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Agricultural Development, Industrialization, and Basic Needs Fulfilment: A Taxonomic Approach

Habibullah Khan and John Alton Zerby¹

Abstract: Three aggregate indices representing agriculture, industry, and basic needs were constructed by combining various subsets of indicators with the help of the Wrocław taxonomic method. The composite scores were then utilized to rank 126 countries, which are again divided into three groups by using a clustering technique for subsequent analysis. Agricultural progress is more directly related to basic needs fulfilment for the advanced countries than for the least developed countries. While this study lends some support to the view that world agriculture is in disequilibrium, developed countries may nevertheless find that maintaining high standards of living through continuous advances in agricultural productivity is relatively easier than by other means. Producing more primary products than a country needs to satisfy its basic needs adds to its export potential, and that addition helps to prevent protection of agricultural products, which would eventually make satisfying basic needs requirements more difficult. In the past decade, the least developed countries benefited most from industrialization.

Introduction

During the 1940s and 1950s, people generally believed that industrialization was the key factor in economic and social development. Industrial activity was viewed as a source of employment, a supplier of agricultural inputs (such as fertilizer and insecticides), an economizer of scarce foreign exchange, and a promoter of exports. While a group of economists recognized the need to raise agricultural productivity in the LDCs, the greatest stimulant to progress was thought to be the “big push” of an industrialization programme, and the one-sector growth models of the Harrod-Domar type emphasized (at least implicitly) the importance of investment in manufacturing infrastructure.

The two-sector models of the 1960s continued to assign an essentially passive role to subsistence farming but gradually recognized the interdependent nature of agriculture and industrial growth. Ranis and Fei (1961) and Jorgenson (1961) were among the many who perceived the need simultaneously to effect the shift of labour from agriculture to manufacturing and the increased production of food for the growing urban population. Similarly, as noted earlier by Johnston (1951) and Lewis (1954), agricultural surplus provided an important source of capital for industrial development; and a prosperous rural sector could also become a market for the industrial output. More recently, Singer (1979) and Adelman (1983) directed attention to demand linkages and to programmes of agricultural-demand-led industrialization for LDCs.

Interactions between sectors have been modelled and tested within the framework of input-output analysis, and structural changes that accompany the growth process have been examined empirically by a number of economists. The question remains, however, of the relative importance of agriculture versus industrialization and the precise way in which they interact to fulfil the basic needs of a national economy. The study reported here is directed to that question. Although the answers are expressed tentatively, we suggest that the method adopted is likely to be a useful one.

Selection of Indicators and Aggregation Procedures

The principal objective in raising agricultural or industrial productivity is an improvement in the living standards of the population by providing it with an increased supply of basic necessities. The relevance of a basic needs strategy in socioeconomic development and the difficulties associated with measuring basic needs have been discussed by the ILO (1977). Ideally, a single number can be found that can be quickly grasped and provides an indication of basic needs fulfilment. While we have argued elsewhere (Zerby and Khan, 1984) that a single measure of development is not feasible, we nevertheless seek to aggregate a number of social and economic indicators into a basic needs index, which one should view as one of several possible indices. Our procedure is based upon the Wrocław taxonomic method described by Harbison *et al.* (1970) and applied for similar purposes. It relies on the selection of indicator values that are “best” in the sense that they represent the highest values for all development stimulants and the lowest values for all development retardants contained in the sample. The Euclidean distance from the “ideal” values to those for each country, summed over all indicators, is referred to as the pattern of development. These scores are adjusted to provide the desired index.

The indicators of basic needs fulfilment were chosen to reflect health, education, nutrition, sanitation, and general economic or material status, with four indicators selected from each category, as listed in Appendix Table 1 (page 257). An index of agricultural self-sufficiency (*A*) was constructed in the same way from 15 indicators; and 14 industrial indicators were aggregated into an index of industrialization (*I*). The rankings obtained for 126 countries, both developed and developing, for 1970 and 1980 are given in Appendix Table 1. For grouping the selected countries, we used an agglomerative hierarchical program of cluster analysis.⁷

Major Findings

Table 1 shows the rank correlation coefficients between the aggregate indices as well as the *t*-ratios for the regressions of the 1980 basic needs index (*B8*) on the agricultural and industrial variables. *B8* is more highly correlated with *I8* than with *A8* for the set of 126 countries, showing a Spearman rank correlation coefficient of 0.90 compared with 0.35. The change in *B* rankings during

