A Structural Approach to the Projection of Occupational Categories and Its Application to South Korea and Taiwan

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THIS ARTICLE suggests a method for projecting occupational structures which both in concept and technique departs from the traditional approaches. It is primarily concerned with methodology [2] and the estimates and projections made in the case of South Korea and China (Taiwan) are therefore designed first and foremost as illustrations. The article is divided into three parts: *(a)* a critical review of the traditional methods of projecting occupational structures; *(b)* a structural approach to the projection of occupational categories; and *(c)* an empirical check on the method, viz. the cases of South Korea and Taiwan.

I. A critical review of the traditional methods of projecting occupational structures

Whatever the nomenclature employed [3], most projections of occupational structures consist of estimating the future trend of *employment coefficients*, i.e. the percentage of workers with a certain skill or in a certain occupation within a particular sector of the economy or, alternatively, the " input of employment per unit of output ".

[1] International Labour Office.

[2] I am particularly indebted to G. Morihain, Doctor of Mathematics, and R. Dubois, Master of Mathematics and Engineer of the Advanced National School of Electronics and Data Processing in Paris, both of them external collaborators of the ILO, for the assistance they have given me in the econometric formulation of the method as well as for undertaking the entire programming of the computer.

[3] Occupational nomenclatures often vary from one country to another, which makes comparison difficult—especially at a high level of aggregation. Some of them, however, are

(footnote continued overleaf)

Usually this is done by means of one of the two following methods: international comparisons; or analysis of past trends in a particular country.

These two methods implicitly assume the existence of a production function with complementary factors [1] in which labour as a factor of production is divided up into several categories. In other words, it is assumed that in order to achieve a given volume of output, a certain amount of capital and a certain number of workers in each occupational category (engineers, operatives, etc.) are needed and that these proportions are fixed and not open to substitution.

This theoretical aspect of the question is well known [2] and we need not dwell on it here. On the other hand, a few points can usefully be made about each of these two methods.

1. International comparisons

The major analyses of employment trends by occupational category or level of skill are five in number—

Netherlands Economic Institute: *The educational structure of the labour force : a statistical analysis* (Rotterdam, 1966), by Peter A. Cornelisse *et al.* (mimeographed).

P. R. G. Layard and J. C. Saigal: " Educational and occupational characteristics

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based on or are akin to the International Standard Classification of Occupations (ISCO) Revised (1968), namely—

Code No.	*Major group title*
0/1	Professional, technical and related workers
2	Administrative and managerial workers
3	Clerical and related workers
4	Sales workers
5	Service workers
6	Agricultural, animal husbandry and forestry workers, fishermen and hunters
7/8/9	Production and related workers, transport equipment operators and labourers
X	Workers not classifiable by occupation
—	Members of the armed forces

Other examples are the social and economic categories used in France or the nomenclatures combining occupation with skill and the classification by six standards of training used by experts of the French Planning Commission in 1960.

There is also the classification used by the OECD for Italy (*The Mediterranean Regional Project : Italy* (Paris, OECD, 1965)) taken from SVIMEZ: *Mutamenti della struttura professionale e ruolo della scuola* (Rome, 1961), which distinguishes the following categories: top management and other senior executives; technicians; supervisors; foremen; skilled workers; unskilled workers.

For a discussion of the classification problem see Louis J. Emmerij and Hans H. Thias: " Projecting manpower requirements by occupation ", in *Lectures and methodological essays on educational planning* (Paris, OECD, 1966).

[1] Other methods which assume some degree of substitution between production factors have also been tested with some success, e.g. the manpower needs equation suggested by Ronald G. Bodkin and Lawrence R. Klein (" Nonlinear estimation of aggregate production functions", in *Review of Economics and Statistics* (Cambridge (Massachusetts)), Vol. XLIX, No. 1, Feb. 1967, pp. 28-44).

[2] See, for example, R. G. Hollister: " The economics of manpower forecasting ", in *International Labour Review*, Vol. LXXXIX, No. 4, Apr. 1964, especially pp. 372-379.

of manpower: an international comparison", in *British Journal of Industrial Relations* (London), Vol. IV, No. 2, July 1966, pp. 222-266.

United Nations, Inter-Regional Seminar on Long-term Economic Projections for the World Economy: Sectoral Aspects, Elsinore, Denmark, 14 to 27 August 1966: *The occupational structure of employment, 1960-1980,* by James G. Scoville (ILO) (mimeographed document ISLEP/A/VII.2 (revised)).

Morris A. Horowitz, Manuel Zymelman and Irwin L. Herrnstadt: *Manpower requirements for planning : an international comparison approach* (Boston (Massachusetts), Northeastern University, Department of Economics, 1966) (mimeographed).

OECD: *Occupational and educational structures of the labour force and levels of economic development. Possibilities and limitations of an international comparison approach* (Paris, 1970).

All these studies are based on regression analyses applied to international comparisons of developed and/or developing countries. They involve relating employment to one or more general or sectoral economic indicators.

The economic indicator, i.e. the exogenous factor assumed to reflect the evolution of the employment index, varies from one analysis to another. All the above studies use monetary indicators such as productivity (measured by output per worker), the product per head of the population, the amount of capital used per worker, and the rate of growth of output. The OECD study also uses non-monetary indicators such as the number of telephones per head and the consumption of power, steel and cement per head. Depending on circumstances, the exogenous factor may be general or sectoral. Lastly, some analyses rely on a single exogenous factor while others employ several. Whatever the exogenous factor used, the endogenous variable is always the percentage of workers with the standard of skill or exercising the occupation k, either in sector j or in the economy as a whole. In other words, the employment coefficient is calculated independently from the occupational or educational structure to which it belongs.

This approach means that a variation in the economic indicator will necessarily lead to a variation in the employment coefficient, its significance and extent depending on the elasticity value (subject to the precision of the estimate). Layard and Saigal, for example, assume that the various occupational categories are complementary within the production function. On the other hand, some authors (such as Horowitz, Zymelman and Herrnstadt) allow for the possibility of a certain amount of substitution between different occupations, although without taking this into account in the regression equation.

The projections of occupational structures based on these methods assume that the results of the analysis are characteristic of the occupational structure in the sector of the country in question.

