 | 24 | 0.00 |
| | Elementary school | 24 | 15 | 15 | 13 | 5 | 38 | 3 |
| | Intermediate | 20 | 26 | 17 | 10 | 7 | 18 | 2 |
| | Secondary | 18 | 17 | 18 | 11 | 10 | 8 | 3 |
| | University | 18 | 21 | 16 | 11 | 9 | 9 | 0.00 |
| Age | Less than 20 years | 7 | 12 | 11 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 20-35 | 20 | 17 | 16 | 11 | 9 | 8 | 6 |
| | 35-55 | 22 | 19 | 16 | 12 | 11 | 18 | 1 |
| | 55-65* | | | | | | | |
| Language | Speak Arabic | 21 | 19 | 16 | 12 | 10 | 14 | 3 |
| | Does not speak Arabic | 14 | 7 | 10 | 9 | 17 | 18 | 0.00 |
| Presence of other skills | Present | 12 | 15 | 17 | 11 | 8 | 12 | 2 |
| | Not present | 18 | 17 | 14 | 12 | 10 | 14 | 2 |

* Data not available.

1- With minor exceptions the percentage of observations whowing change out of income group is maximum for the lowest income group ( 1 i.e. $<$ 1000) and minimum for the group ($>$10,000). Between these two groups, and with the exception of the group (7000-10000) the percentage of moves generally declines with increase in income. (Note that the high figure in this group may be attributed to the fact that the length of this group is greater than that of other closed groups and not to higher mobility).

2- The percentage of observations reflecting change of income group, generally, increases with increase in age.

3- Generally speaking, illiterate workers give the least percentage of moves out of income groups. With increase in level of education, the percentage of observations showing move first increases, reaches a maximum and then declines again. This result is further confirmed by a $X^2$ test which causes us to reject the hypothesis that movements out of income groups is the same for all levels of education.

2.4.3. Pattern of movements to Individual income gorups

Inspection of Table( 2.10) reveals the following relationships with respect to destinations of workers leaving their income group:

1- For all factors, the percentage of observations showing move to an income group, is low for the first group, rises with increase in income level, to reach a maximum for middle groups (i.e. the group (2000-3000) and the group (3000-5000) and then fall with further rise in income.

2- The percentage of observations showing change into an income group decreases with increase in age for small income groups (i.e. less than 1000, 1000-2000, and 2000-3000), rises and fall for the middle group 3000-5000, and then increases with age there after.

Table (2.10)
Percentage of Observations showing change to Indicated Income Group
Between two consecutive halves (all levels of factors)

| Factor | Level | Percentage of observations showing change to income group | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | <1000 | 1000-2000 | 2000-3000 | 3000-5000 | 5000-7000 | 7000-10000 | >10000 |
| Marital status | Bachelor | 18.35 | 23.39 | 33.49 | 27.98 | 9.17 | 2.75 | 1.38 |
| | Married(wt.child) | 2.03 | 16.22 | 25.00 | 33.78 | 15.54 | 4.74 | 2.70 |
| | Married(w.child) | 1.28 | 15.32 | 24.47 | 24.26 | 14.68 | 10 | 10 |
| Education | Illiterate | 0.96 | 32.69 | 36.54 | 17.31 | 6.73 | 2.88 | 2.88 |
| | Read & write | 2.26 | 24.06 | 33.08 | 17.29 | 6.77 | 6.77 | 9.77 |
| | Elementary school | 1.80 | 17.12 | 27.03 | 30.63 | 10.81 | 6.31 | 6.31 |
| | Intermediate | 2.55 | 14.01 | 31.21 | 29.94 | 12.10 | 5.10 | 5.10 |
| | Secondary | 1.44 | 16.27 | 24.88 | 33.01 | 14.83 | 5.74 | 3.83 |
| | University | 1.46 | 6.57 | 15.33 | 29.93 | 27.01 | 13.87 | 5.84 |
| Age | Less than 20 years | 9.09 | 27.27 | 36.36 | 18.18 | 9.09 | 0.00 | 0.00 |
| | 20-35 | 2.18 | 18.51 | 27.77 | 29.40 | 13.07 | 6.17 | 2.72 |
| | 35-55 | 0.68 | 14.58 | 24.75 | 23.39 | 13.90 | 12.88 | 13.22 |
| | 55-65 | 0.00 | 11.76 | 17.65 | 11.76 | 29.41 | 17.65 | 11.76 |
| Language | Speak Arabic | 1.86 | 13.99 | 26.73 | 28.59 | 14.48 | 7.79 | 6.56 |
| | Does not speak Arabic | 0.00 | 62.07 | 22.41 | 6.90 | 1.72 | 1.72 | 5.16 |
| | Present | 3.57 | 17.86 | 25.36 | 26.43 | 15 | 6.79 | 5 |
| | Not present | 1.02 | 16.39 | 27.87 | 27.87 | 12.5 | 7.58 | 6.76 |

3- Ignoring the first and last income groups a remark similar to that in (2) can be made concerning the relationship between movement and income group and educational attainment.

2.4.4. Pattern of movements among income groups:

An example of movements among income groups is given by Table (A3). From that table we see that

1- Most of the workers who leave an income group go to the immediately following group. The percentage of movers to a group declines as the distance between it and the group of origin gets wider.

2- If a $\chi^2$ test is conducted, at one percent level, we find that the hypothesis that the distribution of destinations of movers is the same for all groups or origin is rejected.

2.5. Urban-Rural-Urban Mobility

Rural-urban-rural mobility has long captured interest of researchers in the field of labour mobility. This section briefly brings out some of the main features exhibited by the data on urban-rural-urban mobility.

As expected, most workers move from rural to urban areas and only few move from urban to rural areas. As a matter of fact we observe that 10.61% of the workers in rural areas move to urban areas while only 0.34% of the workers in urban areas go to rural areas.

