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THE SOCIAL ECOLOGY OF HUMAN FERTILITY IN NORWAY 1970

by

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THE SOCIAL ECOLOGY OF HUMAN FERTILITY IN NORWAY 1970

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Few social science variables have received the amount of research and discussion which fertility has, Both time series and differentials of fertility have proved remarkably resistant to widely accepted theoretical explanations. The present work presents a theoretical explanation of the regional differentials in fertility observed in Norway in 1970.

From an actor and exchange-oriented point of view, concepts of social structure and social processes are developed such that they permit factors derived front a factor analysis of Norway's ecology in 1970 to be interpreted as measures of basic dimensions of differentiation of the social structure.

A pivotal argument of the theoretical discussion is the different dynamic consequences for the social structure of exchanges based on inalienable experiences versus alienable goods. From this distinction, two types of dimensions are derived; socio-economic dimensions and community dimensions. After considering how social

structure so conceived is most probably distributed in space, here defined as the set of communes in Norway, six factors were extracted. Of these six one was a community factor, labeled Farailism, three were major socio-economic factors, labeled Socio-Economic Status/Urbanization, Affluence, and Deprivation, and two were minor socio-economic factors, labeled Manufacturing and Female Economic Activity.

The theoretical framework is then applied to the decision-making process in families as it affects conceptions and births. The general expectation is that families located in areas having high scores on socio-economic dimensions will find it to their advantage to limit their number of children severely. High scores on the community dimension , on the other hand, indicate a social structure where a relatively larger number of children will be advantageous.

Four parameters describing the fertility level and age pattern of child bearing were estimated by means of analytic graduation. The parameters were put into a regression analysis as dependent variables with the factors as the major explanatory variables. For the four parameters, the amount of explained variance ranged from 81 per cent to 94 per cent. One of the more interesting results is that female labor force participation seems to

have an effect on the level of fertility only indirectly **through** its effect on marriage patterns and timing of **births.**One also might note that manufacturing industry **has** a negative direct effect as well as a positive indirect effect(through marriage patterns).The two effects nearly cancel each other so that the zero order correlation between strength of manufacturing industry and total fertility rate comes out close to zero.

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CHAPTER 1

INTRODUCTION

Any introductory text on sociology will, inform the student that for society to survive, it -obviously- has to reproduce. Children must be born, cared for and socialized to become new carriers of culture and civilization. Reproduction is therefore one of the central areas of sociological research.

'In the present study the number of births within a society will be the problem investigated. More precisely the question to be looked into is why the populations of different regions persistently reproduce at relatively widely differing rates (see table 1.1 below,pp.11-12).

The average number of- births to women in a society -the fertility level of a society- is, compared to many concepts in sociology, straightforward and fairly easy to measure. Counts of number of births and number of women seem in this connection fairly unambiguous, (Yet, as careful research in demography shows: The possibilities for errors and bias are legion. Only relative to the measurement of concepts such as urbanization, modernization, alienation, standard of living etc. does fertility seem unproblematic).

It is a fact that the number of children born to an

average woman varies considerably and with practically every interesting theoretical category ranging from time, via region to social class (Heer, 1968), However no single variable has been found to explain any large proportion of the differentials in fertility (Cho et al 1970).

This is perhaps no great surprise, The level of fertility is too important for society to be permitted to fluctuate greatly in relation to just one influencing variable. Prom the necessity of reproduction and the disastrous -consequences of both too few and too many births, it follows easily that, somehow,, viable social systems have to evolve mechanisms for the control of population growth.

But how is it possible for a social system to control fertility? One introductory text poses the question thus: "Considerations of general welfare and social survival are not ordinarily Important determinants of individual behavior" (Lundberg et al. 1968, 4th ed. pp.291). A hint of where to look for an answer is given by continuing: "Unless immediate personal satisfactions are bound up with them."

The physiological process leading up to the birth of a child is well known. The biologically evolved sexual drives seem sufficient explanation for the fact that births do occur. The problem seen from this perspective is that

many fewer births occur than physiologically possible,

Davis and Blake (1956) have given a list of factors directly influencing fertility at this maximum level. Their eleven "intermediate variables" are grouped into:

I Factors affecting exposure to intercourse,

II Factors affecting exposure to conception, and

III Factors affecting gestation and successful parturition,

For each group of variables voluntary and involuntary causes are distinguished.

The list of variables has a certain elegance in so far as it exhausts the possibilities for directly influencing fertility. But it offers little illumination as to the question of why individuals choose to limit the number of children (voluntary causes) or how social structure makes people want to limit the number of children,, let alone the question of how social structure influences the number of births whatever the individuals want (involuntary causes). Indeed, with regard to the problem of controlling fertility within a society, the distinction between voluntary causes and involuntary causes might be misleading in terms of explaining the fertility level. It would seem that either fertility is wholly voluntarily controlled with conscious efforts to compensate for the "involuntary" causes, or else fertility is functionally controlled with the "involuntary" causes compensating for the effects of

the "voluntary" causes.

A structural-functional explanation (Stinchcombe 1968) of the control of fertility could most easily be imagined to apply to a stable and static society. In such a society it might be expected that the social structure circumscribes the decisions of the members of the society in such a fashion that by and large the children born into the society exactly replace the old members of the society.

This control would almost certainly have to be "strong" in the sense that it includes large redundancies and hence strong resistance to disturbing social change. This means that the control is performed by numerous small effects on all the intermediate variables. Mores, customs and kinship systems, division of profits and property rules, nutrition and morbidity and all the others combine their effects on the intermediate variables in such a way that just enough new members of the society are born to take over the customs, work and habitat of the previous generation without perceptible changes. The level of fertility may thus be seen as a characteristic of the social structure which is necessary to the reproduction of the structure.

Put more formally one may say that in the social system S, the social structure X has the function of producing Y children. Y children is just the right number of children

for the members of S, so that, they are able to socialize them to take over as carriers, of X. One of the effects of X is thus that X is reproduced. This is presumably in the interest of the members of S» but the causal connection from X to Y is not known.

How will such a system behave if change is introduced? No social system can guard itself from outside influences whether it be from pest, crop failure or other disasters,. The most regularly occurring hazards, had to be guarded against by having the social structure produce enough children for surviving the worst of the recurring conditions. In good times this, meant, reproduction at above the replacement level. If the bad times did not return the growing population itself would pose a problem as well as a force toward changes. Food shortage and prolonged lactation would under such circumstances directly affect the fertilr ity (Frisch 1975). But more interesting will be the problem of what happens to the number of births if also the social structure is changed.. The control loops from social structure through number of children and back to social structure, takes from 10-15 years tor a population explosion to 20-30 years when too few are born, And most of this time goes into the feedback path going from number of children to social structure,

If social change becomes institutionalized; as it is said to bo in our societies, this means that a functional

control of fertility cannot possibly work. The control will through a period of time break down and be replaced. by some other kind of control. It might seem that the story of the demographic transition is precisely the story of this change (Lorimer 1954, Part one).

The assumption that the structural functional control would be "strong" with large redundancies means that not all changes in social structure will affect fertility. The changes have to involve most of the different control mechanisms and/or be of a certain magnitude for them to have an effect. Given the sex drive it seems likely that - at least initially - the result of any disturbance of the control mechanisms will be a population explosion (see Lorimer 1954, pp,226-227). However, changes in the social structure will not affect all people equally. This will increasingly be the case with growinq size and complexity of the society. Both the long lag from cause (structural change/fertility change) to harmful effects (population explosion) and the lack of understanding of the precise connections between social structure and fertility makes it unlikely that conscious policies will be able to re-establish the functional control of fertility. If that should be possible, the structural changes necessary at one point-in time to control fertility would have to anticipate the continous process of structural change 15-20 years into

the future. It is hardly feasible.

Instead the differentials of impact from changes in the social structure made it easy to view the harmful effects of excess fertility as a private problem: as irresponsibility. But this contiinous pressure from excess fertility on individuals may also in some sense be said to have been the force behind the development of efficient means for individual control of fertility. The considerations of "immediate personal satisfactions" have become directly linked, to fertility. However, "considerations of general welfare-and social survival" are as far off as ever.

The total fertility of a modern society thus depends on how individuals weigh and value different strategies and: alternative projects. The link between social structure and fertility is as strong as ever. But it has more or less completely changed character. The old fertility re-. gime -if it may be called thus- where the sum of the effects of the "taken for granted everyday life" determined the- fertility level, has been replaced, or is in the process of being replaced, by a new system where individuals increasingly use the existing possibilities to plan their careers and family life.

In this system fertility probably will not be strongly controlled. It is not likely there will be much redundancy in the control. Fertility will be volatile and

easily affected by changes in the social structure. In a system, with individual control of fertility, the position of patents in the social structure will be crucial.

It'will not be the family' not marriage and not the role of women, as such which influence the fertility decisions of individuals and couples. It will be the position of parents in the social structure and how this is affected by structural changes whether these are connected with changes in family patterns, role expectations or something else. The couple must compare being parents with "not being parents on all the different valued aspects of life and decide: Do we want a child now? (Ryder 1959, pp. 426-433,- Cogswell and Sussman 1974, Berge 1978.)

Is there reason for young couples today to believe that they will gain by becoming parents compared to not becoming patents? Judging from the high percentage who actually do become parents the answer must be yes. But also the same couples seem to have second thoughts as they actually experience what it means to be parents. The countries of the industrialized world have universally low fertility, mostly well below the replacement level. Some of those who consider general welfare and social survival are beginning to worry.

Norway belongs to the industrialized world and may be said to be a modern society. Our fertility level (measured

by the total fertility rate) in 1978 was 1.77,21% below replacement level (with preisent mortality and sex ratio at birth the total fertility rate representing the replacement level is computed at 2.11).

From the start of this century up to the middle of the thirties, the fertility was declining rapidly. For the period 1936-40 it was almost 10% below replacement level. After increase commenced in the late thirties fertility rose during the war to reach a top in 1946. After a short decline from '46 to'51 it increased slowly to a record high of 2.98 in 1964, more than 40% above replacement level. From 1964 up to 1977 there was a steady decline picking up speed around 68-69 (for details see Brunborg 1975 and Brunborg 1976).

This last decline started, however, before the more efficient contraceptives, the "pill" and the "I.U.D.", were introduced to the general public. The rapid decline, though, came after they were introduced. One way to interpret this is to say that first there was motivation to reduce the number of children, then the most efficient means to this end was found. Regarding this it is also worth noting that concomitant to the increased use" of efficient contraceptives, the interpretation of the abortion law became more and more liberal until, finally, in 1978 abortions were made to depend only on the woman's decision.

Such observations, however, only "beg the question of how recent changes; compare to the decline during the early part of this century. What were the motivations then, and which were the means? (See for instance Myklebost 1976). And for full measure: exactly what are the motivations today? Close to nothing is known. The interpretation offered here, is that today we are living at the end of the period of transition from the old fertility regime. What a new regime will look like is uncertain. At the moment the individual calculations of optimal courses towards the GOOD life seem a rather shaky foundation for a control of fertility according to considerations of general welfare and social survival. To counter the built in possibilities for rapid fluctuations would seem to require some kind of conscious public policy. But in order to implement measures directed at controlling fertility, more must be known of how different sub-groups of the population respond with regard to fertility as their situation [illegible]

TABLE 1.1 TOTAL FERTILITY RATE[1] TOR COUNTIES OF NORWAY AND FOR NORWAY FOR THE YEARS 1968 TO 1978

THE COUNTIES ARE ORDERED ACCORDING TO RANK IN 1968.

COUNT?		YEAR										
NO	NAME	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
03	OSLO	2.03	1,92	1.76	1.79	1.76	1.63	1.63	1.50	1,47	1.40	1.44
04	HEDMARK	2.51	2.61	2.30	2.42	2.24	2.05	1.92	1.80	1.71	1.63	1,48
01	ØSTFOLD	2.55	2.48	2,36	2.30	2.37	2.12	2.11	1.88	1.78	1.71	1.66
06	BUSKERUD	2.56	2.43	2,28	2.35	2,23	2.04	2,03	1.92	1.75	U65	1,65
08	TELEMARK	2.59	2.59	2.46	2,41	2.32	2.11	2,09	1.94	1.82	1.78	1.72
07	VESTFOLD	2.60	2.54	2.44	2.39	2.40	2.06	1.92	1.91	1.80	1.61	1,66
02	AKERSHUS	2,63	2.5?	2.35	2.26	2.18	2,06	1,93	1*86	1.69	1,61	1.60
05	OPPLAND	2.65	2.66-	2.43	2.42	2.33	2.20	2.07	1.92	1.73.	1.58	1.61
16	SØR-TRØNDELAG	2.83	2.77	2*58	2.68	2.51	2.39	2.23	2.12	1.91	1,78	1.75
09	AUST-AGDER	2.88	2,91	2.74	2,81	2.56	2.45	2.38	2,29	2.35	2.01	1.34
12	HORDALAND	2,97	2.94	2.57	2.61	2=56	2.46	2.34	2.18	2*00	1,90	1,93
10	VEST-AGDER	3.00	3.02	2.75	2.82	2.62	2.49	2,42	2.30	2.26	1.97	2.09
11	ROGALAND	3.18	3,10	2,87	2.85	2.65	-2.50	2.42	-2.-30	2.19	2,08	2.14

[1]See next page.

TABLE 1.1 TOTAL FERTILITY RATE[1] FOR COUNTIES OF NORWAY AND FOR NORWAY FOR THE YEARS 1968 TO 1978, continued THE COUNTIES ARE ORDERED ACCORDING TO RANK IN 1968.