As an illustration we give below some of the results obtained respectively by Layard and Saigal and the OECD (see above) in their studies

TABLE I. COMPARISON OF RESULTS OF ANALYSES BY LAYARD AND SAIGAL AND THE OECD

Occupational category [1]	Estimated elasticity values *(standard deviations)*	
	Layard and Saigal	OECD
0. Professional, technical and related workers .	0.52 (0.06)	0.66 (0.05)
0-0 Architects, engineers and surveyors	—	1.06 (0.13)
0-2 Biologists, veterinarians, agronomists and scientists	—	0.89 (0.29)
0-1 Chemists, physicists, geologists and other physical scientists	—	1.21 (0.21)
1. Administrative, executive and managerial workers	0.61 (0.13)	0.92 (0.10)
1-1 Directors, managers and working proprietors	—	0.92 (0.18)
2. Clerical workers	0.52 (0.08)	0.71 (0.08)
3. Sales workers	0.18 (0.07)	0.14 (0.11)

[1] The analyses are based on the 1958 ISCO and not the revised classification of 1968 since they relate to 1960 census data.

of the relationship between the percentage of employment in an occupational category in relation to total employment and the level of labour productivity measured by the output per worker in the economy as a whole. The elasticities between these two variables are shown in table I.

Comparison of the two series of results clearly brings out the differences between the OECD's estimates and those of Layard and Saigal.[1] It is very difficult in such a brief analysis to go into the causes of these differences. They may be due to dissimilarities in the samples (nineteen countries in the case of Layard and Saigal and forty-two in the case of the OECD, developed and underdeveloped in both instances), but this would go to show how hard it is to deduce any general law of evolution from international comparisons, at least in the present case. Accordingly, one hesitates to go further by passing a value judgment on either analysis. It is perhaps worth adding, however, that the basic data used by the OECD were carefully and exhaustively analysed in order, above all, to make them comparable as between one country and another.

[1] A statistical test comparing two estimates based on two separate samples confirms this finding. In this test, the difference between two estimates is considered to be significant when $e^* - e^{*\prime} > 2\sqrt{\sigma^* - \sigma^{*\prime}}$ where e^* is the estimate of the elasticity and σ^* is the estimate of the variance. This test when applied to the above results shows a significant difference for all the estimates with the exception of group 3, in which the standard deviations are unfortunately high.

Inter-firm comparisons are akin to these analyses in that the idea underlying them is exactly the same as in international comparisons.[1]

2. Analysis of past trends in a particular country

(a) In many cases, the analyses and projections made for a particular country are straightforward extrapolations of past trends. In other words, the future evolution of the employment coefficient is solely a function of time. This clearly restricts the range of possibilities open to policy-makers and may on occasion lead them to perpetuate past mistakes.

The report on Yugoslavia issued as part of the Mediterranean Regional Project [2] contains a variant on this technique which involves using projections of past trends corrected by what are considered to be desirable ratios between different categories of manpower. This method does constitute an improvement but the theoretical justification for it is slight.

(b) Other more worthwhile analyses start from the same basic idea as the international comparisons, i.e. that it should be possible to account for the evolution of an employment coefficient in terms of the evolution of one or more suitably chosen exogenous factors which may combine two types of variables—the value of the coefficient for the previous year and a characteristic economic magnitude such as labour productivity. This type of analysis when applied to a particular country has the advantage that it makes it possible to single out certain limited occupational categories and, whenever the nomenclature does not change from one year or census to another, to make adequate projections based on the actual evolution of the country in question.[3]

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[1] See, for example, the recent comparisons of occupational patterns as between one firm and another carried out by Mark Blaug of the London School of Economics in some eighty-five firms in the British electrical engineering industry. See also Edward J. Mitchell: *An econometric study of international and interindustrial differences in labor productivity* (Santa Monica, Rand Corporation, 1966) (mimeographed).

[2] Paris, OECD, 1965.

[3] See, by way of illustration, the country reports published by the OECD as part of the Mediterranean Regional Project (Paris, 1965); Guy Roustang and Jean-Jacques Silvestre: " Valeur ajoutée par tête dans l'industrie et structure des qualifications ", in *Revue économique* (Paris), Vol. XIX, No. 5, Sep. 1968, pp. 765-784; K. S. Gnana Sekeran: *Interrelations between industrial and occupational change in manpower, United States, 1950-1960* (Philadelphia, Population Studies Center, 1966); R. J. Ball and E. B. A. St. Cyr: "Short-term employment functions in British manufacturing industry ", in *Review of Economic Studies* (Edinburgh), July 1966, pp. 179-207; D. J. Smyth and N. J. Ireland: " Short-term employment functions in Australian manufacturing ", in *Review of Economics and Statistics*, op. cit., Nov. 1967, pp. 537-544; Claude Vimont and Gabriel Rérat: " L'incidence du progrès technique sur la qualification ouvrière. Une nouvelle méthode d'analyse ", in *Population* (Paris, INED), 21st year, No. 3, May-June 1966, pp. 541-562; and Claude Vimont, Philippe d'Hugues and Michel Preslier: "La prévision de l'emploi dans le cadre du V[e] Plan en France. La répartition de la population active par professions en 1970. Hypothèse de travail pour 1978 ", ibid., pp. 483-521.

See also the findings of the Working Party on Forecasting Manpower Requirements which met under OECD auspices in May 1970 (OECD, Manpower and Social Affairs Directorate: Technical reports, MS/M/306/304, 326-328, 336, 337 and 340-342 (Paris, 1970)).

3. Some remarks on the characteristics of traditional projection methods

Of the two main criticisms that can be levelled against the traditional projection techniques, one is theoretical and the other methodological in character, the latter arising out of the former.

(a) Theoretically speaking, these methods are based on a reasoning which is not entirely logical. It can be summed up as follows:

On the one hand, the theoretical importance of the phenomena of *mobility* in the evolution of a country's employment structure is well known.[1] These may take the form of *sectoral mobility*, i.e. the movement of an individual from one sector to another, the systematic study of which is based on the work of Colin Clark; of *occupational mobility*, i.e. the movement of an individual from one occupation to another—where the occupations are quite distinct—with or without changes of skills; or of *skill mobility*, i.e. the movement of an individual from one level of skill to another; this is slower and more marginal than the two foregoing kinds and is brought about, for example, by in-plant training.

In many cases, these different forms of labour mobility are themselves due to more general phenomena such as geographical mobility (especially in the form of migration from the countryside to the towns), or to inter-firm mobility, especially where young or highly educated workers are concerned.

On the other hand, as we have seen, the traditional methods involved explaining the employment coefficient in terms either of economic variables reflecting the level of output, incomes or technology or the value of the coefficient in the previous year or some other combination of these two types of variables. But none of the regression equations takes *direct account* of mobility. Of course it is true that the different exogenous factors also make for mobility; but as a result the causal relationships we are trying to ascertain are functions of functions with a causality which may vary according to the *period covered* by the projection.