On the other hand, the overall movement out of a region - whether urban or rural - does not reflect any specific pattern when looked at with respect to other variables. The only possible relation seems to be between mobility and educational level. This is seen from the 4th column of table (2.2).

Furthermore, Table (2.11) shows that, for all levels of all factors, the fraction of workers leaving an urban area is much smaller than the fraction of workers leaving a rural area thus conforming to the general pattern.

It appears, also, that movement out of a rural area tends to decrease with increase in age and level of responsibility.

## 2.6. Concluding Remarks

The preceeding discussion reveals a number of interesting points concerning labour mobility in the Kingdom of Saudi Arabia. It appears that workers are most mobile with respect to income. In other words, worker's incomes change more than do their industries, regions... etc. This conclusion is consistent with the state of development the Kingdom surpasses.

On the other hand, there is evidence that, the age of the worker, his educational level, his degree of responsibility and whether or not he possesses other skills, are among the factors that influence, though to varying degrees, the pattern of industrial, income and geographical mobility.

Furthermore, Table (2.2) shows that these three types of mobility are strongly related. This, however, is not surprising as a worker's change of industry often entails a change in his geographical location and income.

Table (2.11)

Percentage of Observations leaving Urban & Rural Areas
Between Two Consecutive Halves, for All levels of factors.

| Factor | Level | Percentage of Observations leaving | |
|---|---|---|---|
| | | Urban Area | Rural Area |
| Marital status | Bachelor | 0.38 | 17.58 |
| | Married(without children) | 0.00 | 11.86 |
| | Married(with children ) | 0.41 | 7.22 |
| Education | Illiterate | 0.34 | 7.74 |
| | Read and write | 0.59 | 10.00 |
| | Elementary school | 0.40 | 8.62 |
| | Intermediate | 0.45 | 16.07 |
| | Secondary | 0.35 | 15.79 |
| | University | 0.09 | 6.67 |
| Age | Less than 20 years | 0.00 | 12.50 |
| | 20-35 | 0.44 | 12.91 |
| | 35-55 | 0.15 | 9.68 |
| | 55-65 | 0.87 | 1.79 |
| Language | Speaks Arabic | 0.36 | 9.17 |
| | Does not speak Arabic | 0.19 | 11.90 |
| Presence of other skills | Present | 0.36 | 8.87 |
| | Not present | 0.33 | 11.40 |

Appendix "A"

Table (A1)

Distribution of Destinations by Industrial Group of Origin for Workers in the Age Group 20-35.

| | Tran.Com. & Ut. | Agri | Fact. | Tra. | Gov. & Un.L | Un. |
|---|---|---|---|---|---|---|
| Tan. Com.&Ut. | 0.00 | 0.00 | 17.00 | 42.00 | 42.00 | 0.00 |
| Agri. | 6.00 | 0.00 | 41.00 | 35.00 | 18.00 | 0.00 |
| Fact. | 11.00 | 0.00 | 0.00 | 68.00 | 21.00 | 0.00 |
| Tra. | 25.00 | 0.00 | 42.00 | 0.00 | 25.00 | 25.00 |
| Gov. & Un.L. | 22.00 | 5.00 | 17.00 | 41.00 | 0.00 | 15.00 |
| Un. | 17.00 | 6.00 | 20.00 | 9.00 | 48.00 | 0.00 |

Table(A2)

Distribution of Destinations by Region of Origin for Workers in the Age Group 20 - 35

| | W.R. | C.R. | E.R. | N.R. | S.R. | O.K. |
|---|---|---|---|---|---|---|
| W.R. | 0.00 | 86.96 | 8.70 | 0.00 | 0.00 | 4.35 |
| C.R. | 26.32 | 0.00 | 42.11 | 15.79 | 5.26 | 10.52 |
| E.R. | 7.70 | 77.00 | 0.00 | 7.70 | 0.00 | 7.70 |
| N.R.. | 0.00 | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| S.R. | 33.33 | 33.33 | 33.33 | 0.00 | 0.00 | 0.00 |
| O.K. | 6.73 | 76.96 | 6.73 | 9.62 | 0.00 | 0.00 |

Table (A3)

Distribution of Destinations by Income (SR) Group of Origin for Workers in the Age Group 20-35.

| | < 1000 | 1000-2000 | 2000-3000 | 3000-5000 | 5000-7000 | 7000-10000 | >10000 |
|---|---|---|---|---|---|---|---|
| < 1000 | 0.00 | 63.95 | 23.13 | 10.88 | 2.04 | 0.00 | 0.00 |
| 1000-2000 | 4.19 | 00.00 | 81.12 | 13.99 | 7.00 | 0.00 | 0.00 |
| 2000-3000 | 3.49 | 2.10 | 0.00 | 88.11 | 4.90 | 0.700 | 0.700 |
| 3000-5000 | 1.35 | 5.40 | 2.70 | 0.00 | 83.78 | 6.76 | 0.00 |
| 5000-7000 | 0.00 | 0.00 | 3.23 | 3.23 | 0.00 | 90.32 | 3.23 |
| 7000-10000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.0 |
| >10000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# LONG-TERM ANALYSIS

## 3.1. Introduction

The analysis of long-term movement of labour will be greatly facilitated if the process generating it is mathematically tractable. That is, if a mathematical model can be set that captures the basic features of the process and provides a concise description of its operation. Mathematical modelling not only enables us to have deeper insight into and understanding of the mobility mechanism, as it now operates, but also paves the way for its prediction.

In recent years, researchers in the field of social sciences are becoming increasingly attracted by the idea of employing stochastic models in the analysis of social phenomena. Bartholomew (1967) gives a comprehensive account of the attempts made in this direction.

In this chapter two stochastic models, one a simple Markov model and the other a modified Markov model, are considred with a view of using them to predict future mobility in the Kingdom. Each of the two models is used to describe the four types of mobility incorporated in this study. The performance of the models is then assessed by relating predictions under them to actual observation.