COUNTY NO	NAME	YEAR 1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
18	NORDLAND	3.20	3.04	2.80	2.79	2.61	2.41	2.32	2.14	2.04	1.92	1.99
17	NORD-TRØNDELAG	3.22	2.96	2.79	2.89	2.68	2.64	2.44	2.09	2.02	1.97	1.98
15	MØRE OG ROMSDAL	3.23	3.08	2.91	2.78	2.66	2.50	2.39	2.13	2.01	1.89	1.97
14	SOGN OG FJORDANE	3.27	3.30	3.18	3.05	2.96	2.75	2.56	2.34	2.19	2.20	2.15
19	TROMS	3.41	3.32	2.94	2.98	2.81	2.53	2.42	2.08	1.98	1.84	1.88
20	FINNMARK	3.50	3.46	3.27	3.34	3.00	2.90	2.64	2.24	2.12	1.85	1.95
NORWAY		2.75	2.70	2.50	2.49	2.39	2.23	2.13	1.98	1.86	1.75	1.77
Difference between highest and lowest of county values in % of lowest		72	80	86	87	71	78	62	56	60	57	49

Source;Unpublished tables from The Central Bureau of Statistics, and Berge© 1974'

[1]The total fertility rate is the sum of age specific fertility rates computed from observations in one period of time.The total fertility rates for the counties are estimated by'means of analytic graduation.For further details on fertility rates and analytic"graduation see Appendix C.

county with lowest total fertility has been changing.

One way to interpret the rise and decline of the difference between the counties with the highest and lowest total fertility rate, it to view it as a result of a diffusion process for the new contraceptives. The process might be assumed related to the one studied by Coleman, Katz and Menzel (1957), since contraceptives are being prescribed by physicians. It is known that the new contraceptives were introduced during the middle of the sixties. Judging from the data, the market in the central counties was about satiated by early 1970 as the contraceptives were being introduced in the more peripheral counties. Five years later the diffusion had run its course and the regional differentials re-established themselves as before, but at a lower overall fertility level.

Whether such a diffusion process actually did take place is not known. If it did, it would not be expected to influence the rank ordering of the counties. But If fertility to some large degree is determined by the "environment" of the decision makers, differential development of the counties would be expected to show up in changed ranks.

Spearman's rho of .74 computed for the orderings of 1968 and 1976 is about what might be expected judging from

changes in relative economic conditions. Spearman's rho computed for the rank orderings of the counties in 1965 and 1973 on private consumption per person comes out as .73. "(Based on figures from NOS A 376 and NOS A 925.)

Judging from table 1.1 then, it seems likely that the time trends in fertility should be linked to whatever causes change in the social structure, especially as this affects the position of parents in society. The regional differentials must hence be linked to differences in social structure among regions. Within a social system the distribution of different activities to different regions will cause different conditions for the parents living in the region. This presumably will show up in the fertility level of the region.

In an attempt to specify a theory of social structure so that it explains more precisely the regional variation in fertility than the loose assumptions presented above, the present report will focus on the Norwegian society around 1970.

The data have partly been worked through before (Berge 1973 and 1974). But the estimation technique for fertility has been improved (Hoem and Berge 1974 and 1975, Uoern and Holmbeck 1975) and additional data on the social structure have been secured so the analysis starts from raw data all the way.

The aim of the study is, however, rather theory construction than any kind of testing. Constructing a theory conforming to data makes it impossible also to test the theory on these data. The problem faced is to see how far towards an explanation of the connections between fertility and indicators of social structure it is possible to come, as sociology stands today. The problem will involve most of sociological theory. Bits and pieces have to be collected and fitted together to some kind of coherence. The aim all the time being to explain the expected results. If the theory in the end still does not explain much of the regional differentials of fertility there may be several reasons. The theory may simply not be good enough, or the data required by the theory may not be available. But even if the theory can explain most of the regional variations of fertility, it may not be useful as theory. The theory may be applicable only to Norway in 1970. Its usefulness can only be tested by applying it on other data.

Since it was known in advance that general indicators of socio-economic status and urbanization from for instance, factor analytic studies of ecological variables, correlated with the total fertility rate, one immediate aim was to construct a link between factorial ecology and a general theory of social structure.

The concept of social structure has *never* beer; easy to

understand or operationalize (Boudon 1968, Blau, ed. 1975, Coser, ed. 1975). The first task was to conceptualize social structure in a useful way. This is outlined in chapter two.

Chapter three takes up the question of how space interacts with the social system to produce a distribution of' the social structure. Chapter four describes how it is possible to view factors as dimensions of social structure and chapter five provides a description of the Norwegian social structure in terms of factorial dimensions from an analysis of Census data from 1970. In chapter six the factors along with other variables are applied as explanatory variables to explain the regional variation in fertility.

Estimates of fertility for regions and a description of the procedures providing them are given In Appendix D. The units for which fertility and factors are estimated, are defined and discussed in Appendix B. Appendix C contains a comparative study of the factorial ecology of Norway 1970 with that of 1960 (Sweetser 197G). This study provides a point of departure for the analysis reported in chapter 5.

CHAPTER 2.

THE SOCIAL SYSTEM: STRUCTURE; AND PROCESS

The social system is conceived to consist of a passive element which will be called social structure, and a dynamic element which will be called social processes. The dynamic agents of a process will be called social actors.

Roughly the social structure may be pictured as a framework within which and upon which the various social processes operate to recreate, transform or dissolve the social structure (or, of course, parts of it).

The model as it will be presented here is assumed to apply to systems on any level - from the local community (Sanders 1975) to the capitalist world economy (Wallerstein 1974a&b). But since the aim of this study is to investigate differential fertility by means of regional differentials, the small local social system will represent some kind of conceptual base line.

Social structure

The conceptualization of social structure is based on the works of White, Boorman ana Breiger (1976), White and Boorman (1976) (see also Lorraine and white 1971 and Burt 1976, 1979 and 1980).

A point of departure is a network where various types of social relations tie one social actor to another. One may picture the actors as points In a space joined by various types of lines representing the various types of ties.

There is no need here to go Into details of the development of the concepts of White et al. (1976). Only three of their concepts are essential to the further discussion. The first is the conception of structurally equivalent actors within a network as pictured above, the second is the definition of a position in the social structure as the set of social actors who are structurally equivalent within a network and the third is the definition of a social boundary in terms of the absence of bonds between positions.[1]

The most important element here is the concept of structurally equivalent actors. . White et al. (1976) and Lorrain and White (1971) do not give any substantial interpretation of their concept of structural equivalence. But it seems reasonable' to assume that any such interpretation must imply a rough equality both in terms of quantity and

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[1] If there exist ties between actors in different positions the positions are said to be connected by a bond. More on the terms used will be found in White, Boorman and Breiger (1976) and White and Boorman (1976). For discussions of the concept of boundary see also Barth (1969), Suttles (1972), and Wallerstein (1974a&b).

in terms of quality (content) of the ties for all actors who are structurally equivalent.

This means that actors in the same position in the social structure will have roughly the same interests[1] it the outcomes of the sequences of events defining the relations among them and to actors in other positions. In particular actors in the same position will have common interests in the bonds connecting their position to other positions. Conversely it follows that actors in different positions will have either conflicting interests or no interrelations at all (where boundaries exist).

From this follows that, a mapping of actors into different positions means one or both of two possibilities: either they are mapped into different positions in a statification system or there is a social boundary between the two positions. For simplicity one may think of this structure as a top position defined relative to a bottom position with both related by a boundary to a position of outsiders.

The concepts introduced so far will have to be developed

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1 Here one ought to be careful. It is not necessarily the case that "same interests" are common interests. For instance: In an antagonistic relationship where winner takes all, the interests are opposite, yet in a certain sense similar. It is this meaning of "same interests" which is intended here. Conversely, of course, common interests will according to this always be "same interests".

further later. Their significance is perhaps best seen after a concept of the social processes has been developed and one goes on to link structure and. process a

Social processes

Social processes have to be defined so that they In fact do recreate, transform or dissolve a social structure or a part of it. Since the social structure is defined in terms of relations among social actors, a model of a social process[1] must describe how e relation between two actors is created, transformed or dissolved.

Any type of relation may be described; as consisting of a sequence of events. And. any event may be described as a sequence of actions by one actor *01* transactions between pairs of actors. This means that any model of the social process must include or assume the existence of 3 model of the actor which explains how the actor chooses among alternative lines of action.

The Actor

As a point of departure one may, with Parsons (1951, pp 5)5),

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[1] The conceptualization of social processes proposed here has been influenced by both exchange theory (Homans 1961, Blau 1964, and Ekeh 1974) and economic theory (Marx 1867, Olson 1965, and Malinvaud 1972). Perhaps most through the way such ideas are developed and used by Barth (1966).

assume that social actors are motivated to act in, terms of a tendency to the optimization of gratification"! gratification simply meaning the consequences, of reaching a goal.

It will be convenient to distinguish between the actor and the motivational entity which is going to gratify the actor if and when it is grasped (even if the motivational entity is a mental state). The assumption then implies that the motivational entities may be said to have a quality which somehow motivates an actor to initiate -or refrain from initiating- specific acts in order to claim posession of the entity. This quality will henceforth be called value.[1]

Within the actor some part containing the decision rules and weightings necessary for choosing among motivational entities has to be assumed to exist. This part will be called the choice function of the actor.[2]

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[1] This usage of the concept of value is different from the concept of value used both in modern economic theory and in contemporary psychological and sociological theory: see Robinson 1962, Malinvaud 1972, Rokeach 1973, Parsons 1951, Homans 1961 and Gouldner 1970. The concept as it will be developed here is a generalization of tho concept used in classical political economy and modern nurxist sociology: See Ricardo 1817. Marx 1867, Kobinsoti 1562, Johansen 1963, Mandel 1973, and Isreal 1973.

[2] This concept of a choice funstion is then close to what is meant by "values" in sociology and psychology today: see Parsons (pp.12) and Rokeach (ch. 1). As the concent will be developed here it includes elements ot sociological and psychological theories of norms and values as well as of the micro-economic theory of utilities and preferences (see f.i. Malinvaud 1972, ch. 2).

In the model of the motivational process of the actor it will here be assumed that the processes shaping the choice functions of the actors of a system and the processes producing different types of value and vesting it in particular entities are independent. This assumption can only hold in short run. Of course there have to be links between the production of value and the production of choice functions. The links are, however, not at the actor level. It is at the institutional, level and through historical processes that the social system links up the aggregate flow of individual decisions to the socialization of new members to the system.[1]

The importance of the distinction between the choice function as a property of an actor and the value as a property of motivational entites lies in the dynamic consequences within the proposed model.

Properties of the choice function

Four basic assumptions will be assumed to hold for all choice functions.

t) Postulate of rationality,.

The actor will be assumed to act in order to protect

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[1] Hence one may use the same concepts to describe both choice functions and the value of motivational entities at this macro-level. This may be the reason for the sometimes confusing uses of the concept o£ "values".

and augment the portfolio of value he is endowed with upon entering the system by all means available and permitted by his own choice function,

2) Postulate of optimization.

In order to augment his portfolio of value the actor will, if there are several mutually exclusive motivational entities to choose among, choose the one judged to give most value to the actor.

This implies that the choice function contains an element making the measurement of value feasible, at least on an ordinal scale. The actor has to compare motivational entities in terms of the magnitude of value located in them and in terms of the costs the acquisition will imply.

3) Postulate of depreciation.

The stock of value controlled by an actor will be assumed to be subject to a process of depreciation. In order to protect his portfolio of value the actor will have to initiate activities which will help to recreate his portfolio of value.

4) Postulate of balanced exchange.

The exchange of value between social actors will be assumed to be subject to a principle of balance.[1]

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[1] This principle is based on the principle of reciprocity proposed by Levi-Strauss (1969) and also discussed by Gouldner (1960 and 1970, pp.236-242) and Ekeh (1974).

Each actor will, in transactions with other actors, acknowledge that it the change is unbalanced according to his choice function, i.e. if the actor finds he has received more value than he has given out {or that he has given out more value than he has received), then he will feel obliged one way or another to repay his debt some time in the future (or he will feel entitled to some kind of redemption).

Any. debt may be transferred to a third part so that the redemption may come from or go to an actor different from the one taking part in the original, debt creating exchange.

Two important conclusions follow from these assumptions. One is that in order to protect and augment his portfolio of value the actor has to initiate or take part in activities producing motivational entities containing more value than what the actor puts into the process. The other is that because of the risk of loss of value in a world of uncertainties the actor will try to protect his portfolio of value by c process of diversification[1] where one type of value is exchanged for another type as well as by emphasizing inalienable types of value.

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[1] This will also follow from (or be rein forced by) an assumption of declining marginal utility of any type of motivational entity.

Types of value.

A useful differentiation of social processes and their dynamic consequences must, as structure and process are conceptualized here, rest on an appropriate typology of values.

A basic distinction is the one between alienable value and inalienable value. Motivational entities containing alienable value will be called goods. Motiviational entities containing inalienable value will be called experiences. Value located in goods[1] is in principle divisible. Even if the entity Itself may be indivisible the actor may have proprietary claim to a part of the value located in it. Value located in experiences is In principle indivisible. Either the actor has the whole experience (and hence the value of It) or the actor has a different experience. Experiences may, however, be shared. All actors having the same experience also have the whole value of this experience. The sharing of experiences do not subtract from their value in general, However, if an actor appropriates the value in a gcod its value can not contribute to the oortfolio of value of another actor.

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[1] 1 Both goods and experiences may in some circumstances turn out to be "bads*. What one is talking; of them is the utility of a motivational entity to an actor , And that which is utility to one, may be disutitliy to another.

The basic difference between alienable value and inalienable value is also mirrored in the media used to measure and express the utility which a motivational entity has for an actor. The medium, used to express the utility of value located in qoods is money. The medium used to express the utility of experiences is language (see also Parsons (1975) for a discus's ion of generalized media of exchange).