Table 1—Rank Correlation Coefficients and Regression of 1980 Basic Needs Index on Agriculture and Industry Variables

Correlation†	Regression Variables (<i>t</i> -ratios in parentheses)‡
--- Overall Group (<i>n</i> = 126, $R^2 = 0.90$) ---	
<i>B8,A8</i> = 0.35*	<i>LAND/PER</i> (8.13), <i>8SAL + WAGE</i> (5.89), <i>FERTILIZER</i> (5.47), Δ <i>LAND</i> (-4.45),
<i>B8,I8</i> = 0.90*	<i>8IRRIGATION</i> (3.39), <i>AG/GDP</i> (-3.63), <i>ENROL.SC</i> (3.36), <i>8MANU/EX</i> (2.56),
Δ <i>B,A8</i> = 0.26*	and <i>8STEEL</i> (2.09)
--- Group A (most developed, <i>n</i> = 34, $R^2 = 0.86$) ---	
<i>B8,A7</i> = 0.59*	<i>LAND/PER</i> (9.65), <i>FERTILIZER</i> (5.42), Δ <i>LAND</i> (-5.01), <i>IRRIGATION</i> (4.64),
<i>B8,I7</i> = 0.44*	<i>8AG/GDP</i> (-2.30), and <i>IND.POP</i> (2.27)
Δ <i>B,I8</i> = 0.24	
--- Group B (moderately developed, <i>n</i> = 37, $R^2 = 0.78$) ---	
<i>B8,A8</i> = 0.09	<i>ENROL.SC</i> (4.16), <i>8LIVESTOCK</i> (3.94), <i>8ENERGY</i> (3.72), <i>SAL + WAGE</i> (3.60),
<i>B8,I8</i> = 0.56*	<i>8EXP.R + D</i> (-3.27), <i>8AG/EX</i> (2.97), and <i>STEEL</i> (2.90)
Δ <i>B,A7</i> = 0.37*	
--- Group C (least developed, <i>n</i> = 55, $R^2 = 0.72$) ---	
<i>B8,A8</i> = -0.30*	<i>8SAL + WAGE</i> (6.50), <i>STEEL</i> (5.16), and <i>FISHERY</i> (-3.42)
<i>B8,I8</i> = 0.65*	
Δ <i>B,A8</i> = 0.26	
Δ <i>B,ΔI</i> = 0.25	

[†*B* = basic needs fulfilment, *A* = index of agricultural self-sufficiency, *I* = index of industrialization, 7 = 1970 data, and 8 = 1980 data. ‡*LAND/PER* = arable land per person in agriculture, *SAL + WAGE* = salaried and wage earners as a percentage of the total economically active population, *FERTILIZER* = use of chemical fertilizers per 1,000 ha, *LAND* = arable land, *IRRIGATION* = percentage of land irrigated, *AG/GDP* = percentage contribution of agriculture in GDP, *ENROL.SC.* = proportion of third level enrollment in science and engineering courses, *MANU/EX* = percentage contribution of manufacturing in exports, *STEEL* = per capita steel consumption, *IND.POP* = percentage of economically active population engaged in industrial activity, *LIVESTOCK* = index of livestock production, *ENERGY* = per capita energy consumption, *EXP.R + D* = expenditures on R&D and a percentage of GDP, *AG/EX* = percentage contribution of agriculture in exports, and *FISHERY* = fish caught per 1,000 persons in the total population. *Statistical significance at the 0.025 level.]

the period, however, is more correlated with *A8*. Moreover, among the explanatory variables, arable land per person in agriculture (*LAND/PER*), use of chemical fertilizers per 1,000 ha (*FERTILIZER*), and percentage of irrigated land (*IRRIGATION*) are highly significant. A substantial amount of interdependence between agriculture and industry must therefore exist.

Since the analysis of the entire set of countries cannot show structural differences for various levels of development, the countries were grouped with a clustering procedure using 66 social indicators for 1970.³ Three groups were used: group A, consisting of the 34 most developed countries; group B, containing 37 moderately developed countries; and group C, comprising 55 least developed, primarily African, countries. Both the correlation coefficients and the regression variables show that agricultural progress is more directly related to basic needs fulfilment for the advanced countries than for the least developed countries.