In the long term, changes in the occupational structure may be substantial and in this case it is mainly of interest to find out how the changes in the pattern of the economy (income distribution, consumption, technologies and product mix) affect the " qualitative " characteristics of employment, i.e. levels of skill and training.

In the medium and above all the short term, however, changes in employment are extremely sluggish and are only moderately or slightly affected by variations in economic magnitudes such as income per head or consumption. In such cases it is clear that mobility, reflecting the

[1] On this point see Herbert S. Parnes: " Manpower mobility ", in *Lectures and methodological essays on educational planning*, op. cit., pp. 205-219.

internal dynamics of employment (it would be more accurate to speak of the internal inertia), plays the preponderant part. It follows from this that any errors that may be committed in medium or short-term projections are bound to be important.

(b) From the methodological standpoint, the foregoing remarks point to the following conclusion: in quantitative terms, the changes occurring in the value of employment coefficients are brought about by labour mobility. In addition, since the sum of all the coefficients is constant and equal to 100 per cent, this means that the *evolution of each employment coefficient is closely linked with that of the other coefficients* or, more generally, that the relationships are interdependent.

It follows that the procedure whereby each relationship is estimated separately for each coefficient of the occupational structure is defective, methodologically speaking. Moreover, these econometric weaknesses are reflected in the imprecision of the results. It is, after all, quite common when making projections for all the coefficients of an occupational structure (the percentage of workers in sector j engaged in occupation k) to find that the sum of the coefficients comes to 120 per cent or 80 per cent, whereas by definition all the coefficients should add up to 100 per cent.

Thus the main argument against this type of method is that it combines certain econometric shortcomings with a somewhat illogical approach—as is acknowledged by some authors (see the analysis by Layard and Saigal)—which cannot be avoided.

II. A structural approach to the projection of occupational categories

1. Definition of the method

This approach is structural in that it is based on the concept of structure. Of course, in many ways it does not simplify the idea or clarify the concept to define our approach by means of the word " structure " since there seem to be nearly as many definitions of " economic structure " or " social structure " as there are economists or sociologists, even though in fact objects or phenomena do exist which are theoretically definable in unique terms. Where our method is concerned, Flament's definition seems to be appropriate, i.e. a structure is " a set of interrelated elements in which any modification of one element or relationship leads to a modification in the other elements or relationships ".[1]

[1] C. Flament: " L'étude mathématique des structures psycho-sociales ", in *Année psychologique*, 1958, quoted in R. Boudon: *A quoi sert la notion de structure?* (Paris, Gallimard, 1968) p. 14.

In this definition a structure is characterised by at least three features: a pattern of relationships; the dependence of the elements on the whole; and the dependence of the whole on the elements. This interdependence of the elements within the system is fundamental to an understanding of our approach. Just as, according to Murdock [1], the coherence of social institutions is due to the fact that a society never " chooses " an aggregate of individual institutions but a system of institutions, similarly, the occupational structure of employment is not an aggregate, i.e. a sum total of employment coefficients [2] but an ordered system of employment coefficients.[3]

For methodological purposes, these few remarks have major consequences. For one thing, the study of structure may be based on one of two separate methods—the method of logical deduction which on the whole is that used by Lévi-Strauss [4], or the mathematical models method as used by Bush taking the analyses of Lévi-Strauss as his starting point.[5] We have opted for the latter not because it necessarily gives better results than the former but simply because it lends itself better to projection techniques. In the second place, the model employed consists of a mathematical representation of an ordered system of interdependent relationships. Naturally, therefore, we have selected a matrix form of presentation, i.e. the evolution of the occupational structure characterised by shifts of employment due to mobility (see above) as studied by means of a " transition matrix ". And in the third place, the ordered system which the transition matrix attempts to convey is not an exact, specific system but a probable system. In other words, exact deductions regarding the occupational structure of employment in a given economy are not possible. All that can be claimed is that in a particular economic context employment is more likely to evolve in one direction than another.

To sum up, these three points suggest the following definition of the approach employed: a mathematical model centred on a transition matrix of a probabilistic type. Technically, therefore, it constitutes an application of the Markov chain processes.

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[1] G. P. Murdock: *Social structure* (Glencoe (Illinois), Free Press, 1965), quoted by Boudon, op. cit., p. 194.

[2] See our definition above.

[3] F. Parsons defines an occupational structure as " a system of universalistic-specific-affectively neutral achievement-oriented roles " in *The social system* (Glencoe (Illinois), Free Press, 1951), p. 177.

[4] C. Lévi-Strauss: *Les structures élémentaires de la parenté* (Paris, Presses universitaires de France).

[5] See Boudon, op. cit., pp. 128 ff., for an account of the models worked out by Bush from the investigations by Lévi-Strauss into elementary kinship structures.

2. Description of the method

Without going into mathematical detail here [1], the principle of the method can be illustrated as follows:

Occupational structure in the target year	=	Occupational structure in the base year	×	Transition matrix

The definition of the *occupational structure* hardly raises any problems. It consists of the employed population broken down into occupational categories; the method is applicable whatever nomenclature is used. However, the breakdown must be taken sufficiently far for shifts from one category to another to be possible and significant for purposes of economic analysis. The extent to which it is taken largely depends on the period covered by the analysis and projection. In short-term analyses, the nomenclature used must permit a detailed breakdown—going much lower than the ISCO major groups for example. On the other hand, for medium and above all long-term analysis, the employed population need not be broken down very far, and five or six categories should be sufficient to reveal the underlying trends.

The transition matrix takes the following form:

Occupational categories (1 to 4)	Occupational categories (1 to 4)			
	a_{11}	a_{12}	a_{13}	a_{14}
	a_{21}	a_{22}	a_{23}	a_{24}
	a_{31}	a_{32}	a_{33}	a_{34}
	a_{41}	a_{42}	a_{43}	a_{44}

where $a_{11}, \ldots a_{44}$ represent transition probabilities.

This in short is a square table with a number of lines i equal to the number of columns j and to the number of occupational categories N specified in the nomenclature employed (four in the present case). It is composed of transition probabilities [2] a_{ij}, equal in number to N^2. In the example given, four occupational categories have been assumed, numbered from 1 to 4; a_{11} represents the probability that an individual will remain in occupational category number 1 during the period in question, while a_{12} represents the probability that the same individual will move

[1] See Appendix I below.