The picture is thus that motivational entities have-value. The actor evaluates the motivational entity in terms of utility to him as he is circumscribed by his choice function and his position in social structure. If he acts in such a way that he *is* able to claim possession of the entity its value is added to his portfolio of value.[1]

TABLE 2.1 TYPES OF MOTIVATIONAL ENTITIES AND VALUES IN A SOCIAL SYSTEM

	GOODS	EXPERIENCES
SYMBOLIC VALUE	PRESTIGE VALUE	COMMUNITY VALUE
INSTRUMENTAL VALUE	USE VALUE	INFORMATION VALUE

[1] It must, be a portfolio of value because some of its significance lies in the power it qives the actor through its potential utility to other actors.

Table 2.1 introduces a distinction as fundamental as the distinction between alienable an inalienable value. It is the distinction between what has been called instrumental value and symbolic value.

The instrumental value is supposed to be determined through the primary production process whose output is "one good" or "one experience". How this value is determined is not important to the present argument. But one way to approach that problem may be through specifications of functional characteristics within a particular social system: the use value or information value being determined by the functional characteristics of the entity within a particular historical situation.

However, after being finished from the primary production process and having acquired use value or information value, the value of the motivational entity is not yet fixed. Both goods and experiences will as finished products in various ways enter into the activities of social actors. In these situations there will be added to or subtracted from their basic instrumental value a quantity here called symbolic value.

The most obvious situation where goods are given symbolic value is where they are used to signal group membership. Examples may be the flag, a ring or some special type of clothing. In our type of society most such

signals are linked to the advertisement of position in a stratification system. Hence the label prestige value for this kind of symbolic value.

The symbolic value of experiences is also best seen in their relation to group phenomena. Consider for example a situation where a group of actors are gathered to discuss a common experience. The situation itself will furnish each participant with a unique experience with its own basic value. But the "content" of the situation is to discuss the meaning and significance of a past experience. The activities of the actors are thus operating on two levels simultaneously:while producing a new experience a past experience is given some additional quantity of symbolic value (compare the levels of meaning in myths, Barthes 1969,pp.143-186). In so far as an actor agrees to the assessment of the meaning and significance of the common experience, he will have added to his portfolio of value not only the symbolic value of the past experience, but also a new experience. He may well walk away from the gathering feeling enriched.

In general each experience as it is located in the past of some actor will be said to have some basic information value. Even if an experience totally has destroyed the actor's portfolio of value, it will, taken only by itself, contribute to the actor's stock of knowledge of himself

and his fellow men in their common life-world {Schucz 1932).

While the symbolic value might be either positive or negative, the instrumental value will bo assumed always to be positive.[1] The discussion of motivational entities and value may be summed up as a distinction between two different types of motivational entities, goods and experiences, defined by two characteristics, alienability and divisibility.

TABLE 2.2 DEFINING CHARACTERISTICS OF COOPS AND EXPERIENCES[2]

	ALIENABLE	INALIENABLE
DIVISIBLE	GOODS	
INDIVISIBLE		EXPERIENCES

[1] That some actors are unable to handle some experiences only brings back the considerations of utilities. How actors handle disutility especially of inalienable experiences is interesting, but belongs to another discussion.

[2] Spelled out like this, the defining characteristics of the empty boxes suggest the possibility that maybe here public goods belong. Military protection in precisely alienable and indivisible while a road system is inalienable and divisible. Leaving out public goods from the discussion will have no consequences for the lnter discussion, so the possibility will not be pursued further.

Each type of motivational entity has two types of value, instrumental and symbolic. This requires four types of processes creating value and vesting it in motivational entities.

Next the consequences of the production and distribution of different types of value have to be traced for the social structure.

Linking structure and process

Social structure has been defined in terras of positions, bonds and boundaries. Social processes have been distinguished by the type of value produced and distributed among participating actors. The definition of" social-structure makes the link between structure and process straightforward. The relations among the social actors of the system have to be continuously recreated by the production and distribution of motivational entities as long as the system is working without social change. If the production and distribution of value somehow transforms or dissolves relations there will be social change in the system.

Since it is inconceivable for all relations to be dissolved simultaneously, the social structure will be a more lasting creation than any of the relation!; defining it. Since it is the point of departure for the actions of any

actor, the actual state of the social structure will also influence the way any particular process operates on the structure. The state of the structure will circumscribe the effects of the social processes ,two of which may be distinguished at this point: integration effects and disintegration effects. By integration effects will be meant the creation, strengthening or extension of social relations, by disintegration will be meant the opposite; weakening or removal of relations.

The social structure will shape the effects of the social processes mainly through the distribution of different types of actors across positions. A first approximation may be to distinguish between processes involving actors from the same position and processes involving actors from different positions.

The types of value produced and distributed will also shape the effect a process has on the structure. The main distinction is 'Between value in goods and value in experiences.

Table 2.3 tries to summarize how the types of value interact with type of structure to produce either integration effects or disintegration effects in the structure.

TABLE 2.3 RELATION BETWEEN TYPE OF MOTIVATIONAL ENTITY, SOCIAL STRUCTURE AND STRUCTURAL EFFECTS OF PROCESSES

	PRODUCTION AND DISTRIBUTION OF VALUE LOCATED IN	
	GOODS	EXPERIENCES
PROCESS OPERATING WITHIN POSITION	COMPETITION/ DISINTEGRATION SOCIAL MOBILITY/ INTEGRATION	SENSE OF COMMUNITY/ INTEGRATION
PROCESS OPERATING BETWEEN POSITIONS	DEPENDENCY/ INTEGRATION CLASS CONFLICT/ DISINTEGRATION	CONSCIOUSNESS OF BOUNDARIES/ DISINTEGRATION

If one considers the production and distribution of value located in goods when the actors are in the same position in the social structure, it is seen that the optimization principle will lead to competition and conflict. It seems rather likely that if the position is a closed system, the accumulation of differences in the distribution of goods will in due course break up the former single position into several positions. In an open system the effect is of course social mobility? actors move from one position to another. Whether the process in this case ought to be considered as having an integration effect or a disintegration effect thus

depends on what level of the system which is being considered. The effect is disintegration for the single position, but integration for the stratification system.

The accumulation of differences in the distribution of goods among actors in the same position, can not be attributed to the relations among these actors alone. Because of their common position, they will have the same interests and they will agree on valuations (utility) of goods taking part in their transactions. The balance principle will thus ensure that both parts in imbalanced exchanges will acknowledge the imbalance as debt payable in the future. The accumulation of inequality must thus be attributed to outside interference, to chance or to luck.

This does not hold true if the production and distribution of value located in goods involves actors from different positions in the social structure. Differences in interest will correspond to differences in valuations (utility). This may cause one actor to consider a transaction as balanced while the other finds it is not. Normally such transactions will not result in a lasting relation. There are however cases where the transaction is necessary to both actors. It may be called a dependency relation, The conflict potential is obvious. Such relations could therefore hardly persist without some kind

of power checks. But different positions in a stratification system also involve differences in power. The top dog must by definition have enough power to enforce a continuation of the dependency relation if he also has the necessary information and a choice function permitting him to use it.

Accumulation of unacknowledged debts in such dependency relations is also accumulation of a conflict potential.[1] Thus the process of producing and distributing goods may in the long run contribute to the disintegration of the social structure even if the short run effects are of the integration type by increasing the dependency.

Where the production and distribution of experiences. involve actors from different positions {like actors in a dependency relation), any attempt to go beyond the information value of the experience tc assess the meaning and significance of it (i.e. to give symbolic value to it), can but reveal the differences: in interests and valuations. This will either create a consciousness or increase a consciousness of the differences among actors from different positions. This consciousness will preclude certain types of bonds and is thus a part of the process maintaining a social boundary. In this sense it may be said that the

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1 This relation is also known as class antagonism {Marx and Engels 1843).

production and distribution of experiences contribute to disintegration.

The most important, effects on the social structure of the processes producing and distributing value located in experiences are, however, within positions; that is among structurally equivalent actors. These effects are all of the integration type.

One example may be the experiences furnished by the processes creating increasing dependency within a structure. Considering only the bottom position of the stratification system, the common experiences of dependency and exploitation may be used as input to group processes where the meaning and significance of these experiences are assessed. The experiences, a by-product of the processes creating and distributing value in goods, thus will create or strengthen a boundary reinforcing the separation of the two positions connected by a dependency bond.

But within the position the effect is integration. In this process the defining properties of experiences -that they are inalienable and indivisible- are of crucial importance. The value produced and vested in experiences must necessarily be received by all participating actors. If the process yields value in excess of the time and effort expended dating the process, the balance principle will force the participating (and receiving) actors to

acknowledge a debt to the group of actors qua group. The common- capital of community value and the relations of mutual obligations thus created are the fundament for all sense of community.

The general picture of the effects various social processes have on the social structure is thus that the production and distribution of experiences create solidarity among actors in the same position (structurally equivalent actors) and boundaries between actors in different positions. The production and distribution of value in goods have as their main effect to create or maintain bonded positions. But they will also have important secondary effects through the experiences accompanying the goods.

Since the production and distribution of goods always will furnish experiences in addition to the goods, the production and distribution of goods have perhaps a greater significance for the social structure than "pure" production and distribution of experiences.

The preliminary outline of a model of a social system presented so far has to be refined further if it is to be any help in explaining data. In the next chapter the spatial aspects of a social system have to be considered and incorporated into the model.

CHAPTER 3

SPATIAL ASPECTS OF SOCIAL SYSTEMS

Any social system has a location in space and an existence in time. Within its physical boundaries the system has a history. These simple facts have certain implications for the theoretical model outlined above. The model will have to be modified and extended to include some of these implications,, The time dimension will be touched upon only in so far as it is necessary in order to understand the implications of "sunk costs" -the comparative advantage of the positive to the merely possible as one might say (see Stinchcombe 1968, pp.101-129). The principal concern will be the spatial dimension and how the nature of the locality within which the system is embedded, affects the social processes and molds the social structure.[1]

The basic assumptions of the model concern the characteristics of motivational entities on the one hand, and the choice function of the actors on the other. This part of the theoretical scheme will have to be modified and extended first.

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[1] Important inspiration for the considerations presented here have been found in Firey's (1947) account of "Land Use in Central Boston." and also in Hawley 1950, Mills 1972, and Hunter 1974.

Spatial aspects of choice functions and motivational entities

Introduction of a spatial dimension to the model of a social system, points out the necessity for a postulate in the choice function allowing the actoi to select a location in space.

The social processes have been defined in connection with the creation, maintenance, transformation or removal of relations among actors. Distance, the friction of space, must with regard to this be considered a cost all transactions have to bear. If, aa has been assumed, the intention of any act is to further the reproduction and augmentation of the stock of value of the actor,[1] it must follow that an actor in choosing location in space has to consider both the location of his own stock of value and the locations of implements and actvities by means of which he reproduces and augments his stock of value.

It must hence be expected that an actor will select a location so that the total traveling costs between the location of his stock of value and the locations of the localities within which he recreates and augments his

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[1] This is not such a strong restriction on human activities as it may seem since any human activity will produce value of one kind or another.

portfolio of value are at a minimum.[1] This follows easily from the postulate of optimization. But the decision is circumscribed in several interesting ways connected to the interactions of space and motivational entities.

The most important distinction in regard to this may be a division of motivational entities into movable and immovable. The distinction is of course closely related to the concept of "sunk costs". Movable value is located in motivational entities in such a way that the actor at least in principle may pick it up and move it to a location of his choice. For immovable value this is in principle impossible..

Table 3.1 outlines the distinction between movable and immovable value in goods and experiences by labeling the four types of motivational entities one gets.

TABLE 3.1 SPATIALLY RELEVANT TYPES OF VALUE IN MOTIVATIONAL ENTITIES

	GOODS	EXPERIENCES
IMMOVABLE	VALUE IN LAND	VALUE IN SOCIAL NETWORKS (COMMUNITY VALUE)
MOVABLE	VALUE IN COMMODITIES	VALUE IN INFORMATION

1 Empirical evidence supporting this is reported by Stephan and Tedrow 1977,

Immovable goods are called "land[11] and movable goods called "commodities". Commodities represents no problems for the location of an actor. Land does.

Since land is the most conspicious and probably also the most important of scarce goods, there is bound to be heavy competition for land. It must, however, be inferred that the competition is not for land as such, bat for the value located in it. This brings to focus the problem of which processes determine the value of land. This shall be returned to in a later paragraph. Here it need only be pointed out that the competition for land forces two constraints on the actors' choice of location. First the actors have to select among locations available for bargaining, second they have to select ammong locations with price within their budget constraint (roughly the stock. of alienable value and its rate of increase).

The inalienability property of experiences implies that their value always will move along with the actor, It is movable. However, the production of community value will vest value with the network used in the processing of common experiences. One might call this value "almost" immovable in order to be reminded that under special circumstances the whole network may relocate. But it will simply be called immovable. For a single actor considering relocation it is. If he decides to move, he will not

only lose access to the means by which he used to produce community value, but he will also lose access to the common stock of value vested in the network. Value located in land may at least partly be converted to commodities and brought along. The loss of immovable value upon relocation has to be weighed against the improvements in production possibilities for other kinds of value. If the location of an actor offers no possibility for producing at least as much value in goods as the depreciation of his stock of value, the actor will in the long run be headed for starvation and death. The relocation may become a necessity whatever the losses it incurs.

Spatial aspects of social structure and social processes

Social structure was defined as a network of positions connected by bonds and divided by boundaries. In refining this conception one may think of social structure as consisting of several levels or layers; or, maybe, rather of structures within structures. If one considers the network defined by one particular kind of relation, the resulting picture of positions, bonds and boundaries will be called a sub-structure. For the present three positions, one bond and one boundary will be assumed sufficient for the description of a sub-structure.