Part of the explanation for the absence of a noticeable contribution of agricultural development to the level of basic needs fulfilment for the least developed countries is that: LDCs generally adopted policies of expanding industry irrespective of local resources and skills, the high cost of industrialization led to negligence in agriculture, and resources in agriculture were misallocated in many LDCs. The agricultural productivity gap between more developed and less developed countries may have widened due to a wide distortion of prices in product and factor markets during the past decades (Hayami and Ruttan, 1971), and many economists still believe that world agriculture is in a fundamental "disequilibrium." Additionally, developed countries can maintain their high standards of living through continued progress in agriculture more conveniently than by other means. Failure to raise agricultural productivity is likely to lead to protectionism, which inevitably raises the cost of supplying the basic necessities.

In summary, the aggregation and the grouping reported here are highly simplistic, so that the results form only a preliminary evaluation. Nevertheless, the construction of a basic needs index serves the purposes of providing a single measure that can be analyzed in terms of its correlation structure. Of greatest importance is the existence of dissimilarities among groups of countries, indicating that clustering techniques are likely to contribute substantially to studies of structural change in the development process. Regarding the "big push" doctrine, the most that can be said is that countries in the middle group show substantially more of that influence than countries at the bottom of the development scale. Since the latter display much more variation in agricultural indicators, development goals that seek to reduce that variation must improve the overall relationship; but in the past 10 years, the least developed countries apparently benefited more from industrialization.

Notes

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²Sneath and Sokol (1973) provide a near-exhaustive reference on the subject.

³See Khan and Zerby (1982) for a description of these indicators.

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Appendix Table 1—Country Rankings from Constructed Indices, 1970 and 1980

Country	Group	A7	A8	I7	I8	B7	B8
Albania	B	54	6	41	46	49	52
Austria	A	63.5	22	23	23	23	20
Australia	A	12	21	13	24	1	1
Belgium	A	26	51	19	19	9	12
Bulgaria	A	96	43	17	6	22	24
Canada	A	1	3	8	22	6	7
Czechoslovakia	A	98	29	3	3	19	22
Denmark	A	11	4	18	28	7	21
Finland	A	16	8	22	5	30	30
France	A	57	33	16	20	14	10
German Democratic Republic	A	118	45	14	1	27	27
Germany, Federal Republic of	A	41	31	1	12	16	11
Greece	A	115.5	49	43	39	31	25
Hungary	A	110	30	2	7	26	31
Ireland	A	18	9	29	32	32	26
Italy	A	101	50	20	10	20	18
Japan	A	67	85	4	9	5	4
Netherlands	A	17	12	12	15	4	5
New Zealand	A	6	2	21	17	12	16.5
Norway	A	3	1	10	11	18	13
Poland	A	107	95	11	4	21	23
Portugal	B	39	97	32	30	48	44
Romania	A	119	25.5	25	2	29	34
Spain	A	112	75	34	35	34	29
South Africa	B	60	70	15	18	53	54
Sweden	A	28	14	6	13	11	8
Switzerland	A	44	23	7	14	10	6
UK	A	73	39	9	21	15	15
USA	A	15	7	5	8	17	9
Yugoslavia	A	109	72	28	16	25	28
Argentina	A	104.5	63	31	37	28	33
Bolivia	B	121	102	64	92	101.5	98.5
Brazil	B	108	81.5	56	36	57	56
Chile	B	24	15	33	41	37	47
Colombia	B	93	41	53.5	53	65	39
Costa Rica	B	97	34	71	54.5	40	59
Cuba	B	38	11	27	49	35	32
Dominican Republic	B	90	94	90	72	80	71
Ecuador	B	59	37	80	71	72	74
El Salvador	B	81	77	48	59	70.5	66
Guatemala	C	91	40	51	57	86	88
Guyana	B	54.5	80	40	56	42	41

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Appendix Table 1— Country Rankings from Constructed Indices, 1970 and 1980, continued