## 3.2. A simple Markov model

In this section an attempt is made to describe each of the four types of mobility by a simple Markov model. The main justification for the use of a stochastic model in the description of such types of mobility is that workers move among industries, geographical locations, income groups and urban and rural areas, in what appears to be a hazard manner.

### 3.2.1 The Model

Consider a given type of mobility. Let there be k categories among which workers move and denote by $p_{ij}$ the probability that a randomly selected worker who is in category i in a given half is in category j in the forllowing half. The probability $p_{ij}$ is called the one-half (or one-order) transition probability. Since a worker must be in one of the k categories in any half:

$$\sum_{j=1}^{k} p_{ij} = 1$$

Assume further that if a worker's category is known for any given half say H(r), then his category in any subsequent half depends only on his category in H(r) and not on where he was before* H(r). Technically speaking, we are considering a homogeneous Markov chain with finite state space.

Now, define a kxk matrix P with ijth element $p_{ij}$. The matrix P will be called the one-half transition probability matrix. An important property of the model we are considering is that if P is a one-half transition matrix then $P^n$ is the nth - half (or nth order) transition probability matrix. In otherwords, the ijth element of $P^n$, $p_{ij}^{(n)}$ say, gives the probability that if a worker is in category i in a given half he is in category j after n halves. Another equally important feature of the model is that if P is multiplied by itself sufficient number of times then it will ultimately reaches a limit at which it has identical rows. What this actually implies is that although the destination of the worker in a one-half move may be strongly influenced by the category from which he started, yet as n gets large the workers destination is not affected by his category of origin.

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* The realism of this assumption and the implied assumption that the $p_{ij}$'s 's are independent of time, can of course be questioned but we overlook this here.

3.2.2. Use of the simple Markov model to describe mobility

We now consider the possibility of using the Markov model discussed above to describe and hence predict the four types of mobility. The approach adopted in each case, is to fit the model to data and then use it to predict mobility after a period of five halves. Expectations under the model are then compared to actual observations. Because of the computational effort envolved, and space needed, we shall confine ourselves to the case of all workers.

The first step in the fitting process is to compute the one-half transition probability matrix for each type of mobility. Since the ijth element of P, $p_{ij}$ , give sthe probability that a randomly selected worker who is in category i in a given half is in category j in the following half, then this probability can be computed by multiplying the probability that the worker leaves category i by the conditional probability that he goes to category j given that he left i. In the case of all workers for industrial mobility, for example, this is obtained by properly combining elements in the column headed "percentage of observations showing change" and elements in the remaining columns of Table (2.1). Thus the probability that a worker who is in "Trans Com. & Ut." in a given half is in "Agri" in the following half is $p_{12}$ with

$P_{12}$ =0190 x 0.0667 = 0.00127

The probability that the stays in "Trans. Com. & Ut" is $P_{11}$ with

$P_{11}$ = 1 - .0190 = 0.9810

Table (B.1) , Appendix B, gives the full one-half transition probability matrix for all workers for industrial mobility. Table (B(2) -B(7)) give similar matrices for other types of mobility and some levels of certain factors.

Having obtained the one-half transition matrices, we can obtain transition matrices of any order by simply multiplying each matrix by itself an appropriate number of times. Thus the fifth-order transition matrix can be obtained by multiplying the one-half transition matrix

*by itself five times. The fifth-order transition matrix arrived at this way can be looked at as the expected (under the Markov model) fifth-order transition matrix. In contrast, an observed fifth-order transition matrix can be obtained in a manner similar to that through which we obtained the one-order transition matrix, the only difference being that we use tables referring to changes between two halves separated by an interval of five halves.*

*To asses the model, we compare expectations under it with actual observations using a prediction interval of five halves. Tables (3.1), (3.2), (3.3) and (3.4) give comparisons of expected and observed fifth order matrices for industrial, geographical, income and urban-rural mobility respectively.*

*It is not possible due to the detail of the trables to draw an over-all picture of the comparison between the "observed" and "expected". However, by inspecting the diagonal elements in the tables the following remarks can be made:*

*1. For industrial mobility (Table 3.1), the simple Markov model underestimates, though sightly, stayers in all industries apart from "Agric". This is similar to the result observed by Blumen etal (1955) when studying industrial mobility of labour in the United States. Blumen etal interpreted this as being the consequence of the fact that the simple Markov model does not allow for what they called "industrial attachment". The fact that the model did not underestimate stayers in "Agri" may be due to low tendency on the part of workers to stay in "Agri" as was clearly exhibited by the discussion of chapter (2).*

*2. For geographical mobility, the model underestimates stayers in W.R., C.R., E.R., but overestimates them for N.R., S.R., and O.K., although both the overestimation and underestimation are generally not of considerable magnitude. Note that movement out of N.R., S.R., and O.K. is shown in Chapter (2) to be very high.*

*3. For income mobility the model overestimates stayers in all but the middle and last income groups. Differences between observed*

and expected probabilities are however generally small.

4- For Urban-rural-urban mobility we observe that differences between the observed are not large through the model tend to over-estimate stayers in rural regions and underestimates stayers in urban regions.