FIGURE 3.1 MODEL OF A SUB-STRUCTURE

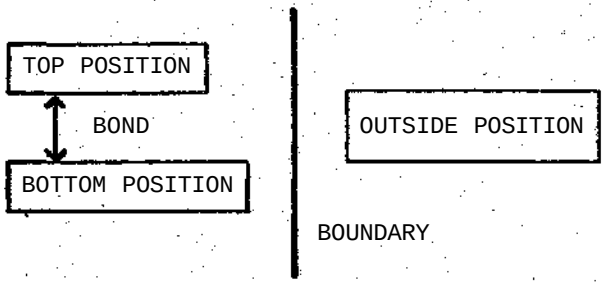

Figure 3.1 identifies the three positions as one position for outsiders not being involved in the defining relation, one top position and one bottom position connected by a bond. Sometimes, however, the top and botton positions will be merged so that only inside and outside positions are found. Whether the structure will have a top and a botton position or only only one inside position will depend on the kind of value going into the definition of the defining relation of the network.

If a sub-structure is derived for each kind of relation even these few elements would seem to create a rather coinplicated overall structure with sub-structures layered within sub-structures or cutting across positions, boundaries cutting bonds or reinforcing other boundaries.

Of most interest may be the cases where positions,bonds and/or boundaries coincide. Then different social processes may have effects reinforcing the effects of each other. The effects may, however, be both negative feedback effects and positive feedback effects (of the explosive type).

Intersecting sub-structures may further be derived separately for different types of actors. Differentiation of actors according to the composition of their portfolio of value will roughly correspond to individuals, corporate actors producing goods (corporations) and corporate actors producing experiences (associations). For corporations the division of their stock of value into movable and immovable is of importance. Often one will find the bulk of their value in immovable or "almost" immovable entities (natural resources and networks of skilled manpower). For all practical purposes such actors may be considered immovable (mining corporations may be good examples).

If spatial proximity is defined as a relation[1] between any two social actors, one may derive a sub-structure which for the present task will be referred to as the spatial sub-structure. Projected onto the map it reveals a familiar picture of densely settled positions separated by sparsely settled boundaries. The densely settled positions may conveniently be referred to as urban areas? and the sparsely settled boundaries as rural areas.

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[1] For investigations of this type of relation see Simrnel 1903, Schutz 1932, Schutz and Luckmann 1973, Goffman 1959& 63, Psathas and Waksler 1973.

Deriving the spatial sub-structure separately for each type of actor and considering the joint spatial distribution, there will, for reasons which will become apparent later, be found a fairly clearcut spatial separation of the different types of actors. The processes determining the spatial segregation of actors are closely linked to the processes determining the value of land and will, be discussed in conjunction with them.

The spatial sub-structure has formally been defined in the same way as sub-structures based on networks of social relations were defined. Formally this is no problem, but the defining relation? "spatial proximity" is definitely not a social relation as this has been defined. The spatial sub-structure is therefore not by definition part of the social structure, That the spatial sub-structure affects the social structure is rather obvious, but whether to include it in the definition of social structure or not, may be a question of what is most useful to do. Since the differences between the spatial sub-structure and sub-structures of the social structure have some significance for the later arguments, one may do best to take the spatial sub-structure as belonging to some class oi: constraining structures. One may think of them as environmental or ecological structures constraining the development of a social system.

Social processes were defined as activities connected with the creation, regeneration, transformation or dissolving of relations between social actors. This permitted a description of the processes in terms of the production and distribution of value. The location of actors in space makes it evident that projection of the social processes onto the map will appear as flows of commodities and/or actors from one location to another. In stating this it is of course recognized that instead of actual commodities the flow may consist of money, and instead of experiences embedded in actors the flow may at least partly, consist of messages.

In fact, according to the assumption of balanced exchanges, any flow of value will create a counter flow of value.

Those cases where the flows and/or counter: flows do not completely consist of commodities are not adequately explored in terms of the types of value exchanged. In table 3.2 a first- outline of the possibilities is presented.

The types of value embedded in goods are taken together and treated as money, since the least studied and therefore* in this connection, the most interesting processes are the conversion processes where value embedded in qoods is exchanged for some kind of value embedded in experiences.

TABLE 3.2 POSSIBILITIES TOR EXCHANGE AND TRANSFORMATION OF VALUE - FLOWS AND COUNTER FLOWS

FLOW TYPE \ COUNTER FLOW TYPE	VALUE IN GOODS	VALUE IN EXPERIENCES		
	ALL TYPES	INSTRUMENTAL	SYMBOLIC	
	MONEY	INFORMATION	HONOR	COMMUNITY
MONEY	YES	YES	YES	NO
INFORMATION	YES	YES	YES	YES
HONOR	*	*	YES	*
COMMUNITY	*	*	*	YES

The production of symbolic value in experiences requires some basic experience at the outset. Hence the initiation of a relation by a flow of symbolic value in experiences is logically- impossible. This is indicated by a star in table 3.2.

The balance principle also has implications for the conversion processes. From this principle it may be inferred that each recepient of value will try to repay his debt by the same type, of value since the question of equivalence-of the amounts of value then is most easily settled.

This means that when, in an established relation, the initiating; flow consists of community valus, the counter flow will also consist of community value.

The possibility of getting a counter flow of symbolic value in return for an initial flow of value in goods, points to a need for distinguishing between honor and community value as two distinct types of symbolic value in experience.

Later in the investigation of the processes determining the value of land it will be argued that the topology of the spatial sub-structure influences the value of the land by some quantity, which will be called the strategic value of land.

In general it seems likely that in any production process (any processing of goods or experiences by actors is a production process or part of one) the topology of the sub-structure involved: in the process will affect both the type and amount of value added to the finished product of the process. One example of this may be that structural equivalence- of actors is a necessary requirement for the production of community value.

If the production, or processing of experiences involves actors in different positions, the outcome may still be the production of community value within positions at the same time as the boundary between the positions will be strengthened. If there is an initial flow of "raw" experiences from one position to another, the flow can not be balanced by a counter flow of community value as

would be the case within a position. Honor or goods may, however, be used to establish a balanced exchange. Often one will find a mixture. The admission fee for attending the performance of some entertainer is then adjusted by a positive or negative flow of honor value.

The flow of experiences through the modern mass media is of special "interest. The sending and receiving positions of the flow are both very obvious. There is almost no admission fee (capital costs for radio and TV, tickets for movies) so even the poorest performance is almost garanteed to provoke a positive flow of honor value. Through the potential size of the audience even the tiniest contribution of honor value from each may turn into a flood if enough contribute

The recepients of the flow of experiences might use them for further processing in a process giving community value. But it is worth stressing the "might" here. The initiating flow is directed at isolated individuals, and the mere size and duration of the flow makes the production of community value that much more difficult while the flow of honor value increases in proportion.

The spatial flows of value during the processes of exchange and conversion of value have a direct bearing on the distribution of actors and the determination of the value of land.

The value of land and the distribution of actors in space

The processes determining the value of land are both influenced by and have an effect on the distribution of actors in space. To see this connection, it will first be argued that by assuming there exist social processes distributing actors to areas according to positions in social structure it will be possible to deduce subsequent differentials in the value of land. Conversely it will, be argued **that** by assuming differentials in the value of land this will create a spatial distribution of actors according to position in social structure.

It will be started by investigating the processes determining the value of land under the assumption that the actors owning the land within an area belong to the same position in the social structure.

The point of departure is the distinction between instrumental value and symbolic value. The instrumental value of land, or the use value, has two sources. One source depends on the interaction of two factors. They are the intrinsic physical characteristics of the land and the possibilities existing technology (the common social capital of information value) gives the actors for extracting goods and/or experiences from the land (food, minerals, oil, housing, scenery, recreaticn, etc.). This may be called the intrinsic value of the land. The other

source depends on the piece of land's location in the spatial sub-structure relative to the location of whatever activities in the surrounding system the judging actor deems relevant to his own projects. This contribution to the value of the land will be called strategic value.

Depending on the intrinsic value and the strategic value, a piece of land will have obvious advantages for some activities. Since the land is scarce, those actors who want to pursue these kinds of activities must compete to gain possession of the land. This will produce a simultaneous separation of actors according to activities and size of their stock of value in goods.

The symbolic value of land has two sources. As goods it will obviously have some prestige value. But it may also contain amounts of community value. This amount will be lost upon converting the land to commodities and serves therefore as an obstacle to any relocation of the actor. But its effect on any plans to relocate is also dependent on the relative sizes of the use value and the prestige value compared to the community value and on the importance attached to the different types of value.

If the actors are distributed across areas according to positions in the social structure, there is a one to one correspondence between area and position in the stratification system. The area where an actor is located will in

this case furnish a unique and easily communicated sign of the actor's position In the stratification system. The land will itself gain some amount oE prestige value. Even without differentials in the instrumental value (intrinsic and strategic value'} of the land, there will have to be differentials in the total value because of the diffeeentials in prestige value.

The ability of an area to furnish concrete physical representations of social boundaries also will be of significance for the amount of community value vested in the area, if the physical characteristics and boundaries of of an area become the visible sign by which actors distinguish between members and non-ir.embers of the social network they use to process and evaluate their common, experiences, then the area as a sign will also signify access to the common capital of community value created by the social network,. Access to land within the area is thus a prerequisite for: access to the capital of community value. It is a necessary, but not a sufficient condition. The buyer does not gain access to the capital of community value, but to the means for producing community value and the promise of a future access to the common capital. The land as a necessary part of the production of community value gains in strategic value for the buyer. For the seller it may seem as at least a partial conversion of

community value to money.

The processes vesting prestige value and community value in a piece of land must in principle be the sure for all areas. Thus the conclusion must be that by assuming actors distributed according to position in social structure, the processes vesting prestige value in land will cause differentials in value corresponding to the differentials in position of the actors located in the area. The processes vesting community value in a piece of land will in principle contribute the same to all areas. But even if there are differentials they will be of small significance because of the limited convertibility of community value.

If the existence of a stratification system is taken for granted the distribution of this across across of constant intrinsic and strategic value will cause differentials in total value.

The opposite line of investigation is to see how differentials in intrinsic and strategic value will affect the distribution of actors.

Above it already has been argued that initial differentials in intrinsic and strategic value will cause a separation of actors according to activities and stock of value in goods (alienable value). But in addition to this distributional effect, the processes producing

symbolic value and vesting it in the land will also contribute to and reinforce the seperation of actors according to position in social structure.

According to the choice principles proposed, an actor will try to locate as close as possible to the social network he uses to reproduce and augment his capital of community value. Assuming a "normal" life cycle of families (i.e. the existence of children and inheritance rules favoring the children), this will within each area favors 1) Those with the largest capital of immovable value located within an area ("sunk costs"), and 2) Those with the largest stock of capital in commodities.

This means that in areas where the land has high value the actors are apt to be of two types: "old family" and "new rich". Inheritance of capital both in land and in social networks enables actors of "old family" to locate optimally in relation to the production of community value High value of the land in the area also indicates that the overall strategic value of the land is high. Locaction within this area is then close to optimal for a wide range of activities. The area is also apt to have high instrumental value for the production of community value (which is the main activity within a residential acre) either because of intrinsic physical characteristics or because of investments in landscaping (usually both).

At the outset it was the actors with the largest capital in goods who settled the most valuable land. Later, as land within such areas became available it was still the most wealthy - the "new rich" - among those considering relocation who won out in the competition for the land. In this way the prestige value of an area is both preserved and reinforced in a way that makes it likely it will remain high relative to other areas. However, if the total wealth of a society increases rapidly so that many "new rich" are produced? the relative ranking of an existing high value area may be threatened from two lines of development. If the availability of land within established high prestiga areas is small, the ranking of the area may be threatened from a now area where the "new rich" through investments; in Landscaping and communication lines increase both the strategic value and the prestige value of the land where they have located. If, on the other hand, land is available within established areas, the production of community value within the established area may be threatened by a too high rate of entry of "new rich". Preservation of the prestige value of an area may thus inhibit the sustained high production of community value within the area.

At the top of the stratification system coincidence among social boundaries is more likely than

in the middle of the stratification system. This makes for more common interests, and is thus conducive to the production of community value. In the lowest part of the stratification system one also finds overlapping social boundaries with consequent possibilities for the production of community value. But the low instrumental value and the negative prestige value will more than offset the effect the possibly higher production of community value might have on the strategic value of land in the areas where actors from the lower positions in the stratification system are living. The value of land in such areas will remain lower than elsewhere.

The majority of actors who are neither at the top nor at the bottom of the stratification system, have, even if barred from the most valuable land, fairly much to choose from.

Their main guideline for choosing location would seem to be the minimization of the traveling costs between the location where they pursue the activities required to reproduce and augment their stock of value in goods and the location of the social network which they belong to. This means that the location of, for example, corporate actors and kinship networks will have a decisive influence on the location of individuals. Depending on the rate of change in activities and the number of relocations of activities

(and whole corporate actors) there will be corresponding difficulties for the production of community value among individuals who are forced to relocate by changes in the location of corporate actors. For those forced to move the accumulated capital of community vaiue is lost along with the access to the means producing it (the social network). But also those remaining lose since a part of their network disappears.

So far the argument has been concerned with actors and positions at the same level in the social structure.

Across levels the activities of one type of actor may influence the value of the land of other actors through changes in the strategic value of the land. This is most obvious where public investments in communication facilities affect the traveling costs and/or the instrumental value of the land. Effects of this kind are not evenly distributed over the land and they may often change the differentials in the value of land enough to redirect the flows of actors and thereby also the processes maintaining the symbolic value of the land.