[2] A probability is defined as the number of probable cases divided by the number of possible cases. Its value ranges from 0 to 1. It has exactly the same significance as the more widely used expression to the effect that there are so many chances out of 100 that a given event will occur.

from occupational category number 1 to category number 2 during the same period; in the same way, a_{41} represents the probability that an individual who was formerly in category 4 will move into category 1 during the period in question, and so on.

For example, the calculations may show that, between 1967 and 1968 in South Korea, a technician had 95 chances out of 100 of remaining one (probability = 0.95) and 5 chances out of 100 of becoming a manager (probability = 0.05). More generally, it is possible to distinguish two types of probabilities—

(1) Those along the diagonal of the transition matrix, i.e. in the above example, a_{11}, a_{22}, a_{33}, a_{44}. They express the probability that an individual will remain in the occupational category he was in before. These probabilities thus measure to some extent the stability of the occupational structure during the period in question.

(2) Those not on the diagonal, i.e. all probabilities with the exception of the foregoing. They express the likelihood that an individual will change his occupational category during the period concerned. These probabilities off the diagonal thus measure individuals' degree of mobility.

It is possible therefore to work out a *mobility index M*

$$M = \frac{\text{sum of the probabilities off the diagonal}}{\text{sum of the probabilities on the diagonal}}$$

It can be shown that this index is in fact equal to

$$M = \frac{N}{tr} - 1$$

where N is the number of occupational categories employed; and tr is the sum of the probabilities on the diagonal.

For a given country, the higher the index M the greater the degree of mobility. However, the value of this index lies mainly in the comparisons that can be made between a large number of countries.

In the model studied here, the transition matrix is not constant but *varies over time*. This means for example that, during the period in question, the probability that an individual will change his occupational category may increase or diminish. This feature is very important because the major criticism usually levelled against methods of this type is that they only use coefficients that are constant over time.

The transition probabilities a_{ij} may thus vary over the period in question under the influence of exogenous factors. With this method —unlike the traditional methods—the exogenous factors are not determined in advance. In other words, for econometric purposes, the model assumes one or more exogenous factors; for analytical purposes, the

exogenous factors are specified in each empirical application. This is a further advantage, since the exogenous factors may vary according to the country if analysis shows that the causes of evolution differ from one country to another.

III. An empirical check on the method: the cases of South Korea and China (Taiwan)

These two countries have been chosen as examples because of the high quality and regularity of their employment statistics. In Taiwan, the same quarterly survey has been carried out since October 1963 by a manpower survey research group of the Department of Social Affairs, while South Korea has been conducting similar surveys since August 1962.

1. Basic data

(a) For both countries *six occupational categories* have been selected:

1 — professional, scientific, technical and related workers;
2 — administrative and managerial workers;
3 — clerical workers;
4 — sales workers;
5 — agricultural and related workers, miners and related workers;
6 — craftsmen, production-process workers, transport, communications and services workers.

This classification, which is dictated by the fact that both countries use the ISCO, has the latter's drawbacks, of which its authors are well aware, e.g. in categories 5 and 6 it is quite impossible to distinguish between skilled and unskilled workers.

The statistics used in the estimates for the transition matrix cover the period 1963-68, or six years; they are shown in table IVA (see below).

(b) The choice of *exogenous factors* was somewhat more difficult because of the tentativeness of economic theory in this field. We have assumed that the occupational structure of employment in a developing country alters mainly under the influence of two factors: the *supply factor* and the *demand factor.*

To start with, the evolution of the occupational structure appears to be particularly influenced by the supply of educated manpower. This conclusion derives from the fact that employment standards tend to rise when the supply of manpower is adequate and vice versa, especially in countries such as South Korea and Taiwan which are in the early stages

of their development.[1] Even with technical assistance at a high level, the supply of certain occupational categories will depend to some extent on the output of the training system.

We have therefore estimated a *net supply of educated manpower* for the period 1963-68 in each country. This is given by the following equation:

$$S_t = ({}_iGM_{t-1} \cdot p_i \cdot r_i) + ({}_iGH_{t-1} \cdot p_i) - R_{t-1}$$

where S_t is the net supply of educated manpower for year t, in other words the number of young people with an education of secondary standard or above who come on to the employment market; GM is the number of secondary school graduates in the previous year $(t-1)$ of either sex i (i = males or females); GH is the number of university graduates in the previous year who join the active population in year t, of each sex i; p_i represents the activity rates of each sex; r_i is the proportion of secondary school graduates of each sex who do not go on to university and therefore come on to the employment market; and R is the replacement need for workers with a secondary education or above, i.e. the number of workers of this type stopping work in the previous year $(t-1)$.

The data concerning the number of secondary and university graduates are taken from the official education statistics issued by the two countries concerned.[2] On the basis of international comparisons[3], the participation rates are estimated at 0.40 for women and 0.90 for men (a weighted average of 0.75 over-all). In the same way, the replacement needs have been estimated at 1.5 per cent of the active population. Lastly, the proportion r_i of young people coming on to the labour market after completing their secondary education has been estimated as follows. The statistics for South Korea give this type of information[4], the proportion being about 30 per cent; the same figure has been employed for Taiwan as well. This being so, the estimates of the net supply of manpower with an education of secondary standard or above, viz. S_t, are shown in table IVA below.

Secondly, the evolution of the occupational structure is also influenced by demand factors, especially changes in the pattern of con-

[1] It must not be forgotten that even though the growth rates of Taiwan and South Korea are very high—of the order of 10 per cent over the years 1960-67 (United Nations: *Yearbook of national accounts statistics, 1968* (New York, 1969), Vol. II, pp. 102-103)—these two countries had an income per head of only US$ 220 and US$ 140 in 1967, while farm employment still accounted for 40 and 55 per cent respectively of the total in Taiwan and South Korea.

[2] Economic Planning Board, Republic of Korea: *Korea statistical yearbook*, years 1962 to 1969; Directorate General of Budgets, Accounts and Statistics, Executive Yuan: *Statistical abstract of the Republic of China*, years 1962 to 1969.

[3] OECD: *Problems of human resources planning in Latin America and in the Mediterranean Regional Project countries* (Paris, 1967), and *A technical evaluation of the first stage of the Mediterranean Regional Project* (Paris, 1967).

[4] *Korea statistical yearbook*, op. cit.

sumption. In view of the heterogeneous character of the occupations in each category, we have used a very simple general indicator of the pattern of consumption, namely the relationship C_t between the private consumption of services CS_t and total private consumption CT_t.[1] The calculations in table IVA show that the consumption of services rises faster than total consumption, since the elasticity of CS_t in relation to CT_t is equal to 1.56 for South Korea and 1.37 for Taiwan during the period in question. This trend towards an increasingly service-oriented economy after the initial expansion of production leads to a shift in the occupational structure towards the service trades. We have, however, assumed that there is a time-lag of two years, in other words that the changes in the pattern of consumption are only reflected in the occupational structure of employment two years later.