When the one-order transition probability matrix is multiplied by itself a sufficiently large number of times it reaches a limit. At this limit, we see the distribution of workers among the various categories when the system stablizes. If this distribution is compared to present state we see how far the present distribution deviates from the equilibrium level. For geographical mobility we find:

| | W.R. | C.R. | E.R. | N.R. | S. R. | O.K. |
|---|---|---|---|---|---|---|
| Percentage of workers in each region (present) | 5 | 63 | 13 | 5 | 1 | 13 |
| Percentage of workers in each region(at the limit) | 5 | 69 | 19 | 1 | 1 | 5 |

which reflects a surprising degree of agreement. Similarly for urban-rural-urban mobility we get:

| | Rural | Urban |
|---|---|---|
| Percentage of workers in each area (present) | 7 | 93 |
| Percentage of workers in each area (at the limit) | 9 | 91 |

for which deviations are also small. However if we considered income mobility we obtain:

| | < 1000 | 1000-2000 | 2000-3000 | 3000-5000 | 5000-7000 | 7000-1000 | >10000 |
|---|---|---|---|---|---|---|---|
| Percentage of workers in each income group (present) | 18 | 21 | 22 | 21 | 8 | 5 | 5 |
| Percentage of workers in each income group (at limit) | 6 | 6 | 7 | 9 | 9 | 7 | 56 |

which shows stricking disagreement. It is interesting to note that according to this result, if the model applies, about half the working population will, in the long run, have monthly income greater than 10000.

For industrial mobility we obtain:

| | Tran.Com.& Ut. | Agri. | Fact. | Tra. | Gov.&Un.L. |
|---|---|---|---|---|---|
| Percentage of workers in each industrial group (present) | 12 | 7 | 18 | 24 | 39 |
| Percentage of workers in each industrial group (at limit) | 17 | 9 | 17 | 33 | 24 |

Before closing up this section, it should be pointed out that only transition matrices for income and urban and rural mobility actually reached their limits (up to two decimal places) after multiplied by themselves about 100 times. For geographical and industrial mobilities the figures given as limiting distribution in fact give a distribution near the limit as they stablize upto only one decimal place.

### 3.3. The Mover-Stayer Model

Blumen, Kogan & McCarthy, in their 1955 pioneering work, introduced the mover-stayer model when attemtping to analyse the industrial mobility of labour in the United States. It is essentially a Markov chain model modified to allow for industrial attachment. The mover-stayer model proved to be more successful for describing the

Table (3.1)

Comparison of Expected & Observed Fifth-Order Matrices
(All workers) - Industries

| | | Tran.Com.&Ut. | Agri. | Fact. | Tra. | Gov.&Un.L. |
|---|---|---|---|---|---|---|
| Tran. Com. & Ut. | obs. | 0.887 | 0.012 | 0.021 | 0.048 | 0.033 |
| | Exp. | 0.886 | 0.004 | 0.020 | 0.041 | 0.049 |
| Agri. | obs. | 0.088 | 0.576 | 0.097 | 0.134 | 0.106 |
| | Exp. | 0.063 | 0.619 | 0.094 | 0.133 | 0.088 |
| Fact. | obs. | 0.007 | 0.009 | 0.840 | 0.099 | 0.044 |
| | Exp. | 0.012 | 0.005 | 0.820 | 0.123 | 0.038 |
| Tra. | obs. | 0.019 | 0.005 | 0.025 | 0.925 | 0.017 |
| | Exp. | 0.018 | 0.009 | 0.028 | 0.905 | 0.024 |
| Gov.&Un.L. | obs. | 0.029 | 0.004 | 0.017 | 0.055 | 0.886 |
| | Exp. | 0.022 | 0.000 | 0.022 | 0.058 | 0.882 |

Table (3.2)
Comparison of Expected & Observed Fifth-Order Matrices
(All workers) - Geographical regions

| | | W.R. | C.R. | E.R. | N.R. | S.R. | O.K. |
|---|---|---|---|---|---|---|---|
| W.R. | obs. | 0.564 | 0.389 | 0.017 | 0.023 | 0.000 | 0.006 |
| | Exp. | 0.539 | 0.320 | 0.063 | 0.023 | 0.016 | 0.038 |
| C.R. | obs. | 0.008 | 0.963 | 0.018 | 0.006 | 0.001 | 0.005 |
| | Exp. | 0.019 | 0.957 | 0.018 | 0.000 | 0.000 | 0.005 |
| E.R. | obs. | 0.008 | 0.078 | 0.897 | 0.018 | 0.000 | 0.000 |
| | Exp. | 0.049 | 0.048 | 0.879 | 0.001 | 0.011 | 0.010 |
| N.R. | obs. | 0.000 | 0.214 | 0.078 | 0.708 | 0.00 | 0.000 |
| | Exp. | 0.040 | 0.104 | 0.093 | 0.754 | 0.001 | 0.006 |
| S.R. | obs. | 0.000 | 0.560 | 0.120 | 0.160 | 0.160 | 0.000 |
| | Exp. | 0.069 | 0.519 | 0.142 | 0.001 | 0.264 | 0.004 |
| O.K. | obs. | 0.046 | 0.575 | 0.042 | 0.058 | 0.000 | 0.278 |
| | Exp. | 0.052 | 0.065 | 0.240 | 0.002 | 0.005 | 0.613 |

Table (3.3)
Comparison of Expected & Observed Fifth-order Transition Matrices ( All workers ) - Income groups

| | | <1000 | 1000-2000 | 2000-3000 | 3000-5000 | 5000-7000 | 7000-10000 | >10000 |
|---|---|---|---|---|---|---|---|---|
| <1000 | obs. | 0.272 | 0.364 | 0.238 | 0.106 | 0.019 | 0.000 | 0.001 |
| | Exp. | 0.294 | 0.290 | 0.223 | 0.137 | 0.038 | 0.009 | 0.005 |
| 1000-2000 | obs. | 0.013 | 0.337 | 0.419 | 0.185 | 0.028 | 0.008 | 0.009 |
| | Exp. | 0.019 | 0.361 | 0.346 | 0.203 | 0.048 | 0.011 | 0.008 |
| 2000-3000 | obs. | 0.003 | 0.021 | 0.352 | 0.495 | 0.089 | 0.019 | 0.019 |
| | Exp. | 0.019 | 0.025 | 0.386 | 0.371 | 0.131 | 0.037 | 0.027 |
| 3000-5000 | obs. | 0.002 | 0.009 | 0.018 | 0.514 | 0.328 | 0.085 | 0.044 |
| | Exp. | 0.025 | 0.021 | 0.023 | 0.447 | 0.304 | 0.101 | 0.075 |
| 5000-7000 | obs. | 0.000 | 0.000 | 0.024 | 0.012 | 0.383 | 0.461 | 0.119 |
| | Exp. | 0.004 | 0.000 | 0.005 | 0.007 | 0.557 | 0.270 | 0.154 |
| 7000-10000 | obs. | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.404 | 0.596 |
| | Exp. | 0.023 | 0.004 | 0.001 | 0.000 | 0.000 | 0.423 | 0.544 |
| >10000 | obs. | 0 022 | 0.022 | 0.000 | 0.000 | 0.000 | 0.000 | 0.957 |
| | Exp. | 0.068 | 0.021 | 0.011 | 0 006 | 0.001 | 0 000 | 0.890 |