But, on the other hand, it is also the actors living in areas with land of high value (i.e. the most wealthy and powerful actors) who are in the best position both to invite favorable developments and to avoid unfavorable encroachments on their land.

Thus it may be concluded that the processes producing value and vesting it In land and the processes distributing actors to particular locations are but two manifestations of the basic processes creating and maintaining the social structure of a social system. This may be a useful point of departure for an effort to derive a quantitative description of social structure from regional data.

CHAPTER 4

DIMENSIONS OF SOCIAL STRUCTURE

Chapters 2 and 3 have presented an outline of the logical implications of some more or less plausible a priori assumptions. As the model is presented it will permit empirical deductions only at the most general level. This chapter will develop the concepts further to aid a theoretical interpretation and a quantitative description of the Norwegian social structure in 1970.

The actual description possible will of course be cit- sumscribed by the data available. It seems likely that the theoretical framework .will point to ma jo. deficiencies in the data. Rather than accepting this as *an* unfortunate, and unalterable state of affairs, efforts •will faa **made** to use the theory to bridge the gap between patches of data. The available data may thus be n<?eo ,is con- straints on the development of the theory, wnere data are available, assumptions and concepts have :o he altered or added so that there is consistency between model'and data. Where data are not available, the theory will point; to possible connections between available *a no* unavailable data. **Thus** it may be possible to -jnder stand a bit more of what shapes the development of -i society.

As a first step in this direction a discussion of the available data will be necessary.

The data

The data available to this study are of the type traditionally used by students of factorial ecology (see for example Anderson and Bean 1961, Sweetser 1965b, Dogan and Rokkan 1969, or Berry and Kasarda 1977). Data were collected for as small anas aa possible consistent with the wish **for** as complete coverage as possible. This means that the information gathered refers to communes (municipalities). The core of the: data derives from the "Population and Housing Census 197C" (Velum 1-V, Central Bureau of Statistics, Oslo 1974-"3 5). The Central Bureau, of Statistics also supplied a tape: prepared for the Norwegian '"Level of Living Study" where income data from the taxation files were added to census data.

The commune tables published from the census aie available in machine readable farm ifrom the Norwegian Social Science Data Service (KSD) along with a variety of other data collected at; the level, oi' the commune. The census data for 1970 were accordingly supplemented with other data (such as the Agricultural Censur. of 1967) available through the Commune Data Bank of the NSD.

Thus *a* file containing seme !'800 items of information

for each of the 451 communes of Norway as of 1970 was collected. In addition to these data the Central Bureau of Statistics also made available detailed tables of the population and the vital events in the population for each of the years 1968 to 1971. The population tables give the distribution of the population of each commune according to age in one year intervals, sex and marital status for the first and last day of each year.

If it is possible to derive a picture of the social structure from such data, the first question to be answered is: How do these data relate to the general picture of a social system presented earlier?

As a point of departure one may divide the data into three types:

1) One type of data describes proprties of the commune considered as an actor within a larger social system,
2) a second type of data describe a distribution of actors (individuals, corporations, associations) located within the commune according to some characteristic differentiating the actors, and
3) a third type of data describe some of the aggregate flows of value in goods and the flow of actors (individuals) across the boundary of the commune.

A total of 113 relative variables v/ere defined (precise definitions are given in table Al of Appendix A) ,

most of them ol: the second type . As will be apparent from a consideration of the definitions* variables of the second type may be Interpreted in terms of sub-structures-oa these have been defined earlier.

Process, structure and regional variation

Since social structure*. has been defined so that it Is both the point ol: departure and the final product p£ the social processes? there is a certain asymmetry in the concepts with important implications for the kind of data necessary in order to study specific problems, and the kind of problems specific data may be used to study.

Thus a study of social change will need observations both of the social structure at the starting point of.the study and at the end of the time period of interest as well as the processes transforming the structure. *h* study of the social processes will also need observations from at least two points in ti-p.e.

With observations only from 1970 this study is from the outset restricted to social structure.

While the study of.' process data alone would be rather pointless considering the circumscription of any process by the structure within which it operates, the study of data on the structure a3c;p.e, may give results of three kinds:

1) It can be" used to determine what the structure actually looks like before one goes on to study the processes transforming itj

2) the description of the structure can be used to make
• ' inferences about the processes In terms of necessary
• conditions foe 'the reproduction of the structure? and, finally,

• 3) it may be,possible to determine the constraints, this particular structure will represent on any specific type of process.

If it then in addition may be assumed, as Appendix B suggests reasonable, that a structure is relatively stable in.the short rum (say 10 years), the description of the social structure arrived at here may be used to determine how'a social .structure circumscribes a process like- the fertility decisions, of a family. In chapter 6 this will be attempted.

A complete description of the social structure as previously defined, would require a complete enumeration of both actors and relations between actors. While the first task is the objective of the censuses, the second task has .scarcely been considered. Just a few of the relations are recorded at any time. To record all .relations is clearly rot possibleoBut why would it be desirable or necessary to record many relations?

It would seem to be a reasonable a3i=..r-:t ion thai: thec^ are just a small number of theoretically i ^in iJ ;^,r:i: relations among the actors (like the Marxist no-lien-: c:f tha relations of production as the: one aaa ˜5or;;i3;it: *i* ul a1*-ion among actors).

A reasonable definition of "'theoretically sigr.:.Xiicrn; "" relation would be that a large class of rirt voriu- :del::? n.J. by non-significant relations in some s-^ase would h; similar to the network defined by one oi the ricn;, fix-ant relations. Thus a comparison opstatio: ,aèterir.ining; similarity) will divide the universe o^ ^!.i poasiblo act* works into a few equivalence classes vhere one ˜t:a-ore:i-- cally significant", or "'major", oq al dc ;;nj;:r srel^-;ici will define the prototype oJ: the Retwr^i or ˜::cs c.:.a&3„ and hence also the sub-structure,

If the assumption of a. few inajoi: *x-e'l.:.zi*-ns ia ten.it Le, it follows that a sample of the relations ; ≒*j* »tiouç-h to determine the social structure in. t.oir.^ e-: thr major sub-- structures. In the chapters *2* a^-i ˜:.> *It* 'n,a argued that the mapping of actors :r:rto "oundec positions implied the establishment *si* a stratification system where one position ˜-onto ins t'it- more "resourceful" actors and tiie other- position *t.:^e* ,le?3 "resourceful" actors.

By assuming a small number of different sub-structures

it becomes feasible to think of the social structure in terms of a small number of dimensions. Each class of sub-structures will then be represented by one dimension. For the different sub-structures representing hierarchies one may think of the dimension as a continuum measuring the distances between the two positions. For sub-structures connected by boundaries, one may think of the dimension as a continuum measuring the strength of the boundary.

Each dimension may thus be thought of as a generalized description of one equivalence class of sub-structjres with the dimension measuring the strength of either bonds or boundaries (for the term equivalence class: See Fararo 1973).

The exact number of dimensions and the exact nature of the dimensions must be considered empirical questions at any point in time. The model of the social structure must allow the number of dimensions to vary through processes differentiating out new dimensions and collapsing others. But even so , it ought, from the model presented, to be possible to determine a minimum number of dimensions and their nature.

The sub-structures are defined in terms of the production and distribution of different kinds of value. The different dynamic consequences of the production and

distribution of value in goods compared to the production and distribution of value in experiences, suggest that distinct sub-structures ought to arise. One may call the dimensions based on the production and distribution of goods **the** socio-economic dimensions. And the dimensions **based** on the production and distribution of value in experiences **the** family/community dimensions.

The previous chapter introduced beside the social structure a class of sub-structures working as some kind of external constraint, on the development of a social system. The example discussed was labeled the spatial sub-structure. The spatial sub-structure affects the production and distribution of both value in goods and value in experiences. Whether a spatial dimension will be separable from the socio-economic and family/community dimensions is an open question. But in order to distinguish the effects such constraining sub-structures have on the social structure from the effects of the internal processes of the social system one must take care to include them in the analysis.

The model as it is presented thus points to at least three dimensions. In general, if there are more dimensions, they will be expected to be of three types:

1) Socio-economic dimensions,
2) Family/community dimensions, and
3) System-ecological dimensions.

t« Socio-economic dimensions

The general argument as to the simultaneous separation of actors according to location in space otid position in a stratification system may be applied to any properly defined areal division. Hence it is to bo expected that it will be possible to arrange the communes into <i hierarchy along- a socio-economic dimension according to th:> characteristics of the actors located in '.tie commune.

At the same time, and from the same argunencs, it is obvious that the actors themselves are distributed in a hierarchy within their commune of residence.

This suggests a possible alternative to the straightforward interpretation of a statement that a commune is high on a socio-economic dimension.

The straightforward interpretation is that actors within the commune on the average will be high in socio-economic status in a national stratification system.

However, a national stratification system has its Local manifestations. In general it must be expected that a local stratification system can be described by *a* simple transformation of the national system.

Particularly, if one is operating with a two state stratification system,any transformation preserving this property nay reasonably be assumed linear as a first approximation.

A socio-economic dimension of social structure is then a generalized description of a class of two state stratified sob-structures.A high score on the dimension means on average a great distance between positions in the sub-structures of the class the dimension describes.Assuming a linear correspondence between global and local stratification systems,it seems possible to interpret a commune's score on the dimension as a characteristic of the internal stratification of the commune.A test of such an interpretation would be to compare dimensional score of homogeneous communes with the scores of heterogeneous communes. If it is correct,homogeneous communes of both high and low status ought to have low scores compared to heterogeneous eoanranes.Xf the dimensional score describes the average status of the commune within a national stratification system,heterogeneous communes ought to have scores between the scores of homogeneous communes of high and homogeneous cotsmmes of low status.The question will be returned to

briefly at the end of chapter 5.

2. Family/community dimensions

Data appropriate for making inferences about sub-structures originating from the production and distribution of value in experiences, are not among those available to this study. The possibility for detecting such dimensions thus rests on the assumption that any particular family/community sub-structure will be isomorphic to some of the sub-structures reflected in the data available. Assumptions about the interrelations (intercorrelations) of socio-economic dimensions and family/community dimensions might also facilitate the identification.

For each family/community dimension an isomorphic sub-structure from which derived data exist must be identified.

A family/community dimension is supposed to measure the strength of boundaries around positions. For the communes it then seems reasonable to interprete the measure as the average strength of the boundaries of all positions within which value in experiences is produced and distributed, and to expect differentiation between sub-structures based on community value and sub-structures based on information value. The most common sttings for the production

and distribution of community value are the family and the neighborhood *

The population of a commune may be described according to family and neighborhood characteristics among which ethnic origin obviously is one. Assuming a constant rate of production of community value across all communes for each type of family-neighborhood combination, variations among communes in the prevalence of one or another family-neighborhood type will follow the variation in the average strength of the boundaries around the positions maintained by the production and distribution of community value in families and neighborhoods.

Similar arguments hold for the production and distribution of information value. Obvious settings to look for would be educational and research institutions. Data of the required type here is* however,- scarce.

3. System-ecological dimensions: the spatial dimension

In order to control for the effects of the spatial sub-structure on the social structure some direct indicator of it has to be included in the analysis. From the definition of the spatial sub-structure it would seem that the best indicator of the regional distribution of its positions (the urban areas) and the strength of the boundaries separating them (the rural areas) simply is a measure of

the population density of the different regions. This also makes it convenient to refer to the spatial dimension as the urban dimension. Since the boundaries of the spatial sub-structure imply a transaction cost for all social relations one may also use sub-structures of the social structure as indicators of the spatial sub-structure if they are particularly easily affected by this cost. Trade relations may define one such sub-structure. Since the spatial dimension as it is reflected in the spatial distribution of actors is a constraint on the system it affects both socio-economic and family/community dimensions and must be expected to show intercorrelations with both kinds of dimensions.

Interrelations of dimensions

So far the dimensions have emerged as a generalized description of the social structure in terms of distance between positions and strength of boundaries around positions. The investigation of the number and nature of these dimensions also needs some idea of how they are interrelated. As a point of departure observe that a sufficient condition to produce uncorrelated dimensions as these have been defined above is a complete partitioning[1] and/or specialization[1] of the activities of the actors of a social

[1] Partitioning/specialization of activities is a generali-

system intents of value produced. This partitioning/specialization may appear both as actors specializing on only one type of value and as a partitioning between networks used to produce and/or distribute the different kinds of value.[1] In this case the degree to which different dimensions of a social structure will correlate becomes an empirical question.[3]

However, considering the inherent dynamic in the production and distribution of the two types of value (in goods or in experiences), one must expect that correlations other than 0 and 1 between a socio-economic dimensions and a family/community dimension would be possible only for comparatively short transitional periods.

zation of the notion of "division of labor" central to the discussion of social structure by Blau, Coser and Lenski in Blau (ed.» 1975). It also has a prominent place in the discussions of the increasing scale of social, organization (see Hunter 1974 and Barth (ed.) 1978).

[1] The question of whether the partitioning/specialization of activities also is a necessary condition for the emergence of distinct dimensions is theoretically interesting, but since I do not feel able to suggest an answer, and since, because of the universal prevalence of partitioning/specialization of activities, the answer is not needed for the further argument, it will be left unresoved here.

[3] Anthropological studies point to the same conclusion: see, for example, Godelier (1966). This means that the uncorrelated dimensions usually found in social ecological studies of American and Scandinavian societies are culture specific findings in the sense that the specific social structures and the corresponding development of the choice functions interact in a way that produce sharply separated arenas for the production and distribution of different kinds of value. See Abu-Lughod (1969) and Berry & Kasarda (19/7), especially page 131-133.