In order to check these assumptions, we have calculated the coefficients of correlation between each occupational category and the two exogenous factors (see table II).

TABLE II. COEFFICIENTS OF CORRELATION BETWEEN THE EXOGENOUS FACTORS AND OCCUPATIONAL CATEGORIES

Country	Exogenous factor	Occupational category					
		1	2	3	4	5	6
South Korea	S [1]	0.910	0.852	0.912	0.915	−0.783	0.922
	C [2]	0.183	0.492	0.691	0.894	−0.822	0.806
Taiwan	S [1]	0.984	0.932	0.901	0.910	−0.796	0.869
	C [2]	0.762	0.729	0.642	0.888	−0.946	0.889

[1] Net supply of educated manpower. Since S_t is expressed as a number of individuals, the correlation has been made with the number of workers in each occupational category. [2] Pattern of private consumption. Since C_t is expressed as a percentage of CT_t, the correlation has been made with the percentage of workers in each category.

It would appear therefore that there is a very close link between the net supply of educated manpower and the evolution of each occupational category both in South Korea and Taiwan with the exception of category 5, which is accounted for by the nature of the occupations it covers (mainly in farming). The supply factor therefore has a general influence on the trend of employment. On the other hand, changes in the pattern of private consumption have little effect on the activities grouped under categories 1, 2 and 3—which require an above-average standard of education—whereas they are mirrored fairly closely by changes in categories 4, 5 and 6 (sales workers, farmers and related workers, crafts-

[1] See United Nations: *Yearbook of national accounts statistics, 1968*, op. cit.

men, production-process workers, transport, communications and service workers).

It has been assumed therefore that the transition matrix was variable during the period studied and altered under the influence of the two exogenous factors—the supply of educated manpower S and the pattern of private consumption C.[1]

2. The results of the estimate for the period 1963-68

(a) Since the transition matrix varies from one year to another, we have estimated five matrices for the years 1963-64 to 1967-68. They are shown in Appendix II.

The mobility indices (measured as described above) are given in table IVA. They show that inter-occupational mobility is higher in South Korea than in Taiwan. Nevertheless, it was fairly low over this period since none of the indices is higher than 0.143. This is partly due to the high level of aggregation, i.e. if the estimates had related to more precise occupational categories, it is likely that the results would have revealed a higher degree of mobility.

In the case of South Korea, average mobility varied little over the period in question. The index remained around 0.135 with a slight rise in 1966 ($M = 0.143$), which may well be due as much to the imprecision of the basic data as to any actual increase in mobility.

In the case of Taiwan on the other hand, inter-occupational mobility, although very limited, rose markedly between 1963 and 1968, i.e. from 0.069 to 0.126.

(b) In order to analyse the results in more detail, the transition matrices for the last period (1967-68) are given below in table III, since the year in question is to some extent characteristic of the over-all evolution.

The figures in table III show that it is possible to distinguish three groups of probabilities for movements between occupational categories 1 and 2, between categories 3 and 4, and between categories 5 and 6. A number of conclusions may be drawn.

(1) During the period in question, mobility between occupational categories 1 and 2 was slight in Taiwan and very slight in South Korea, i.e. the transition probabilities a_{11} and a_{22} are equal to 0.91 and 0.96 for Taiwan and 0.98 and 0.98 for South Korea. This means, for example, that in the latter, an individual belonging to category 1 in 1967 had 98 chances out of 100 of still being in that category in 1968 as against

[1] In the calculations, each exogenous factor was centred on its average and reduced to a value close to unity by dividing it by a multiple of 10. This does not affect the results and is done for reasons of econometric convenience.

TABLE III. TRANSITION MATRICES FOR THE PERIOD 1967-68

Occupational category	1	2	3	4	5	6
South Korea						
1	0.98	0.02	0	0	0	0
2	0.02	0.98	0	0	0	0
3	0	0	0.60	0.40	0	0
4	0	0	0.16	0.84	0	0
5	0	0	0	0.05	0.92	0.03
6	0	0	0	0.03	0	0.97
Taiwan						
1	0.91	0.09	0	0	0	0
2	0.03	0.96	0	0.01	0	0
3	0	0	0.71	0.29	0	0
4	0	0	0.13	0.87	0	0
5	0	0	0	0.07	0.90	0.03
6	0	0	0	0.02	0	0.98

91 chances out of 100 in Taiwan. In other words, his chances of securing a managerial or administrative post (category 2) were only 9 out of 100 in Taiwan and 2 out of 100 in South Korea.

(2) On the other hand, mobility between occupational categories 3 and 4 was fairly high and showed a steady increase between 1963 and 1968 (see Appendix II below). The partial mobility indices, i.e. those calculated for these two categories alone, are 0.27 and 0.39 respectively for Taiwan and South Korea compared with only 0.07 and 0.02 for the first two categories. However, in both countries there would appear to be greater mobility out of clerical work (category 3) *into* sales activities (category 4) than vice versa.

(3) The transition matrix (like those for previous years—see Appendix II) shows no likelihood of movement between categories 1 and 2 on the one hand and the remaining categories on the other. This is true of course only for the period 1963-68.

(4) Occupational mobility in jobs requiring a low standard of education (occupational categories 5 and 6) is very slight. During the period in question, *migrant farm workers tended mainly to move into commercial occupations*, in all likelihood petty trading in semi-urban areas. The very low level of mobility for category 6 is partly due to the high level of aggregation of this category which comprises craftsmen, production-process workers and transport, communications and service workers. What seems to be happening to this category is that the number