Table (3.4)

Comparison of Expected & Observed Fifth-order Tranisition Matrices ( All workers ) - Urban & Rural Areas

| | | Rural | Urban |
|---|---|---|---|
| Rural | obs. | 0.458 | 0.542 |
| | Exp. | 0.514 | 0.486 |
| Urban | obs. | 0.010 | 0.990 |
| | Exp. | 0.014 | 0.986 |

American industrial mobility than the simple Markov model. Since then, the model continued to capture interest of researchers in the field of labour mobility. Recently Wynn & Sales (1973) fitted the mover-stayer model to the British labour force, and El-Beshir & Ahmed (1978) fitted it to Sudanese labour mobility. Although the mover-stayer model was originally developed to describe industrial mobility, there are strong indications that it can also be employed to describe other related mobilities. This section is devoted to the application of the model to geographical, income and urban-rural mobilities in addition to industrial mobility.

3.3.1. The Mover-Stayer Model

In its simplest version, the mover-stayer model assumes that workers can be divided into two groups: "Movers" and "Stayers". Stayers are those workers who developed attachment to an industry and who remain in it with probability one. Movers, on the other hand, are workers who developed little or no attachment to an industry and whose movement followed a simple Markov Chain.

Let $s_i$ be the fraction of workers in category i who are stayers in a designated half. Furthermore, let $m_{ij}$ denote the fraction of workers, among movers, who move from category i to category j between two consecutive halves. According to this notation, the probability that a worker who is in category i in a given half is also in category i the following half is $P_{ii}$ where

$$Pii = (S_i)\, 1 + (1 - S_i)\, m_{ii}$$

Also,

$$P_{ij} = (S_i)\, 0 + (1 - S_i)\, m_{ij}$$

If we now denoted by S the matrix of stayers where

$$S = \begin{bmatrix} S_1 & & O \\ & S_2 & \\ O & & \ddots S_k \end{bmatrix}$$

and by M the one-half transit matrix for movers with M taking the form

$$\begin{bmatrix} m_{11} & m_{12} & \cdots & m_{1k} \\ m_{21} & m_{22} & \cdots & m_{2k} \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ m_{k1} & m_{k2} & \cdots & m_{kk} \end{bmatrix}$$

then P, the one-half transition matrix for all workers (movers and stayers) is

$$P = S + (I - S)\, M \qquad \ldots\ldots\ldots\ldots (1)$$

It can be shown that the n-order transition matrix for all workers is given by

$$P^{(n)} = S + (I - S)\, M^{n} \qquad \ldots\ldots\ldots\ldots (2)$$

To estimate S & M Blumen etal (1955) adopted the following procedures:

1- Find on estimate for the limiting matrix $\lim_{n\to\infty} M^{n}$ say $M^{n\,\lim}$

2- Find on observed $P^{(n)}$, say $P^{(n)}_{obs}$ for n reasonably large

3- Substitute $M^{n\,\lim}$ & $P^{(n)}_{obs}$, respectively, for $\lim_{n\to\infty} M^{n}$ & $\lim_{n\to\infty} P^{(n)}$ in

$$\lim_{n\to\infty} P^{(n)} = S + (I - S) \lim_{n\to\infty} M^{n}$$

obtained by taking the limit of (2) as $n\to\infty$ and solve to obtain an estimate for S, say $\hat{S}$.

4- Substitute $\hat{S}$ & $P^{(1)}_{obs}$ respectively for S&P in (1) to obtain an estimate for M, say $\hat{M}$. This completes the estimation process.

The matrices $P_{obs}^{(1)}$ & $P_{obs}^{(n)}$ are the observed one-order and the observed n-order transition matrices and the procedure for obtaining them is discussed in the last section. To estimate $\lim_{n\to\infty} M^n$ which is a matrix of identical rows taking the form

$$\begin{bmatrix} m_1 & m_2 & \cdots & m_k \\ m_1 & m_2 & \cdots & m_k \\ \vdots & \vdots & & \vdots \\ m_1 & m_2 & & m_k \end{bmatrix}$$

we use a matrix of the form

| | | | | | Total |
|---|---|---|---|---|---|
| — | $X_{12}$ | $X_{13}$ | .... | $X_{1k}$ | $X_{1.}$ |
| $X_{21}$ | — | $X_{23}$ | ... | $X_{2k}$ | $X_{2.}$ |
| . | . | . | | . | . |
| . | . | . | | . | . |
| $X_{k1}$ | $X_{k2}$ | $X_{k3}$ | | — | $X_{k}$ |
| Total $X_{.1}$ | $X_{.2}$ | $X_{.3}$ | | $X_{.k}$ | $X_{..}$ |

where $X_{ij}$ is the number of workers who are in the ith category in the initial half and in the jth category in the nth half (for n large). Note that no diagonal elements exist due to the fact that the matrix deals only with movers. An approximate maximum likelihood estimate for $m_j$ is given by

$$m_j = \frac{X_{.j}}{X_{..}}$$

We shall use this estimate here although Goodmon (1961) showed that it is inconsistent.