The case of coincidence between a socio-economic dimension and a family community dimension is intererting* It would mean that the sub-structures based on the production and distribution of community value were equal (in the theoretically interesting aspects) to the sub-structures based on the production and distribution of value in goods. If this situation is stable, the question of which relations are dominant ,those based on community value or those based on value in goods, boils down to a consideration of whether flows of goods may be caused by bonds of loyalty or bonds of loyalty caused by flows *of.* goods. If the stipulations made about the basic differences between the processes producing and distributing value in goods and value in experiences hold, then any situation whero the socio-economic relations become dominant,must be unstable. Any few accidents would suffice to destroy the structural equivalence of the actors, breaking them up into a stratification system and creating a foundation for separating the production of community value-from the production of value in goods.

It is thus most likely that the dimensions either are uncorrelated, or in some cases collapsed with family/ community dimensions dominating socio-economic dimensions.

The degree of partitioning/specialization of activities of the actors within a social system also has another

interesting implication for the study of the structure of the system. The higher the degree of partitioning/specialization, the greater the number of different sub-structures will be. This means that with higher degree of partitioning/specialization an increasing number of dimensions will be needed to complete the picture of a social structure.

The relation between the urban dimension and the two other types of dimension is of particular interest since all three possible combinations have been reported (as a separate factor, Sweetser 19711 fused with a socio-economic factor, Sweetser 1970, and fused with a familism factor, Sweetser 1978). One fundamental implication of increasing density of population is the economies of scale associated with it both for production and distribution of most kinds of value. But it also seems reasonable to assume the existence of thresholds for the various types of value above which increasing densities may cause diseconomies ("economies and diseconomies of scale"s see Mills 1972 chapter 1),

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[1] The causes of a higher degree of partitioning/specialization may be related to the processes shaping the choice functions of actors in relation to structural transformations and what one might call cultural drifts or shifts. However, for the present task it will suffice to take the degree of partitioning/specialization (i.e. number of dimensions)as an empirically determined parameter characterizing our social structure at one point in time.

Increasing urbanization (population density) thus may **favor** the generation of both socio-economic sub-structures and family/community sub-structuxes. The general expectation would seem to be that urbanization. v;ould have a **slight** correlation with both of thGiiuF[«wever,at least two **factors** will confound this expectation.,One is the degree of partitioning/specialization of the society studied. **The** other is the relative irnportan.ee of the production of **value** in goods tied to particular location defined outside **the** social system (like mining, farming etc.),

If a large proportion of the production of value in goods is tied to particular locations, th» economies of increasing urbanization obviously have proportionately less influence, and the association between urbanization and a family/community dimension would seem proportionately stronger.

With increasing degree of partitioning/specialization one gets at least a spatial partitioning of socio-economic sub-structures, maybe also a specialization, as well as an increasing size of the largest agglomeration of actors. Considering the possibilities of diseconomies of size, it seems reasonable to expect that the ledger the largest agglomeration, the less likely a close association between a socio-economic dimension and a f.rban dimension will be.

Thus a general socio-economic dimension jnc the urban

dimension may fuse in Norway while they separate In Massachusetts (Sweetser 1970),

While there are economies of increasing density for the production and distribution of community value, it seems likely that the threshold *a.t* which diseconomies may be observed, will be markedly Lower than tor value in goods* This may be attributed to the requirement of structural equivalence of the actors partaking in the process.

The concentration of actors In space will as a part of the process increasing their efficiency in various production and distribution processes specialize and partition the activities of the actors. This increases the number of positions, which means a. decrease In the average number of actors in each post ion and a sore than proportionate reduction in the probability of two or more structurally equivalent actors mee-iiruj to assess the meaning and significance of their coir/aon experiences. In a rural/urban dichotomy the production of cc^T.unity value thus may-be favored by rural areas(even it a slight urbanization also there may strengthen the co:raunity) . This means that if a family/community dimension and the urban/dimcns/on fuse one ought to expect a bipolar factor.

While there were reasons to believe that socio-economic and family/community factors would be uncorrelated under present forms of partitioning/specialisation of activities.

there does not seem to he reason to expect the same for the urban dimension.. On the c!ontiarj, it seems fair to say that the cot relations between the urban dimension and the other dimensions w.i.:u. *Izo* i,repentant parameters characterizing a social system,.[1]

Dimensions, of social structure and existing data

So far three types of dimensions 'nave been described. Of the family/community and socio--economic dimensions there may be several of each.

In order to investigate these dimensions empirically the way these theoretics:-; constructs will appear in data must be considered in mo::e detail.

As a point of departure ircaqi.ne a projection onto the map of the positions; of 1:he major sub-structures as if these had been ofcserved. it would then be possible to count? within each commute, the number of actors belonging to each position. This would constitute an immediate and precise description, of cbe social structure of each commune. Aggregation oi the nuirbers would produce the structure for the whole society and would constitute the norm against which to judge each community. But the picture of

[1] Thus the procedure used by Janson (1971, 1972) *OZ* retaining "size" as an oblique factor among otherwise orthogonal factors would sseem to have the best theoretical foundation. This is also recommended by Sweetser (1974).

the social structure thus derived would not be sufficient to judge about distances between positions or strength of boundaries. For socio-economic sub-structures one would in addition need information on the distribution of resources among the positions. For the family/community sub-structures one would want information on the total volume of community value produced. While data of the former type exist, data on the latter aspects of the social structure must be considered almost unexplored phenomena. Frequency, intensity and duration of contacts within the community value production networks are some important clues (compare the discussion in Simon 1957, chapter 6). The relative amount of time allocated to this kind of production compared to time allocated to the production of goods is another possibility. With a proper-specification of the various types of networks, a tenable approximation might be to assume, as suggested above, a constant rate of production of community value for each actor in each type of network. Then the strength of the boundary for each type of network would be proportional to the number of actors in the network, at least up to some upper limit where diseconomies may appear.

However, the major sub-structures of the social structure are not directly observable,, At least not until more empirical work has 1) established the number of such

major sub-structuresj 2) identified indicator relations for each sub-structurej and 3) taken a census of the actors with these relations included.

What is needed is some way to draw inferences from s small and random sample of observations to the unobserved dimensions or sub-structures generating the observations.,

The data available consist of numbers of actors with one or another characteristic. In most cases one may interprete the information in terms of relations. This is in a sense a projection onto the map of a sample of the primary sub-structures, but without information necessary to reconstruct the networks and no information on the morphological differences among the networks. Is it possible from this information to draw any inferences about the degree of isomorphism among the sub-structures behind the observations?

If two sub-structures are isomorphic (that is: belong to the same equivalence class in terms of defining a major sub-structure or dimension of the social structure), it would seem reasonable to assume that the proportions of actors within an area belonging to the various positions of the two sub-structures, will correlate highly across areas.

If this assumption holds a technique like factor analysis may be used to disentangle the observed intercorrelations

and rearrange them so that the "hidden" dimensions of the social structure will appear.

This is precisely the way ecological factor analysis has been employed during the last couple of decades? To sort out intercorrelated variables in order to discover some kind of "hidden" or "basic" dimensions which would account for the differences among units on several variables.

Factorial ecology[1]

Factorial ecology grew out of social area analysis (Shevky & Williams 1949, Bell 1953, and Shevky & Bell 1955). Social area analysis was founded on a somewhat loose notion of increasing scale* Increasing scale was taken to mean increasing degree of division of labor and specialization of institutions, and assumed to be reflected in increasing specialization of urban land use and population differentiation. Combining the theoretical notions with "happy hunches" Shevky, Bell, and Williams were able to hypothesize three indices as fundamental i;o the differentiation of urban arecs (usually census tracts;, These indices they labeled: Social rank, later usually called socio-economic status? urbanization, now usually

[1] The term was coined by Frank L. Sweetser in his 195 is paper.

reflected and called familism or family status; end segregation or ethnic status.

The Social Area Analysis as presented by Shevky *and* 3e»ll (1955) met both interest* scepticism and well-founded: criticism, the latter most clearly expressed by Hawley and Duncan (1957). Hawley and Duncan do not find any connection between the theoretical speculations of Shevky and Bell and their proposed indices, and the empirical ovidence of their validity seemed rather questionable.

The application of factor analysis to the problem of identifying dimensions of differentiation, seems to have been forced by the need to at least establish the empirical validity of the earlier hypothesized indices (Bell 1955, Van Arsdol, Camilleri, and Schmid 1958).

During the next decade repeated replications- and extended investigations seemed to establish beyond doubt some kind of empirical validity of the first proposed indices (S9S bibliographies in Abu-Lughod 1969 and Berry and Kasarda S977)u

However, reports of important deviations from the expected pattern accumulated (lack of ethnic status factor: Sweetser 1965ai lack of family status factor: Abu-Lughod 1969), and the theoretical link between the often methodically sophisticated factorial ecology and the rest oi: sociological theory was at best as shaky as the debahe between Shevky/Bell and Hawley/Duncan had left it.

It was due time for attempts at a theoretical refoundation. Berry and Rees {1969} try to construct a behavioural basis. The three basic factors: Socio-economic status, family status, and ethnic status will arise depending on how three questions on residential location are answered:

Where can I afford to live?, What kind of life-style do I want?, and In what racial or ethnic area do I want to, or am I allowed to, live?

The independence of the three dimensions will depend on the degree to which the answer of any one of the three questions is dependent on the answer to the other two. While this ties neatly into the discussion in chapter 3 above, it stops short of answering the next question: How does one explain the other factors appearing in the studies of factorial ecology?

Abu-Lughod (1969) starts out from another direction. Noting that especially studies of cities in other cultures show two or more of the hypothesized major dimensions collapsing, she tries to outline the conditions;under which factors 1} will be detectable, and 2) will be separable in the analysis . Her conclusions, aptly summarized by Berry and Kasarda (1977, table 7.2) , are based ona notion of increasing scale (taken to mean specialization and partitioning of activities of the actors of the system), where

the stage of development of the society determines the pattern of intercorrelations among the variables used to identify the factors.

Also Hunter (1974) uses a notion of increasing scale as a theoretical foundation for investigating "differentiation and fusion" in the social structures of local communities.

While Abu-Lughod admits that the theory of increasing scale not yet is specific enough to be of much assistance in empirical investigations, Hunter is only comfortably vague: "The implications of an "increase in scale" for local community social structure are usually expressed in two ways: In shifting forms of social interaction and in changing patterns of institutional structure and functional utilization." {Hunter, 1974, pp.15).

The crucial link between shifting forms of social interaction (taken to mean differentiation of activities) and the pattern of intercorrelation among the ecological variables is not specified.

However, both Hunter (1974) and Berry and Kasarda (1977) are notable for the emphasis on linking factorial ecology to classical social (or human) ecology. Hunter is relying more on the pioneering works of I.W. Thomas, Robert £., Park and Ernst Burgess, Berry and Kasrada more on the reconstruction by Amos H. Hawley (1950).

Classical social ecology derived its core concepts from analogies to the study of plant and animal ecological systems. Briefly described the central ideas may be summarized by the sequence of concepts (see Park and Burgess 1925): concentration - competition - dominance - centralization - expansion - decentralization - invasion - succession - segregation. The sequence implicitly defines a dynamic theory of a social system as well as some core processes of the development (competition, expansion, invasion/succession). The central theoretical task was to understand the processes involved in adapting a population to its (physical) environment. This implied a comparative neglect of cultural processes and the interplay between cultural processes and those investigated. As a consequence competition came to dominate the theoretical work as an explanatory force to the exclusion of cooperation. This left wide margins for both theoretical and empirical critiques (see for example Alihan 1938, Gettys 1940, and Firey 1945). By 1950 the theoretical force of this approach to the study of social systems seemed spent.However,in that year Hawley (1950) published a theoretical reconstruction of the ecological study of social systems titeled "Human Ecology". Hawley shifts the emphasis from competition to interdependence. At the core of his argument is the distinction between what he

calls symbiotic dependance and comrnensalistic competition. Symbiosis and commensalism are here used to characterize structures. Symbiosis means a stratified exchange system, commensalism means structural equivalence of the actors in an exchange system. It is also obvious that it is exclusively the production and distribution of goods which areof interest. Thus the explanation of integration by commensalism (or "consensus" or "mechanical solidarity") does not go further than the assertion that such integration exists (Hawley 195Q, pp.209).

Like his predecessors Hawley's theoretical scheme is exclusively macro-oriented. Concepts of actors and motivational systems are lacking or only implicitly used in so far as they must be assumed by statements of functional requirements for the survival of the population..

The introduction of a model of the actors of the system (both individual actors and organizations) alone with an attention to the production and distribution of symbolical and cultural "entities", would seem to be the key points where links between social ecological theory one, the rest of sociological theory might be. forged.

In fact, the attention to socio-cultural processes was always a prominent side current of the main stream ecological studies (Zorbaugh (1929), Wirth (1928), Firey. (1947)). But attempts at more thorough integration *of.*

the perspectives seems to appear first with the works of Suttles (1968, 1972) and Hunter (1974).

The need for theoretical links between ecological theory and traditional sociological theories is also apparent in Berry and Kasarda (1977). Reviewing the classical contributions of Tönnies, Durkheim and Simmel as well as the work of Park, Burgess, Thomas and Wirth they arrive at an operational focus on social networks in order to "identify the social organization of communities in systemic terms" (page 56). It is worth noting their conclusion that the main determinant of community attachment is length of residence, and their speculations on simultaneous processes building up and eroding away community attachment (page 70-71). A theory explaining the "nature of local community life, in an urban society" roust "at its minimum,.... comprehend the tension between increasing scale and mobility in a truly national society, on the one hand, and increasing insistence upon a mosiac of small and coherent communities with predictable life styles within a context of intensifying cultural pluralism, on the other". (page 72).