Country	Group	A7	A8	I7	I8	B7	B8
Haiti	C	48	108	113	96	119	107
Honduras	B	13	74	60	66	75	81
Jamaica	B	65.5	118.5	46	52	38	37
Mexico	B	31	42	47	43	51	48
Nicaragua	B	84	123	52	83.5	60	58
Panama	B	78	57	49	63	35	46
Paraguay	B	56	38	74	58	59	61
Peru	B	4	79	62	47	61	72
Puerto Rico	A	10	109	30	27	8	19
Trinidad and Tobago	B	114	117	37	34	39	36
Uruguay	A	120	64	42	45	33	35
Venezuela	B	71	68	35	42	44	43
Afghanistan	C	115.5	84	114	108	126	120
Bangladesh	C	111	92	117	95	114	105
Brunei	B	74	46	68	66	63	57
Burma	C	49	55	100	111	88.5	94
Cyprus	A	14	61.5	39	31	41	38
Kampuchea	C	5	104	116	116	76	111
Yemen, People's Democratic Republic of	C	83	73	93	109	107	112
Fiji	B	51	32	65	83.5	54	55
Hong Kong	A	2	126	26	33	3	3
India	C	88	87	89	60	82	90
Indonesia	C	79	28	102	78	77	65
Iran	C	122	66	55	67	79	64
Iraq	C	36	107	70	82	78	73
Israel	A	102	76	24	25	13	14
Jordan	B	33	89	112	89	68	86
Korea	B	89	10	50	26	50	49
Kuwait	B	103	36	38	38	24	16.5
Laos	C	95	44	87	90	98.5	103
Lebanon	B	58	47	45	54.5	43	45
Malaysia	B	69	5	80	40	45	50
Mongolia	B	63.5	103	61	48	52	52
Nepal	C	100	90	123	125	117	110
Pakistan	C	68	54	95	93	92	92
Papua New Guinea	C	8	16	119	87	98.5	96
Philippines	B	117	53	58	61	70.5	68
Saudi Arabia	C	87	124	59	73	94	70
Singapore	A	9	35	36	29	2	2
Sri Lanka	B	75.5	18	122	104	56	75
Syria	B	125	27	77	62	55	53
Thailand	B	80	52	110	94	67	78
Turkey	B	70	86	63	51	58	60
Vietnam	C	77	24	96	97	83	95
Yemen Arab Republic	C	61.5	112	126	124	124	123
Algeria	C	82	106	75	81	93	69
Angola	C	22	114	67	76	122	114
Benin	C	72	69	105	112	104	98.5
Botswana	C	29	125	104	88	90	82
Burkina Faso	C	92	61.5	106.5	110	123	125

[Continued on next page.]

Appendix Table 1—Country Rankings from Constructed Indices, 1970 and 1980, continued

Country	Group	A7	A8	I7	I8	B7	B8
Burundi	C	113	93	86	107	125	126
Central African Republic	C	47	81.5	82	113	105	108
Chad	C	32	58	124	120	118	124
Congo	C	106	113	103	91	74	79
Egypt	B	27	48	44	44	62	67
Ethiopia	C	30	25.5	120	115	112	123
Ghana	C	35	99	68	99	84	104
Guinea	C	86	13	85	121	116	119
Ivory Coast	C	61.5	65	109	102	85	85
Kenya	C	52	98	77	64	66	77
Lesotho	C	45	120	92	117	97	83
Liberia	C	50	88	108	101	100	89
Libya	C	126	116	66	68	47	40
Madagascar	C	75.5	91	88	79	81	80
Malawi	C	20	17	121	100	108	118
Mali	C	19	20	106.5	126	111	115
Mauritania	C	25	111	99	105	113	116
Mauritius	B	54.5	105	57	75	46	42
Morocco	C	40	110	101	71	64	63
Mozambique	C	23	101	84	77	110	113
Niger	C	7	19	94	114	120	122
Nigeria	C	34	60	98	70	95	87
Rwanda	C	85	78	111	103	103	101
Senegal	C	94	122	91	98	87	102
Sierra Leone	C	46	71	73	80	106	109
Somalia	C	42	115	125	123	121	117
Sudan	C	65.5	59	118	122	101.5	97
Togo	C	37	83	76	106	109	93
Tunisia	C	124	100	81	50	69	62
Uganda	C	43	56	97	119	88.5	106
Tanzania	C	21	67	115	74	115	91
Zaire	C	104.5	96	53.5	118	91	84
Zambia	C	123	121	83	85	96	100
Zimbabwe	C	99	118.5	71	86	73	76

Discussion Opening – Mary Ahearn

The approaches of the three papers dealing with the broad subject of people in rural societies differ in level of analysis, the extent to which the research is based on economic theory, and the analytical techniques employed. The common ground of the papers is a focus on the role of agriculture in development.