### 3.3.2. Use of the Mover-Stayer Model to Describe Mobility

As we did for the simple Markov model we now consider the use of the mover-stayer model to describe mobility in the Kingdom. To estimate $\hat{S}$ & $\hat{M}$ in each case we shall be using $P_{obs}^{(1)}$ and $P_{obs}^{(5)}$. Also to

estimate the mj's we use matrices giving the distribution of destinations for halves separated by an interval of five halves.

Following the procedure described in the proceeding subsection we estimate S&M for all workers and for selected levels of certain factors. These are given as Tables C1 - C4 in Appendix C. Using (2) we estimated the expected fifth-order transition matrix, for all worker, for each type of mobility. By using (2) it is also possible to estimate transition matrix of any order and hence predict mobility at any desired future half provided the interval is not very large.

Tables(3.5) - (3.8) give the expected and observed fifth-order transition probability matrices for each type of mobility. It is obvious from the tables that the mover-stayer model overestimated stayers in all types of mobility, the only real exception being stayers in urban areas. This may be attributed to the strong urbanization trend which is a characteristic of the modern world. The overestimation is, however, least for industrial mobility.

That the mover-stayer model overestimated stayers is confirmed by column (3) of Table (3.9) where it is seen that the expected number of stayers is larger than the observed number for all categories in industrial and geographical mobility and in 86% of the cases in income mobility. Note that the fact that only 50% of the cases show overestimation in urban-rural-urban mobility may be due to the fact that there are only two categories in this case and to the remark made at the end of the preceeding paragraph.

## 3.4. Comparison of Simple Markov Model with Mover-Stayer Model

It is obvious from columns (1) and (3) of Table (3.9) that whereas the mover-stayer model tends to overestimate stayers the simple Markov model does this only to the case of income mobility. The fact that the mover-stayer model overestimates the number of stayers (a fact that Blumen and his co-workers also observed in the case of the

American labour ) is due to the fact that stayers in the sense defined in subsection 3.3.1 do not really exist. Not only do workers leave work for such reasons as illness....etc. but they also change industry and location whenever a better opportunity arrises. We particularly believe that the chances for such changes should be expected in a country like the Kingdom of Saudi Arabia where the economy is undergoing rapid changes in all sectors and locations.

Comparing columns (2) and (4) we see that both models had their best performance in the case of industrial mobility. None of the two models, however, proved universally superior to the other although the simple Markov model seems to be slightly better. This is particularly so if the information in columns (1) & (3) is taken into account. Added to this its simplicity, we are inclined to recommend it for future predictions.

Table (3.5)

Comparison of Expected & Observed Fifth-Order Matrices
(All workers) - Industries

| | | Tran.Com.&Ut. | Agri. | Fact. | Tra. | Gov.& Un.L. |
|---|---|---|---|---|---|---|
| Tran. Com.&Ut. | obs. | .887 | .012 | .021 | .048 | .033 |
| | Exp. | .925 | .004 | .013 | .028 | .026 |
| Agri. | obs. | .088 | .576 | .097 | .134 | .106 |
| | Exp. | .047 | .704 | .066 | .104 | .069 |
| Fact. | obs. | .007 | .009 | .840 | .099 | .044 |
| | Expt. | .012 | .006 | .880 | .068 | .028 |
| Tra. | obs. | .019 | .005 | .029 | .928 | .019 |
| | Exp. | .011 | .006 | .017 | .939 | .016 |
| Gov. & Un.L. | obs. | .029 | .004 | .017 | .065 | .886 |
| | Exp. | .015 | .002 | .016 | .039 | .912 |

Table (3.6)
Comparison of Expected & Observed Fifth-Order Matrices
(All workers) - Geographical Regions

| | | W.R. | C.R. | E.R. | N.R. | S.R. | O.K. |
|---|---|---|---|---|---|---|---|
| W.R. | obs. | .564 | .389 | .017 | .023 | .000 | .006 |
| | Exp. | .673 | .229 | .045 | .014 | .013 | .026 |
| C.R. | obs. | .008 | .963 | .018 | .006 | .001 | .005 |
| | Exp. | .015 | .968 | .011 | .001 | .001 | .004 |
| E.R. | obs. | .008 | .078 | .897 | .018 | .000 | .000 |
| | Exp. | .026 | .039 | .925 | .001 | .007 | .006 |
| N.R. | obs. | .000 | .214 | .078 | .708 | .000 | .000 |
| | Exp. | .039 | .090 | .052 | .807 | .004 | .008 |
| S.R. | obs. | .000 | .560 | .120 | .160 | .160 | .000 |
| | Exp. | .097 | .446 | .106 | .003 | .332 | .018 |
| O.K. | obs. | .046 | .575 | .042 | .058 | .000 | .278 |
| | Exp. | .097 | .289 | .116 | .013 | .012 | .475 |

Table (3.7)
Comparison of Expected & Observed Fifth-Order Matrices
(All workers ) - Income groups

| | | <1000 | 1000-2000 | 2000-3000 | 3000-5000 | 5000-7000 | 7000-10000 | >10000 |
|---|---|---|---|---|---|---|---|---|
| <1000 | obs. | .272 | .364 | .238 | .106 | .019 | .000 | .001 |
| | Exp. | .402 | .209 | .203 | .122 | .044 | .012 | .006 |
| 1000-2000 | obs. | .013 | .337 | .419 | .185 | .028 | .008 | .009 |
| | Exp. | .019 | .427 | .291 | .178 | .059 | .016 | .008 |
| 2000-3000 | obs. | .003 | .021 | 352 | .495 | .089 | .019 | .019 |
| | Exp. | .033 | .028 | .421 | .299 | .147 | .047 | .024 |
| 3000-5000 | obs. | .022 | .009 | .018 | .514 | .328 | .085 | .044 |
| | Exp | .051 | .025 | .025 | .527 | .229 | .096 | .045 |
| 5000-7000 | obs. | .000 | .000 | .024 | .012 | .383 | .461 | .119 |
| | Exp. | .076 | .016 | .011 | .008 | .596 | .197 | .094 |
| 7000-10000 | obs. | .000 | .000 | .000 | .000 | .000 | .404 | .596 |
| | Exp. | .212 | .074 | .039 | .019 | .004 | .518 | .133 |
| > 10000 | obs. | .022 | .022 | .000 | .000 | .000 | .000 | .957 |
| | Exp. | .016 | .013 | .009 | .047 | .001 | .003 | .956 |