TABLE IVA. BASIC DATA AND ESTIMATES

Country	Year	Exogenous factors [1]		Occupational category (as % of total employment)												Mobility index (M)
				1		2		3		4		5		6		
		S ('000)	C (%)	VO	VE	VO	VE	VO	VE	VO	VE	VO	VE	VO	VE	
South Korea	1963	51.27	12.53	2.46	—	0.76	—	3.47	—	10.05	—	63.56	—	19.70	—	—
	1964	50.20	13.92	2.09	2.37	0.72	0.85	3.75	4.06	10.89	10.69	62.27	62.35	20.28	19.68	0.130
	1965	58.43	15.59	2.04	1.98	0.77	0.83	3.99	4.65	11.91	10.81	59.41	61.46	21.88	20.26	0.136
	1966	66.34	15.10	2.30	1.94	0.76	0.87	4.70	5.00	11.72	11.46	58.96	58.85	21.56	21.85	0.143
	1967	81.21	15.36	2.77	2.22	0.85	0.88	4.62	5.12	12.61	12.25	55.93	57.00	23.22	22.52	0.139
	1968	79.67	15.61	2.81	2.75	1.06	0.98	4.42	4.70	13.43	13.52	53.34	54.80	24.94	23.26	0.132
Taiwan	1963	24.54	16.95	3.80	—	1.33	—	5.96	—	9.98	—	53.32	—	26.61	—	—
	1964	29.45	18.27	4.17	3.96	2.65	2.90	5.17	5.41	10.34	9.75	50.41	51.00	27.26	26.98	0.069
	1965	31.88	19.88	4.07	3.66	2.81	3.20	6.44	6.13	10.73	10.22	47.32	49.55	28.63	27.24	0.070
	1966	39.12	19.47	5.15	3.72	3.78	3.71	7.32	8.20	11.19	10.74	44.26	45.02	28.30	28.60	0.085
	1967	43.39	20.09	5.11	4.68	3.47	4.25	7.20	7.05	11.33	11.66	43.66	44.06	29.22	28.27	0.107
	1968	45.99	20.99	5.17	4.73	3.34	3.83	6.78	6.61	12.62	12.02	39.80	40.62	32.29	32.20	0.126

Note: S = net supply of educated manpower; C = pattern of private consumption; VO = values observed; VE = values estimated by the model.

[1] The reference years take account of the time-lags referred to above.

of workers is expanding partly as a result of the growth of the active population and partly because of the influx of migrant farm workers. On the other hand, it is likely that mobility within it is average or high, a fact that is not brought out by the table.

In order to gauge the accuracy of the estimates, table IVA gives the values observed *VO* and the values estimated *VE*. It shows that the errors are very slight and that the model fits the observations closely despite the marked fluctuations in certain occupational categories, especially numbers 1, 2 and 3. We are therefore entitled to assume that the model possesses real " forecasting value ".

In order to check this assumption we carried out " projections " for 1969. Using the transition matrix for 1967-68 and the corresponding values of the exogenous factors, we estimated a new transition matrix for 1968-69 which gave projections for 1969. We then compared the latter with the actual values taken from manpower surveys conducted in 1969 and obtained the following results:

TABLE IVB. VALUES OBSERVED (VO) AND PROJECTIONS FOR 1969

(as % of total employment)

Occupational category	South Korea		Taiwan	
	VO	Projection	VO	Projection
1	3.55	3.20	4.44	4.34
2	0.94	0.85	3.20	3.75
3	5.12	4.82	6.32	6.61
4	13.12	13.60	12.34	12.31
5	51.92	52.13	40.10	41.00
6	25.35	25.40	33.60	31.99

As can be seen, the projections based on the model are very close to the actual values.

3. Projections for 1975

By way of illustration we have made projections for 1975 on the basis of the estimated transition matrix for 1967-68 and the projections of the exogenous factors.

(a) We began by assuming that the consumption of services *CS* was a function of the level of total private consumption *CT*; in other words, assuming Engel's law to be valid, we supposed that the structure of private consumption alters in a consistent manner.

Accordingly we have fitted the equation $CS_t = a + bCT_t$ to the data for the period 1961-68, with the following results (values in wons for South Korea and new Taiwan dollars for Taiwan):

South Korea: $CS_t = -50.36 + 0.230\ CT_t \quad R = 0.984$
(0.018)

Taiwan: $CS_t = -4.99 + 0.283\ CT_t \quad R = 0.994$
(0.013)

Assuming a growth in private consumption of 6.5 per cent per year in each country[1] we have deduced the value of the private consumption of services, from which we can calculate the index of the structure of consumption C_t (see table VI below).

(b) We then assumed that the supply of educated manpower S_t would expand on the average by 7 per cent per year in South Korea and Taiwan alike. The results are given in table VI below.

(c) In this way it is possible to estimate the seven transition matrices for the successive periods 1968-69, . . . 1974-75. For the final period the estimates are as follows (table V):

TABLE V. PROJECTION OF THE TRANSITION MATRIX FOR 1974-75

Occupational category	1	2	3	4	5	6
South Korea						
1	0.99	0.01	0	0	0	0
2	0.08	0.92	0	0	0	0
3	0	0	0.58	0.42	0	0
4	0	0	0.24	0.76	0	0
5	0	0	0	0.08	0.89	0.03
6	0	0	0	0.03	0	0.97
Taiwan						
1	0.99	0.01	0	0	0	0
2	0.13	0.84	0	0.03	0	0
3	0	0	0.63	0.37	0	0
4	0	0	0.29	0.71	0	0
5	0	0	0	0.11	0.87	0.02
6	0.01	0	0	0.03	0	0.96

These projections do not show any noteworthy changes in the structure of the matrices except for the appearance of a probability other than nil for movement from category 6 into category 1. By and large, occupational mobility can presumably be expected to increase, e.g. the M indices rise from 0.128 (1967-68) to 0.174 in the case of South Korea and

[1] This assumption is slightly higher than the rates for 1963-68 but close to the development plan targets for both countries.

from 0.119 (1967-68) to 0.200 in the case of Taiwan. This applies particularly to occupational categories 3 and 4.

(d) Once the annual transition matrices are estimated it is possible to deduce the corresponding occupational structure of employment from the data for 1968. The results of these projections are given in table VI.

TABLE VI. PROJECTIONS OF THE OCCUPATIONAL STRUCTURE OF EMPLOYMENT

(as % of total employment)

Country	Year	Exogenous factor		Occupational category					
		S ('000)	*C* %	1	2	3	4	5	6
South Korea	1970	9.0	17.4	3.0	1.2	4.5	13.8	52.0	25.5
	1972	10.3	18.4	3.9	1.9	5.0	15.0	45.6	28.6
	1975	(11.8) [1]	19.4	4.8	2.5	5.6	16.2	39.0	31.9
Taiwan	1970	52.6	23.8	5.3	3.5	7.5	12.8	37.0	33.8
	1972	60.3	24.8	5.7	3.6	8.0	14.1	32.4	36.0
	1975	(69.0) [1]	25.8	6.1	4.0	8.6	16.0	26.0	39.1

Note: S = net supply of educated manpower; C = pattern of private consumption.

[1] This is the value for 1974 which determines the matrix for 1974-75 (see Appendix I).