Berry and Kasarda do not succeed in providing such a theory, but present important clues. They are on the verge of providing an actor model explaining what people are after and how they go about getting it (page 81), but

turn to more traditional social ecological studies.

Thus, a comprehensive theory linking actor to system and explaining the contradictory processes tearing down, building, rebuilding and transforming the social structures does not seem to exist. Still, bits and pieces of such a theory are scattered around,and one way to read the present study, i3 as an effort to collect and fit together necessary bits and to see how far from the goal sociology is today.

It has long been assumed that factor analysis of ecological variables reveals fundamental dimensions of social structure. But a satisfactory interpretation of what the factors means theoretically does not seem to be available.One result so far may be the outline of a possible link between sociological theory and factorial ecology.With the tentative answers present, the next task is to apply them to the data presented by the variables defined in table Al of Appendix A.

CHAPTER 5

THE SOCIAL ECOLOGY OF NORWAY 1970.

The reasoning in chapter 4 outlined one possible explanation of how factor analysis of ecological variables can provide a description of the social structure/ and it suggested how the results might be interpreted. The present chapter will report on a factor analysis of data on Norwegian communes in 1970. The data available to the study were presented in chapter 4 along with. definitions of 113 relative variables(see table Al in Appendix A).characterizing different aspects of the spatial distribution of the social structure in Norway as it is observable for the 451 communes in 1970.

The variables.

Appendix C presents a replication with 1970 delta of Sweetser's 1960 analysis(Sweetser 1970).The 113 variables used in the present study are an expansion of the variable list given in Appendix C(table C2). The expansion was undertaken with an eye to the problem of covering relations possibly defining other dimensions than those already included in the data.

The variables were arranged into 12 sub-sections as follows:

1	Land and population	11 variables,
2	Age and sex	13 variables,
3	Culture groups	2 variables,
4	Family and household	19 variables,
5	Housing	11 variables,
6	Migration and mobility	5 variables,
1	Employment and occupation	10 variables,
8	Industry	16 variables,
9	Politics and taxes	9 variables,
10	Education and income	8 variables,
11	Cars and people	4 variables, and
12	Health and crime	S variables.

This all but exhausted the possibilities of the raw data. The problem of the quality of the data is adresses in Appendix C e page 283-285 , and will not be discussed here.

The units of analysis.

The units of the analysis have been called communes. In fact, three of the communes had a population of less than 500 and was added to neighboring communes so that the 113 variables were computed for 448 analytical units. Details

on which communes were combined are found in Appendix C, page 267-68.

The 448 analytical units were distributed according to size as follows;

Population size	Number of communes
500- 999	16
1000- 4999	235
5Q00- 9999	113
10000-49999	78
50000-	6
SUM	448

While these units may be used in a study of the social structure, they will not suffice for the study of regional variations in fertility which is the aim of the next chapter, Good estimates of the fertility level of a region require a larger population than most communes have (see Appendix B, page 211-12). For this reason the 451 communes (or equivalently the 448 analytical units) were grouped together into 102 analytical units called fertility regions, How this was done is described in Appendix B. The main considerations were 1) to have a population of at least 20,000 and if possible not more than 40,000, and 2) to approximate as closely as possible a contiguous area of homogeneous culture and economic structure.As an

indicator of culture,dialect was used. As indicator of economic structure,the basic code of commune t.ype from the Central Bureau of Statistics was used.The stuciy will thus proceed with two sets of analytical units. The "443-set" will be referred to as communes end the MOZ-ssst[11] will ae be called fertility regions.

The factor analytic technique.

The mathematical and statistical foundations? of the factor analytic technique are not an issue hare. Necessary background on this may be found in Barman (1967) ,Rummel (1970),and Lawley and Maxwell (1971)„ Various implementations of different factor analytic techniques were available at the University of Oslo's DEC-10 compute]: .For tha analysis reported here the procedures contained in SPSS Release 7.02A were used (see Nie et al. .1975)/cf the various possibilities contained *in* SPSS the principal factors method with varimax rotation to simple structure was chosen.For practical guidance during ihe analysis Sweetser (1974) was relied on.

^Wilkinson and Dallal(1977) report that SPSS,among sevecal Other widely used program packages, was, in earlier ... eloarsos prone to produce,under certain condi tienn, errorr in the correlation coefficients.In release *7,Q2h* th-i-: problem seemed to be solved.

Transfor.ma;t.i*bns::of vaciafales.

In order to approximate the requirement of linear•relationships and to reduce the possibility of restrictions on the-range of the correlation coefficients, transformations of Skewed variables were used (see Hummel* 1970 chapter 1iy. Inspecting distributional parameters like mean, range, standard error, skewness, and kurtosla transformations of square toot and logarithm were applied until skewness and kurtosis showed a reasonable approximation to the values of a normal distribution (zero). Two variables .showed kurtosis in excess of 10 and skewness in excess of 2.5.. Of these two, variables no, 5 and no, 109, only. no.-. 5 seemed problematic with a skewness of 3.3 and a kurtosis of 29-.5« Variable no, 5, the rate of population change from I960 to 1970, was also the most heavily transformed of all with a logarithm of a square root. It was decided to drop this variable from the analysis. Besides the compound: transformation of variable no, 5, 12 variables were transformed by square root and 13 by logarithm (to base 10). Which variables were transformed is • noted in the table defining the variables, table A] of Appendix 2.

Selecting variables for factorization.

With 112 variables to select from and a limit of 100 in

the computer program not all could be put Into the analysis immediately. Neither is it likely that sufficient care was shown in defining the variables for them all to be useable. Already the inspection of the univariate distributions revealed 3 variables with missing data on 102 units. Apparently 102 communes were without densely settled areas. Hence variables "!8$_8$ 20, and 22, all concerning sex ratios, in densely settled areas,, had to be dropped from the analysis.

The next step was to inspect the correlation roatrix for excessivly high correlation;:;:. High Intercotrelations of variables not only mean duplication of information, but in a more technical sense may imply linear dependence in the correlation matrix, This means that the correlation matrix is impossible to invert, and hence, factor scores cannot be computed. Since it is essential to this study to have factor scores, it was decided to exclude one variable from each pair with inteicorrelations of more than .85 or -.85 .

Inspection of the correlation matrix turned up 9 pairs of highly correlated variables.Their intercorrelations and tihe choice of which one to retain are detailed below;

Var. no. of incl. variable,	Var. no. of excl. variable.	Variable name.	Coefficient of correlation.
08	02	Mean size of aggl. ». Number of people in densely settled areas	..993
107	no	High education > % of children aged 0-14 with family head of high education	.951
04	83	Total population i Tot.no. of corp. in manufe and trade	.946
56	40	Cabins per 100 families, % children aged 0-14 in families with cabin	.930
SO	41	% of HU's with bath&WC, % children aged 0-14 in houses without bath	-.903
04	114	Total population, Total no. of lorries	.886
27	44	% married age 20+, % women age 15+ married or seperated and with own HU	.876
52	09	% HU's in farm houses, % pop. in densely settled areas	-.866
16	17	% women age 20-65, Sex ratio of tot.pop.	-.850

While the high intercorrelations hardly are surprising considering the meaning of the variables, it is not quite obvious, in all instances, that the intercorrelations necessarily must be high. It is interesting to note that

families with children aged 0-14 years seem to be distributed exactly like the rest of the population with respect to summer houses, education, and quality of houses.if number of children influences the level of material welfare, one would not expect the high intercorrelations found here.The next step in selecting variables for factorization was to inspect the correlation matrix for variables essentially uncorrelated with the rest. For a variable to contribute to the definition of a factor it has to correlate with at least one other variable. Ecological correlations are usually high. Sweetser's (1974) advice to drop from the analysis variables with zero or only one correlation of ^=.50 or larger was followed.

This turned up 23 variables. In two cases variables with two correlations of ±.50 or above lost one of them as the 23 were removed. All told 25 variables were essentially uncorrelated with the rest and were dropped from the list of variables to be factored. The 25 variables removed were:

10 Small farms, 11 Small forest properties, 23 Sex ratio of in migrants, 24 Sex ratio of out migrants, 25 % of pupils using "Nynorsk"? 28 % women 20-21 married, 30 % women 25-29 married, 37 Ratio of non-family HH to one-fam. HH, 45 % of all old people living in private HH,

56 Cabins per 103 famll ii=s< 60 Coranvting ratio* 70 **Blue collar** women,, 74 !;1raer: vifch disability pens, aged -60, 75 Regional, developraent projects* 96 % votes for **Kr.F.** party, 97 % of l«ft votes for far-left parties, **102** % personal taxpayers, I(i4 % of voiaen **16-24** in **school,** 105 % of men **16-24** in school, 109 Mean income **per** farmer, 112 Persons killed on the roads, **113** Acci-dents on the roads per 1000 inh., 115 Sick leave from work per 100 pecs. 16 tc 1 1V Physiciar,s per lOQOinh., and 119 Violent crimes per tOOCj.nh..,

All but two (37 and 70) of these variables are from the **expansion of** the variable List used ir Appendix c. It may safely be concluded that it is not. easy to find, data and define variables **for** now factors.

At this point 75 variables wera left for factorization. A trial run revealed two facts: there was still linear dependence in the correlation matrix, and there were still several variables which either dafineci a factor of their own or did not contribute to the definition of any factor. If a variable does not fit into the overall pattern of in-tercorrelations defining the factors this shows up as low communality. The factors are taking care of only a small portion of the variance o£ the variable. It was decided to drop all variables with a communality of less than .50.

This excluded another 10 variables from the variable list:

07 Number of agglomerations, 21 Sex ratio: Women 20-24/ men 25-29, 2ft *h* of pop, born abroad, 29 % men 20-21 married, 37 Net migration, 64 % ec.act. of pop., 72 % women 16-69* with disability pension, 84 Investments per manuf. corp. • 85 Mean volume of trade per trade cor p., and 118 Suspected criminals per 1000 inh.

Variable 57 defined together with 58, Gross migration, their own Migration factor. Removing 57 therefore led to the removal of !i8,

With .64 variables 6 fairly will defined factors emerged. But still the correlation matrix could not be inverted ; hence no J'iacto.e scores could be computed. The pairs of variables inth intercorrelations just within the bound of ±.85 were candidates for removal:

Var. no.	Variable name	Coeff. of correlation
65	9 women 16-69 ec. act. excluding those working unpaid in fam, enterprises	
63 ft	wonen 20-59 ec. act.	.843
14	% of age group 20-59 aged 20-39	
13	$ aged 65+	-.840
01	Land area	
06	Inh. per km²	-.835

Removing variable .65 brought no change. The next in line for removal would have been 14 following size of correlation as a criterion. By accident 01 was removed first and now factor scores could be computed. More important than the small difference between -.835 and -.840, seemed to be the fact that. 01 only had 3 correlations outside the bounds ±.50 while 14 had 16 correlations this large.

A 6 factor'factorization of the 62 variables now left showed all communalities above .50, and factors scores could be computed. But still not all variables contributed meaningfully to the definition of a factor. As a rule of thumbr factor loadings lazcer than ,45 are used when interpreting the meaning of a factor. Variable 38, % of single pop. aged 66+(had ,,337 as its highest loading, and variable 08, Mean size of agc-i. , had- .447 as its highest. Dropping these two from the analysis produced the matrix Of factor loadings reported in table A2 of Appendix A.

Dimensions of social structure in Norway 1970.

Table A 2 of Appendix *P*> contains a description of six dimensions of social, structure as revealed by the data available. The theoretical dicussion of the previous chapters led to the expectation of throe types of factors.

One type should toe based on the networks constituted by the flows of alienable value(value in goods), one type on the networks constitued by the flows of inalienable value (value in experiences), and one type on the spatial distribution of the actors of the system (an urbanization factor)-

Table 5.1 is excerpted from table A2 of Appendix A, It was constructed by taking the five highest and the five lowest loadings of each factor if the factor had as many loadings exceeding an absolute value of .43. The question then is; How do the findings correspond to the expectations?

The most specific expectation of the factorization was for the spatial distribution of actors to show up in an urbanization factor. Of the variables in table 5.1 the most direct clue to such a factor would be no. 6 "Inhabitants per km^2". The factor this variable loads on is, however* not exclusively an urbanization factor. Thirteen variables load on the factor in table 5.1 (it is more than TO variables because variables selected may load on more than one factor) „ Of these 7 may be said to indicate urbanization :

79 % pop. dependent on trade,

6 Inhabitants pet km^2,

53 % of households with i-2 rooms.

82 •! of farms which are dairy farms?

3 % of farms with more than 10 da.,

77 % pop. dependent on agriculture, and

52 % of housing units in farm houses.

Besides direct measures of population density, it is to be expected that those activities -transactions- which ace most influenced by the cost of spatial distance will be patterned most closely in accord with the spatial sub-Structure, Hence agriculture must be expected to indicate low degree of urbanization and trade high.(That **service** industries face the same conditions as trade in this regard is shown'in Appendix A, table A2, v?here variable 80, M% pop.dependent on services", loads on the same factor as variable 79 with a coefficient of .62.)The competition for space may also account for the prevalence of small housing units in larger agglomerations.

The other six variables loading on this factor **are** i "High education, % men. in professional and managerial occupations, % of tax payers with income above 60*000 (Nkr.),' Commune tax per capita, % of tax payers with income below 12,000, and % of pop. with only primary edu-» cation." Ate all clearly concerned with the distribution Of educational and economic resources.