Table (3.8)

Comparison of Expected & Observed Fifth-Order Matrices
(All workers ) - Urban & Rural Areas

| | | Rural | Urban |
|---|---|---|---|
| Rural | obs. | .458 | .542 |
| | Exp. | .612 | .388 |
| Urban | obs. | .010 | .990 |
| | Exp. | .012 | .988 |

Table (3.9)

Comparison of Simple Markov Model with the Mover Stayer Model

| | Simple Markov Model | | Mover-Stayer Model | |
|---|---|---|---|---|
| Type of Mobility | Percentage of cases in which expected diag. element exceeds the observed | Average percent differences* between expected & observed diag. elements | Percentage of cases in which expected diag. element exceeds observed | Average percent differences between expected & observed diag. elements |
| Column No. | (1) | (2) | (3) | (4) |
| Industrial | 20 | -.4 | 100 | -6.17 |
| Geographical | 50 | -15.5 | 100 | -20.8 |
| Income | 71.42 | -36.14 | 86 | -18.55 |
| Urban-Rural-Urban | 50 | -5.24 | 50 | -12.48 |

* For each category, the quantity $\frac{100(obs. - Exp.)}{Exp.}$ is computed and the arithmatic mean of the resulting signed differences is obtained.

Appenxix (B)

Table B(1)

One-Order Transition Probability Matrix
(All workers) - Industries

| | Tran. Com.& Ut. | Agri. | Fact. | Tra. | Gov. & Un.L. |
|---|---|---|---|---|---|
| Tran.Com.& Ut. | 0.982 | 0.001 | 0.003 | 0.007 | 0. 007 |
| Agri. | 0.013 | 0.923 | 0.020 | 0.026 | 0.018 |
| Fact. | 0.002 | 0.001 | 0.967 | 0.023 | 0.007 |
| Tra. | 0.004 | 0.004 | 0.005 | 0.983 | 0.004 |
| Gov. & Un. L. | 0.004 | 0.003 | 0.004 | 0.01 | 0.979 |

Table B(2)
One-order Transition Probability matrix
(All workers) - Geographical Regions

| | W.R. | C.R. | E.R. | N.R. | S.R. | O.K. |
|---|---|---|---|---|---|---|
| W.R. | 0.9000 | 0.0672 | 0.0116 | 0.0055 | 0.0059 | 0.0098 |
| C.R. | 0.004 | 0.992 | 0.003 | 0.000 | 0.00 | 0.001 |
| E.R. | 0.011 | 0.006 | 0.978 | 0.000 | 0.003 | 0.002 |
| N.R. | 0.009 | 0.018 | 0.018 | 0.954 | 0.00 | 0.001 |
| S.R. | 0.002 | 0.139 | 0.039 | 0.00 | 0.800 | 0.000 |
| O.K. | 0.012 | 0.010 | 0.052 | 0.005 | 0.001 | 0.921 |

Table B(3)
One-Order Transition Probability Matrix
All workers - Income groups

| | <1000 | 1000-2000 | 2000-3000 | 3000-5000 | 5000-7000 | 7000-1000 | >1000 |
|---|---|---|---|---|---|---|---|
| < 1000 | 0.8115 | 0.1241 | 0.0432 | 0.0184 | 0.0028 | 0.00 | 0.00 |
| 1000-2000 | 0.0050 | 0.8387 | 0.1328 | 0.0235 | 0.00 | 0.00 | 0.00 |
| 2000-3000 | 0.0040 | 0.0060 | 0.8479 | 0.1299 | 0.0086 | 0.0022 | 0.0014 |
| 3000-5000 | 0.0090 | 0.0044 | 0.0044 | 0.8711 | 0.0907 | 0.0114 | 0.0090 |
| 5000-7000 | 0.00 | 0.00 | 0.0016 | 0.0016 | 0.9066 | 0.0820 | 0.0082 |
| 7000-1000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.8667 | 0.1333 |
| >10000 | 0.0192 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.9808 |

Table B(4)
One-Order Transiton Probability Matrix
(All workers) - Urban & Rural areas

| | Rural | Urban |
|---|---|---|
| Rural | 0.894 | 0.106 |
| Urban | 0.003 | 0.997 |

Table B(5)
One - Order Transition Probability Matrix
( Workers with Secondary School Education ) - Industries

| | Tran.Com.&ut. | Agri. | Fact. | Tra. | Gov. & Un.L. |
|---|---|---|---|---|---|
| Tran.Com.&Ut. | 0.990 | 0.00 | 0.00 | 0.010 | 0.00 |
| Agri. | 0.060 | 0.760 | 0.120 | 0.060 | 0.00 |
| Fact. | 0.00 | 0.00 | 0.980 | 0.020 | 0.00 |
| Tra. | 0.00 | 0.00 | 0.006 | 0.992 | 0.002 |
| Gov. & Un.L. | 0.009 | 0.00 | 0.005 | 0.014 | 0.972 |