By and large, the economy of Taiwan appears to be evolving towards a modern structure more rapidly than the Korean despite the fact that the growth rates for both countries are similar. For example, occupational category 5, which is composed mainly of farmers, should only account for about one-quarter of total employment in Taiwan by 1975, whereas it will still comprise nearly 40 per cent of the labour force in South Korea. Nevertheless, in both countries the percentage of persons employed in this category should fall sharply while simultaneously the percentage in category 6 will increase. Roughly speaking, this is akin to the way in which labour is absorbed in the " success case " dealt with by Fei and Ranis.[1]

On the other hand, certain trends may seem somewhat disturbing. Purely and simply in order to give some idea of the magnitudes and without in any way prejudging the value of the comparisons, we give below some figures showing the occupational structure of employment in Japan in the year 1969.[2]

[1] John C. H. Fei and Gustav Ranis: *Development of the labor surplus economy. Theory and policy* (Homewood (Illinois), Richard D. Irwin, 1964).

[2] *Monthly Reports on the Labour Force*, Japan.

Occupational category	% of total employment
1	5.5
2	2.5
3	14.4
4	13.2
5	19.0
6	45.4

Compared with Japan, the percentages of South Korean and Taiwanese workers in category 3 (clerical workers) may seem abnormally low and of those in category 4 (sales workers) abnormally high. This might mean that the upward movement of junior supervisors and clerical workers is not sufficiently rapid and that if the tendency continues, there might in the longer term be a shortage in occupations of this kind; the point is worth emphasising because this state of affairs is characteristic of the developing countries where personnel of this type are sometimes in desperately short supply. On the other hand, it is possible that the sharp increase in the number of sales workers conceals, if not a certain amount of underemployment in this category, at least the survival of traditional forms of commerce, because the likely importance of commercial activities for export in 1975 is not enough to account for this sudden expansion. In terms of job creation, the tendency is of course satisfactory, at least initially, but it is less satisfactory when one considers the need to modernise the economy.

It goes without saying that these conclusions are only valid to the extent that the projections are reliable; they are given in any case simply as an illustration. Furthermore, since we are dealing with projections, the estimates should not be regarded as being in any way *hard and fast*. They merely help to indicate the *probable* future and the better *possible* future that could replace it if present policies were adjusted.

IV. Conclusions

From a strictly methodological standpoint, the quality of the results shows that the structural method is superior to the traditional approach. By building the concept of mobility into the model, it highlights the interdependence of the different trends. Moreover, the fact that the model is not predetermined, as in the case of international comparisons, makes for greater flexibility in practice. Other examples of this flexibility are the possibility of using alternative nomenclatures for occupational categories other than those employed here or of adding an additional category of individuals who are not yet in employment in year t but will be in year $t + 1$: this would make it possible to take account of the influence of the growth of the active population for analytical purposes. The fact that both demand and supply factors are allowed for is a real

advantage since it clearly reveals the duality of the causative factors and therefore of employment-creating policies. There is nothing novel about the purpose of the latter being to act on supply and demand simultaneously. What does seem novel, or at least useful, is to present a simulation of reality in such a way that the interdependence of the factors at work and of the changes occurring within a given structure affect the simulation as they do the real world.

Appendix I. Formulation of the model

1. General formulation

We have assumed the existence of a non-stationary transition probability governing the movement of an individual from group L_t to any of the groups L_{t+1}, since a group represents the exercise of a given occupation (the number of groups being N). We have therefore assumed the following process:

$$L_{t+1} = L_t \cdot P_t \qquad \ldots\ldots\ldots\ldots\ldots (1)$$

where L_t is the line vector of the distribution of employment by occupation; L_{t+1} is the same variable at time $t+1$; and P_t is the square matrix of the transition probabilities p_{ij}, of order N ($i = j = 1, \ldots N$).

In this process, the theorem of total probabilities makes it possible to define as follows the probability that an individual will be in group L_j at $t+1$ if he was in group L_i at t:

$$Pr\,(L^i_t + L^j_{t+1}) = Pr\,(L^i_t) \cdot Pr\,(L^j_{t+1}/L^i_t) = a^i_t \cdot p_{ij} \qquad \ldots\ldots (2)$$

In equation (2), a^i_t represents the probability that an individual will be in any one component of L_t. *This is an* a priori *probability*. In practice, it is measured by the proportion of individuals in each group, i.e. the proportion of workers in occupation k in relation to the total employed population.

The probability of being in any component of L at $t+1$ is as follows:

$$Pr\,(L^j_{t+1}) = \Sigma_i\, Pr\,(L^i_t) \cdot p_{ij} = \Sigma_i\, a^i_t \cdot p_{ij} \qquad \ldots\ldots (3)$$

In this equation p_{ij} represents the *conditional probability* of a transition between the two groups L^i_t and L^j_{t+1}, so that there is always a *positive or nil* probability of a shift from one group to the other.

Since the occupational structure at time t (i.e. *a priori* probabilities a^i_t) is known, the problem consists of estimating the transition matrix P_t in the equation (1) above. This raises somewhat complex problems.[1] Theoretically the problem could be solved using the maximum likelihood estimator applied to a stationary transition matrix [2], giving the estimate—

$$\hat{P} = (\hat{p}_{ij}) = (n_{ij}/\Sigma_j n_{ij}) \geqslant 0 \qquad \ldots\ldots\ldots\ldots (4)$$

where n_{ij} represents all *transitions* from groups L_i to groups L_j.

In practice, information about the manpower shifts n_{ij} is hardly ever available. On the other hand, it is possible to obtain statistical data about the breakdown of

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[1] On this point see the excellent article by T. C. Lee, G. G. Judge and T. Takayama: " On estimating the transition probabilities of a Markov process ", in *Journal of Farm Economics* (Ithaca (New York)), Aug. 1965, pp. 742-761.

[2] T. W. Anderson and L. A. Goodman: " Statistical inference about Markov chains ", in *Annals of Mathematical Statistics*, Vol. 28, 1957, pp. 89-110.

employment by occupation at different periods of time. These data, however, represent only the *result* of the employment shifts (variations of n_{ij}) and not the values of the shifts themselves n_{ij}.

When such is the case, i.e. in virtually all empirical applications, it has been shown [1] that it is possible to estimate the transition probabilities p_{ij} either by using the least squares method or by quadratic programming or by linear programming.[2] We have used the last method, which minimises the absolute deviations between observed and estimated values.

2. Formulation of the linear programme model

We have assumed the following model:

$$L_{t+1} = L_t \cdot P_t + U_t \qquad \ldots\ldots\ldots\ldots (5)$$

with the same notations as in (1), U_t being the line vector of the residuals.