The first two papers in this session have a narrow scope, focusing on agricultural labour issues. Agriculture labour is a key variable in both production and in rural development.

Nattrass, May, and Peters' paper supports the trend of the declining employment opportunities in agriculture as development occurs. Their paper described the benefits and costs associated with the migration patterns resulting from the South African apartheid system. They also reported the results of a survey of black households regarding their incomes, occupations, and perceptions regarding the reasons for migration. Their paper has a major deficiency—it lacks an economic conceptual framework. Such a deficiency is even more problematic when applied to a situation with such critical social and political problems as exist in South Africa today.

Brandt and Cipriano estimate a farm labour demand function in order to explain the causes of low rates of farm labour absorption in Brazilian agriculture. A rate of growth in farm employment that is less than the rate of growth in agricultural output is a common aspect of development and increases in agricultural productivity. In the USA, for example, about 2 percent of the population is engaged in farming. Although this paper makes a contribution to measuring the relationships among inputs in agricultural production, a more relevant question regarding labour absorption is to analyze employment opportunities in nonagricultural sectors and simply to acknowledge the relative decline in farm employment opportunities.

After acknowledging the importance of the interaction of sectors in their introduction, Khan and Zerby focus on determining the separate roles of agriculture and industry in development. A great deal has been written in this area that ignores the interdependencies of the two sectors. The interdependence, although more difficult to model, offers a more fertile area for understanding the path of development. Emphasis should be given to testing explicit hypotheses regarding the linkages and balance between sectors. The measures of agricultural development used by Khan and Zerby are largely market based. This approach is understandably a result of data availability. However, one of agriculture's contributions to basic needs is the accessibility of food to farm families. In developing countries with a large segment of the population engaged in agriculture, this contribution is major, but home consumption and the value of barter are not included in market-oriented measures of agricultural output.

Nattrass *et al.* raised a distributional issue related to the adequacy of the Khan-Zerby basic needs indicator. South Africa scored above average using the Khan-Zerby index and compared very favourably with other African countries. Aside from the positive effect that the relatively prosperous whites had on the index, the standard of living for blacks in South Africa is high relative to other blacks in Africa. But the Khan-Zerby index is incomplete because it does not incorporate distributional or political issues related to well-being *within* a country, including economic and political stability. For example, Nattrass *et al.* reported a Gini coefficient of 0.47 for the bantustans surveyed. A relevant equity measure would be a Gini index for all of South Africa. The expected probabilities associated with a given level of basic needs attainment—as determined by the degree of political stability and the distributional issues within a country—are important elements of basic needs fulfilment. The Khan-Zerby index could have accounted for circumstances in the South African situation by including social and political indicators, such as percentage of population voting in national elections, percentage of intact families, and the rate of domestic and criminal violence.

Discussion Opening – Pieter H. du Preez

As the first opener has dealt with the problems of Nattrass, May, and Peters' paper quite adequately, I will not elaborate on her remarks.

Regarding the Brandt and Cipriano paper, one can mention the polemic about the use of mathematical models. Kenneth Boulding, for instance, describes the concept of a production function involving heterogeneous aggregates of land, labour, and capital as “pure economic alchemy” and “a total blind alley,” and in this context he also refers to the Cobb-Douglas function. Boulding's

concern, however, is with the real world, which contains large elements of randomness and unpredictable parametric change caused by, *inter alia*, biological and social factors. But, qualifying this view, he rightly argues that “models must be appropriate to the system that they attempt to describe.” In this sense, I have no problem with the paper under discussion, because the nature of the factors, as well as the relationships described, lend themselves to a fairly mechanistic analysis without much risk of missing out on other important related factors.

The use of a mathematical model such as theirs can, therefore, be of positive value. Some of the results obtained can be significant in formulating agricultural policy; e.g., the relatively low impact of subsidies and the positive effect of new markets on labour absorption.

More information would be welcome on some aspects, however; e.g., why the effect of technology displaces the labour demand function to the right. The reason for that is not clear because technological changes affect labour absorption differently, depending on specific conditions; e.g., the nature of the technological change and the relation to other factors.

Khan and Zerby's paper supplies statistical evidence that, in the early stages of development, industry contributes more to basic needs fulfilment than agriculture. The causes of this should be noted and corrected because initial development is built on agricultural development. Indications that the importance of agriculture in the fulfilment of basic needs increases with development is, however, most interesting.