Table B(6)
One - Order Transition Probability Matrix
(Workers in the age group 20-35) - Geographical Locations

| | W. R. | C.R. | E.R. | N.R. | S.R. | O.K. |
|---|---|---|---|---|---|---|
| W.R. | 0.890 | 0.096 | 0.009 | 0.00 | 0.00 | 0.005 |
| C.R. | 0.003 | 0.990 | 0.003 | 0.002 | 0.001 | 0.001 |
| E.R. | 0.002 | 0.014 | 0.98 | 0.002 | 0.00 | 0.002 |
| N.R. | 0.00 | 0.04 | 0.00 | 0.960 | 0.00 | 0.00 |
| S.R. | 0.070 | 0.070 | 0.070 | 0.00 | 0.79 | 0.00 |
| O.K. | 0.012 | 0.131 | 0.012 | 0.015 | 0.00 | 0.83 |

Table B(7)
One - Order Transition Probability Matrix
(Workers in the age group 20-35) - Income Groups

| | < 1000 | 1000-2000 | 2000-3000 | 3000-5000 | 5000-7000 | 7000-1000 | > 1000 |
|---|---|---|---|---|---|---|---|
| < 1000 | 0.804 | 0.125 | 0.045 | 0.022 | 0.004 | 0.00 | 0.00 |
| 1000-2000 | 0.007 | 0.835 | 0.134 | 0.024 | 0.00 | 0.00 | 0.00 |
| 2000-3000 | 0.006 | 0.003 | 0.838 | 0.143 | 0.008 | 0.001 | 0.001 |
| 3000-5000 | 0.001 | 0.006 | 0.003 | 0.895 | 0.088 | 0.007 | 0.00 |
| 5000-7000 | 0.00 | 0.00 | 0.003 | 0.003 | 0.909 | 0.085 | 0.00 |
| 7000-1000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.917 | 0.083 |
| > 1000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.0 |

Appendix C

Table C(1)

$\hat{M}$ & diagonal elements of $\hat{S}$ for all workers & workers with Secondary Education (with parenthesis) - Industries

| | $\hat{M}$ | | | | | $\hat{S}$ |
|---|---|---|---|---|---|---|
| | Tran.Com.&Ut. | Agri. | Fact. | Tra. | Gov.&Un.L. | |
| Tran.Com.&Ut. | 0.866(.808) | 0.008(0.000) | 0.024(.000) | 0.051(.192) | 0.051(.000) | 0.864(.000) |
| Agri. | 0.029(.064) | 0.828(.744) | 0.045(.128) | 0.058(.064) | 0.040(.000) | .555(.000) |
| Fact. | 0.010(.000) | 0.005(.000) | 0.830(.879) | 0.119(.121) | 0.036(.000) | .807(.000) |
| Tra. | 0.039(.000) | 0.030(.000) | 0.043(.038) | 0.854(.947) | 0.034(.015) | .884(.015) |
| Gov.& Un.L. | 0.023(.054) | 0.020(.000) | 0.023(.032) | 0.058(.084) | 0.876(.830) | .828(.830) |

Table C(2)

$\hat{M}$ & diagonal elements of $\hat{S}$ for all workers & workers in the age group (20-35), within parenthesis, - Geographical regions

| | $\hat{M}$ | | | | | | $\hat{S}$ |
|---|---|---|---|---|---|---|---|
| | W.R. | C.R. | E.R. | N.R. | S.R. | O.K. | |
| W.R. | .785(.795) | .144(.179) | .025(.017) | .012(.000) | .013(.000) | .021(.009) | .533(.463) |
| C.R. | .031(.022) | .938(.920) | .023(.029) | .000(.015) | .000(.007) | .008(.007) | .869(.864) |
| E.R. | .096(.016) | .052(.112) | .819(.840) | .000(.016) | .026(.000) | .017(.016) | .884(.872) |
| N.R. | .028(.000) | .056(.101) | .056(.000) | .857(.899) | .000(.000) | .003(.000) | .679(.737) |
| S.R. | .026(.075) | .165(.075) | .046(.075) | .00(.000) | .763(.775) | .000(.000) | .157(.079) |
| O.K. | .034(.016) | .100(.180) | .059(.016) | .006(.023) | .001(.000) | .800(.765) | .268(.271) |

Table C(3)

$\hat{M}$ & diagonal elements of $\hat{S}$ for all workers & workers in the age group (20-35) (within parenthesis) - Income groups

| | < 1000 | 1000-2000 | 2000-3000 | 3000-5000 | 5000-7000 | 7000-10000 | > 10000 | $\hat{S}$ |
|---|---|---|---|---|---|---|---|---|
| < 1000 | .743(.738) | .169(.168) | .059(.061) | .025(.028) | .004(.005) | .000(.000) | .000(.000) | .267(.257) |
| 1000-2000 | .006(.008) | .798(.803) | .167(.160) | .029(.029) | .000(.029) | .000(.000) | .000(.000) | .207(.161) |
| 2000-3000 | .005(.006) | .007(.003) | .828(.832) | .147(.149) | .009(.008) | .002(.001) | .002(.001) | .116(.040) |
| 3000-5000 | .013(.001) | .006(.009) | .006(.005) | .815(.844) | .130(.131) | .017(.010) | .013(.000) | .314(.329) |
| 5000-7000 | .000(.000) | .000(.000) | .002(.006) | .002(.006) | .868(.849) | .116(.139) | .012(.000) | .290(.411) |
| 7000-1000 | .000(.000) | .000(.000) | .000(.000) | .000(.000) | .000(.000) | .793(.000) | .207(.840) | .357(.16) |
| > 10000 | .417(.000) | .000(.000) | .000(.000) | .000(.000) | .000(.000) | .000(.000) | .583(.000) | .954(.000) |

Table C(4)

$\hat{M}$ & diagonal elements of $\hat{S}$ for all workers and workers with Secondary Education, (within parenthesis) - Urban & rural groups

| | $\hat{M}$ | | $\hat{S}$ |
|---|---|---|---|
| | Rural | Urban | |
| Rural | .815(.000) | .185(1.000) | .427(.097) |
| Urban | .018(.000) | .982(1.000) | .815(.067) |

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