If we note the value $q_i(t)$ at time t of the ith exogenous factor ($q_i(t)$ being a scalar), P_t can be written as follows:

$$P_t = P_o + \Sigma^z_{i=1}\, q_i\,(t)\, P_i \qquad \ldots\ldots\ldots\ldots (6)$$

where z is the number of exogenous factors; P_o is the fundamental stochastic matrix (independent of t), of order N; and P_i is the exogenous matrix associated with the ith exogenous factor, of order N.

After the introduction of z exogenous factors, model (5) can be written:

$$L_{t+1} = L_t P_o + L_t\,(\Sigma^z_{i=1}\, q_i\,(t)\, P_i) + U_t \qquad \ldots\ldots (7)$$

or alternatively using the notation $q_o(t) = 1\ \forall t$:

$$L_{t+1} = L_t\,(\Sigma^z_{i=0}\, q_i\,(t)\, P_i) + U_t \qquad \ldots\ldots\ldots\ldots (8)$$

This expression is thus fully linear in relation to the unknowns, viz. the errors $u_i\,(t)$ and the components a^t_{jk} of the matrices P_i. Since the criterion to be minimised is the absolute deviations, i.e. the vectors U_t, we must, as in the case when the variables are not accompanied by any signs, employ intermediate variables such as:

$$u'_i\,(t) \geqslant 0 \qquad \forall\ i,\ t$$
$$u''_i\,(t) \geqslant 0 \qquad \forall\ i,\ t$$
$$u_i\,(t) = u'_i\,(t) - u''_i\,(t) \qquad \forall\ i,\ t$$

The problem of identifying P_t by linear programming amounts therefore to finding the matrices $P_i (i = 0,1, \ldots z)$ and the vectors U'_t and U''_t which minimise the absolute deviations U_t, giving the following formulation:

Definition equation :

$$L_{t+1} = L_t\,(\Sigma^z_{i=0}\, q_i\,(t)\, P_i) + U'_t - U''_t \qquad (\text{with } q_o\,(t) = 1)$$

Objective function :

$$\Sigma_t\,(U'_t - U''_t)\ I \rightarrow MIN \qquad (I = \text{identity vector})$$

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[1] G. Miller: " Finite Markov processes in psychology ", in *Psychometrika*, Vol. 17, 1952.

[2] For details of these three methods see Lee, Judge and Takayama, op. cit; L. Telser: " Least squares estimates of transition probabilities ", in *Measurements in economics*, Stanford Papers, 1963, pp. 271-292; H. Theil and S. Goldberger: " On pure and mixed statistical estimation in economics ", in *International Economic Review* (Osaka), Jan. 1961. See also T. Lee, G. Judge and A. Zellner: *Estimating the parameters of the Markov probability model from aggregate time series data* (Amsterdam, 1970).

Constraints :

$$P_o R = R \qquad (R = \text{identity matrix})$$
$$(\Sigma^z{}_{i=0}\, q_i\,(t)\, P_i)\, R = R$$
$$a^0{}_{jk} \geqslant 0 \qquad \forall\, j, k$$
$$\Sigma^z{}_{i=0}\, q_i\,(t)\, a^t{}_{jk} \geqslant 0 \qquad \forall\, j, k$$
$$u'_t,\ u''_t \geqslant 0 \qquad \forall\, t$$

The first two constraints mean that the sum of the components of each line in matrices P_o and P_t is equal to unity. The next two are concerned with the non-negativity of these components for P_o and P_t respectively.

Lastly, this model is of course only valid for regular sequences of observations—monthly, annual, etc.

Appendix II. Transition matrices by period

1. South Korea

Occupational category	1	2	3	4	5	6
1963-64						
1	0.98	0.02	0	0	0	0
2	0	1	0	0	0	0
3	0	0	0.60	0.40	0	0
4	0	0	0.20	0.80	0	0
5	0	0	0	0.04	0.94	0.02
6	0	0	0	0.01	0	0.99
1964-65						
1	0.97	0.03	0	0	0	0
2	0	1	0	0	0	0
3	0	0	0.60	0.40	0	0
4	0	0	0.22	0.78	0	0
5	0	0	0	0.04	0.94	0.02
6	0	0	0	0.01	0	0.99
1965-66						
1	0.97	0.03	0	0	0	0
2	0	1	0	0	0	0
3	0	0	0.60	0.40	0	0
4	0	0	0.22	0.78	0	0
5	0	0	0	0.06	0.92	0.02
6	0	0	0	0.02	0	0.98
1966-67						
1	0.97	0.03	0	0	0	0
2	0	1	0	0	0	0
3	0	0	0.60	0.40	0	0
4	0	0	0.20	0.80	0	0
5	0	0	0	0.05	0.92	0.03
6	0	0	0	0.02	0	0.98
1967-68						
1	0.98	0.02	0	0	0	0
2	0.02	0.98	0	0	0	0
3	0	0	0.60	0.40	0	0
4	0	0	0.16	0.84	0	0
5	0	0	0	0.05	0.92	0.03
6	0	0	0	0.02	0	0.98

2. Taiwan

Occupational category	1	2	3	4	5	6
1963-64						
1	0.88	0.12	0	0	0	0
2	0	1	0	0	0	0
3	0	0	0.93	0.07	0	0
4	0	0	0.09	0.91	0	0
5	0	0	0	0.05	0.94	0.01
6	0	0	0	0.01	0	0.99
1964-65						
1	0.90	0.10	0	0	0	0
2	0	1	0	0	0	0
3	0	0	0.92	0.08	0	0
4	0	0	0.13	0.87	0	0
5	0	0	0	0.05	0.94	0.01
6	0	0	0	0.02	0	0.98
1965-66						
1	0.95	0.05	0	0	0	0
2	0	1	0	0	0	0
3	0	0	0.90	0.10	0	0
4	0	0	0.22	0.78	0	0
5	0	0	0	0.06	0.92	0.02
6	0	0	0	0.02	0	0.98
1966-67						
1	0.90	0.10	0	0	0	0
2	0.01	0.99	0	0	0	0
3	0	0	0.77	0.23	0	0
4	0	0	0.13	0.87	0	0
5	0	0	0	0.07	0.91	0.02
6	0	0	0	0.02	0	0.98
1967-68						
1	0.91	0.09	0	0	0	0
2	0.03	0.97	0	0	0	0
3	0	0	0.71	0.29	0	0
4	0	0	0.13	0.87	0	0
5	0	0	0	0.07	0.90	0.03
6	0	0	0	0.03	0	0.97