The authors show scientific modesty by warning that aggregation and grouping are highly simplistic and form only a preliminary evaluation. The need for further research in this field is obvious, especially regarding the causal relationship between agriculture and basic needs fulfilment. The wrong application of basic needs fulfilment can even be a deterrent to self-sustained development.

Continuation of this kind of research into the linkages between agriculture and industry is also necessary because of the one-sidedness of emphasis on only industrial or agricultural development. In fact, development cannot be compartmentalized, and the greatest merit of a paper such as this one is the intersectoral approach, which is of the utmost importance for general development.

Discussion Opening – *Herwig Palme*

From the most interesting analysis by Natrass, May, and Peters, which is largely a description of a situation at one point in time, one is compelled to conclude that, under the given circumstances, a solution to the problems is unlikely within the existing overall system. The results of their investigation show that space for survival under less dependent conditions is practically nonexistent. What can be done to improve the situation? The implication is that improvement can only be achieved by changing at least some features of the present system. The points to be discussed could be the identification of the particular points from which changes could realistically be expected to start in order to broaden the basis for reasonable rural development in the area and for the people concerned.

The major finding of Brandt and Cipriano's demand analysis of Brazilian agriculture—that tractors reduce labour demand substantially—begs for more information about the description of the variables used in the production function, like the concentration coefficient (is it ownership or operational units?) or the dummies (is technological progress implied or not?). The adequacy of the form of production function chosen can be questioned. One might have used a more disaggregated form, including livestock and different forms of capital, since the results somewhat contradict experience from other Green Revolution countries. At least the findings demand a more detailed and more precise explanation. One way of dealing with this question could be the construction of two production functions, one for big and one for small farms. In the results, the influence of the dummies shows strong and highly significant coefficients that are not referred to in the interpretation. In view of the unclear nature of the significance of the dummies (particularly if one interprets them as signifying technological progress), some important information appears to be incorporated in these variables.

Concerning the analysis of Khan and Zerby, a number of issues can be raised on methodological and interpretational grounds. With respect to the methodology applied, one may start from the fact that an enormous amount of information was put into the analysis, but subsequently much of it was lost by way of the chosen procedure and, I suspect, obscured as well.

The problems start right from the beginning when the basic assumption was made that one can represent a structurally enormously differentiated and complex situation in one number, and that a ranking of these indices would adequately reflect real differences in the degree of basic needs fulfilment. Additionally, the ranking itself (by discrete steps) results in a loss of information about distances in relative positions. The rank correlation process creates problems of its own since, for any reasonable interpretation, one has to identify or at least postulate a theoretically-based interrelationship between indices and variables, which, in my view, is simply impossible for the whole world.

The same kind of problems apply to the clustering procedure. Several methods or strategies are available, each with its own characteristics that have an influence on the results. Here again, a theoretically-based assumption about the nature of the structure of the different categories of economies is needed for any sensible interpretation. Since a hierarchical method of clustering was applied, the implicit assumption was made that some sort of (evolutionary) relationship exists between the different types. This carries additional implications with respect to the relationship between the indices as well. That such deliberations were made is not indicated, meaning that interpretation cannot avoid substantial arbitrariness.

With respect to the interpretation of the results, this seems at least extremely difficult, if not impossible, as the brief comments made above may indicate. Such doubts appear to be justified by the major finding: that agricultural progress is more directly related to basic needs fulfilment in the advanced than in the least developed countries. To say the least, this puts established knowledge on its head and runs straight into the face of simple logical thinking, as one cannot imagine how this could be possible in practical terms. These issues strongly demand very careful interpretation and explanation, which are not given by the analysis presented.

General Discussion – René Benalcázar, Rapporteur

Among the questions raised were: How do Natrass, May, and Peters define a migrant? Anyone who is away from home? For how long? Their findings are static, representing only one point in time. The current situation is the result of a process that has taken some time, and one would hope that it would change for the better over time. Let politicians solve political questions. But agricultural economists could estimate the social and economic costs of rural-urban circulating migration.

What are the implications of the findings of Khan and Zerby's paper in terms of more agriculture or more industry? How was income from agriculture calculated? Were *in situ* consumption and other factors such as housing considered?

Participants in the discussion included H.I. Behrmann, T.E. Gina, J. van Rooyen, K.L. Sharma, and J.B. Wyczkoff.