Finding education and income interrelated and loading on the same factor might seem to contradict the claimed

TABLE 5.1 DIMENSIONS OF THE NORWEGIAN SOCIAL STRUCTURE 1970.* FROM A VA11MAX ROTATED FACTOR MATRIX OF A PRINCIPAL " FACTORS SOLUTION

VARIABLES	FACTOR COEFFICIENTS					
HO. SHORT NAME	UKB/ SIS	AFFL UHC	DEPR IVAT	FEM. ECAC	FAMI LISM	MANU FACT
107 High education	.87	•	•	•	•	•
68 % men in prof/manag.occ	.86	*	·	•	•	•
100 % tax payers inc.6Q000+	.70	•	•	•	•	•
79 % dep. on trade	.69	•	.	•	•	•
6 Inhabitants per km^2	.65	•	•	•	•	•
111 No of cars per family	•	,71	..	•	•	•
43 ft men with own dwelling	•	.68	•	•	•	•
98 CoiTffmane tax per capita.	,54	.62	.	*	•	•
19 Sex ratio wmn/men 16-39	•	.57	.	•	•	•
31 % married men age 30-34	•	.55	.	•	•	•
9 4 % votes for left wing	•	«	„80	•	c	•
39-Housing units 1.01+pers	•	•	.79	•	•	•
42 Children in HU's 1.01+p	•	•	.77	«	·	•
53 % households with 1-2 r .	.48	•	.58	c	·	•
• 63 % women age 20-59 ec. ac	•	•	•	.79	·	•
59 1 occupied within comm*	•	•	•	.78	e	•
•62 'Be.Act. women with chi	•	»	•	.63	•	•
66 % women with primary oc	•	•	•	.53	·	•
82 % dairy farms	-.47	•	*	.47	•	•
34 % child families	•	•	•	•	.89	•
12 % age 5-14	•	•	•	•	.82	•
14 % age 20-39 of 20-59	•	•	•	•	.75	•
47 HU's built 1960-70	•	•	*	•	co	•
27 % married age 20+	•	.49	•	*	.59	•
33 Child ratio	•	-.50	*	•	.53	•

TABLE 5.1 DIMENSIONS OP THE NOKQBIAN SOCIAL STRUCXUHE I'E»70 continued

VARIABLES		EM2EOR OQEFFICIEOTS				
NO.	SHORT NAME	TJIRB/ isnas	*hFEL* mac	DEPR IVAT	FEM. BCAC	FAMt LISM	MANU FACT
101	% tax payers inc.-12000	-.51	-.54	.	.	.	.
3	% farms 10+ da	'-..54	-.51	.	.	.	.
77	% dependent on agricult	-,55	.	.	.	.	.
106	% with primacy school	-.56	.	.	.	.	.
52	% HU's in farm houses	-.60	.	-.47	.	.	.
95	% vote for Center party	,	.	-.48	**.46**	.	.
51	% HU's in one family st	«	.	.	-.72	.	.
15	Dependancy ratio	.	**-.54**	**-.54**	.	.	.
116	index of health care ex	„	-.60	.	.	.	.
99	State transfers per res	„	**-.67**	.	.	.	.
32	Large families	.	-.78	.	.	.	.
46	HU's built before 1910	.	.	-.63	.	-.48	.
55	% HH's with telephone	.	.	-.68	.	.	.
54	fc HH's with 4+ rooms	.	.	**-=.73**	.	.	.
73	% men with disability p	.	.	.	.	**-.50**	.
81	Rate pensioners/ec.act.	.	.	.	.	-%74	.
13	% age 65+	.	.	.	.	**-.83**	.
78	% dep. on manufacturing	.	.	.	.	.	**.84**
69	.% men in blue collar oc	=	.	.	.	.	.70
86	Mean no.workers per frm	.	.	.	.	.	**.61**
76	Rate occ in sery./manuf	.	.	.	.	.	-=.70

*Excerpt from table A2 of Appendix *h*.

distinction of value in goods and value in experiences. One way to resolve the problem is to note that not all information counts as education in the data as they are collected. It is the economically valuable aspects of information which is reported: the possibility for converting the information into hard cash.[1] Thus education comas to indicate potential for generating value in goods. This must not be taken to mean that education plays no part in the production and distribution of value in experiences. But those aspects of education are not measured.

The urbanisation factor thus coincides with a socio-economic status factor. From Appendix A, table A2, it is seen that this combined SES/URBANIZATION factor is by far the strongest in the matrix. With 26 loadings of .45 or higher in absolute value it accounts; for 28% of the variance of the input data.

The second strongest factor has 15 loadings this high and accounts for 19% of the variance. While the SES factor just discussed may be said to indicate some kind of potential for acquiring value in goods, this second

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[1] The trend towards increasing importance of education for the economic future of people in industrial society may perhaps be attributed precisely to the fact that information is inalienable and thus more difficult to monopolize than alienable goods. However, new technology (computers) certainly is changing this "fact". The consequences for society may be more far-reaching than most suspect today.

factor seems to lie based on differences in spending patterns: how is the income disposed of?

The indicators of Lahle 5.1 seem to suggest affluence and a sub-urban life style: marriage loads positively, but child ratio and r.arge families negatively, home ownership and no. of cars per family Load positively while index* ot health care expenditures and state transfers per resident load negatively,. The positive loadings of commune tax per capita and *sen* ratio (women per man in the age group 16-39) and the negative loadings of % tax payers with income below 12,010,. % farms with more than 10 da. and dependency ratio also support a label like AFFLUENCE for this factor. An even better label might have been "The successful consumers", since the contrast to the next factor labeled.DEPRIVATION then obviously would have been "The unsuccessful consumers".

If the first factor was concerned with income generating capacity and the second with the disposition of the income of the affluent, the third factor of table 5.1 is concerned with the deprived, the have riot's.

Small and crowded housing units load positively while large housing units and housing units with telephone load negatively. That the political variables load on this factor and not on any of the other two is a telling comment on the fact that in Norway the consciousness of deprivation

- has been the major political force since the 1930's. Hence the label DEPRIVATION seems appropriate.

The three first factors of table 5.1 thus seem to belong together as one bundle of socio-economic factors. In addition to socio-economic factors it was expected that a family/community factor woald appear. Of the variables in table 5.1 those loading high on the fifth factor seem to indicate prevalence of families with children. For variables like "l child families", "% age 5-14% "% married age 20+" and "child ratio" it is Obvious.. The variables "fe aqe 20-39 of 20-59" and "Housing Units built 1960-70" are linked to thi" through life-cycle and localisation cecisions in conjunction with family building. That it is families with children which indicate a community dimension is as expected. It is **worth** noting that marriage as such is as important to the AFFLUENCE factor as to the FAMILY factor. On the AFFLUENCE factor there are positive loadings of "% married age 20+" and "% married men age 30-34", while "child ratio'[8] loads negatively. At the other end of the FAMILY- dimension the relative absence of families with children is indicated by variables like "Housing "units built before 1910", "% men with disability pension" and indicators of old age population.

Of the two remaining factors one has been labeled

FEMALE ECONOMIC ACTIVITY and the other MANUFACTURING.These **must** be considered minor factors in the sense that the data available do not link them to other social relations than the one implied by their labels. From table A2 of Appendix A it is seen that table 5.1 reports all their loadings above .45 or -.45 . They explain equal amounts (11?£) of the variance of the data.

They roust both be considered socio-economic factors. Their separate existence is thus linked to the importance of specialization and partitioning of activities as it is reflected in the differentiation of networks.

In Appendix C the emergence of a factor for female economic activity is linked partly to the decision to include as economically active those working unpaid in family enterprises (pages 281-82 and 307-08 in Appendix c) . The linkage to rural areas is obvious from variables like "% dairy farms", "% women with primary occupation" and "% vote for Center party". The link may even be stronger here than in Appendix C» Variable 63 "% women age 20-59 economically active" loads with .79 on the factor and includes the women working unpaid in family enterprises. Variable 65 which was used in Appendix c# excluded these women. In table 5.2 it is seen that the correlation between the factor scores for the FEMALE ECONOMIC ACTIVITY factor and variable 65 is .65. It seems that even if work

in primary occupations may be more important in the present analysis than in Appendix C, the conclusion must be that the importance of the change in definition of economic activity may have been overemphasized.

The emergence of a separate factor for female economic activity is a real phenomenon and its explanation and linkage to rural areas must be sought in the processes transforming the Norwegian society. A good first approximation to an explanation might be to look at the "urbanization" of the rural areas. By this is meant the rapid growth of the very small agglomerations at the center of each commune. This process has been observed and discussed by Myklebost (1979) and Kjolsrod (1978). The growth is fed largely by public investments in health and educational institutions and furnishes relatively many job opportunities for housewives.

On the validation of the factors

Of the 113 variables defined in table A1 of Appendix A, 53 were for various reasons excluded from the factorization. By correlating these variables with the factor scores computed as part of the factorization procedure, it is possible to get a test of how the factors measure up to indicators not part of their definitions (Sweetser 1978). The complete matrix of correlations is reported in table

A5 of Appendix A . *In* table 5.2 only the correlations above .45 or ~a45 are shown Not all variables have correlations this.large* and one factor (MANUFACTURING) does not have correlations this large for any variable. None of the reported correlations contradict the Interpretations offered and all seem reasonable. It isp however, interesting to note the positive correlations between FEMALE ECONOMIC ACTIVITY and the variables 40 *% age -14 in House Holds with cabin" and 56 "No. of cabins per family",, It is tempting to predict that with'increasing female economic activity the .factors of AFFLUENCE and FEMALE ECONOMIC ACTIVITY may merge forming, a single factor *

The last column of 5.2 reports the amount of variance the" factors- explain for each variable. The sum of squared correlation coefficients is of course based on all coef~ ficients foe all variables. For 14 variables the factors explain more than 50% of the variation,, Variable no. 5 "Rate of population change 1960-70" which was excluded from the fa^. -rization because of its skewed distribution, is among these. Its correlation with the FAMILISM factor seems reasonable, where families with children settle, population growth tend to be above average.

Of the remaining 39 variables 3 (no. 18, 20 and 22) were without interest because of the large number of missing

TJtBLE 5.2 COEFFICIENT OF CORRELATION BETKESN VARIABLES NOT INCLUDED IN ANY FACTOR!7.ATION AND EACTOR S0CK3S BASED ON THE €0 VARIABLE SOLUTION ON 448 UNITS

VARIABLES	FACTORS					R SQ
NO SHORT SAME NO. SHQK1 RNJL	FAMI LISM	DEPR	SES	EaL		S g
1 Total land area in krt^	.	.	• -,,47	.	.	5 2
2 Total pop. in dense area	.	.	, .	.	.	5 5
5.Kate pop» change 1960-70	. .55	.	„	.	.	5 9
• 7 No* of agglomerations	.	.	.	.	.	3 3
8 Mean pop.size of aqcl.-^e	.	.	.	.	.	5 3
• 9 % of pqp» in dense areas	.	.	..64	.	.	8 3
10 % small of all farirs 10+	.	.	..	.	.	2 8
•11 % • small forest propertie	.	.	.	.	.	1 1
17 Mem per 100 women	.	.	-.62	.	.	59
1 8 Sex ratio of dense areas	.	.	.	.	.	4 3
2 0 >SR age 16-39 dense areas	.	.	.	.	.	2 7
2 1 S R women 2Q-24/m.25-2y	.	.	.	.	.	3 1
22 SR 20-24/25-29 dense are	.	.	.	.	.	15
2 3 S R in migrants:men.•'wcrcen	.	.	.	.	.	0 7
2 4 S R out migrants :m/wcr.en	.	.	.	.	.	0 6
2 5 % pupils using "NVnorsk"	,	. -.46	.	.	.	4 9
26 % of pop.born abroad	.	.	.53	.	.	4 4
2 8 % married of women 20-21	.	.	.	.	.	2 2
29.%• married of men 20-21	.	.	.	.	.	4 3
3 0 % married of women 25-29	.	.	.	.	.	3 8
3 7 'Rate norv-fam.HH/one-t^HH	.	.	.	.	.	0 7
38 % old of single populati	.	.	.	.	.	57
40 % of age™ 14 in Hllw/cabin	,	. „	o .48	„		40
4? % of -14 in fHi wout/luth	. -.48	.	-.53	.	.	59
44 % wcmen with own Hi	,47 ,51	.	.	' .	.	6 7
4 5 % of all 6€+in privatcllil	.	.	.	.	.	0 5
5 6 No. of cabins per family	.	.	.45	.		4 1

T3U3LE 5.2 COEFFICIENT OF CORRELATION BETWEEN VARIABLES NOT INCLUDED continued EN AN* FACTORIZATION AND FACTOR SCORES BASED ON THE *60 VARIABLE SOLUTION ON 448 UNITS

VARIABLES	FACTORS						52
NO. SHORT mm	AFFL UENC	FAMI LISM	DEPR I VAT	SES/ URB.	FEM. BCAC	MANU. FACT	SUM
57 Net migration 1970	.	.	.	.	.	.	28
58 Gross migration t'97Q	.	.	.	.	.	.	32
.60' Commuting ratio 196B-	.	.	.	.445	.	.	39
64 % economically active	.	.	.	.	.	.	38
•65 % W16-69 ecac funpaidwrk	.	.	.	.	.65	.	69
70 Blue collar •women	.	.	.	.	.	.	28
72 % women with disab. pens	-.50	.	.	.	.	.	46
74 % men with disab.p. -60	.	.	.	.	.	.	06
75 Regional development oro	.	.	.	.	.	.	13
83 No. of corp. in manuff&trad	.	.	.	,59	.	.	66
84 Investaupr corp. in rmnuf	.	.	.	.	.	.	34
85 Mean volume of trade	.	.	.	.	.	.	•44
96 % votes for KrF(Chr.p.p)	.	.	-.52	.	.	.	36
• 97 % of left votes for left	.	.	.	.	.	.	21
102 % -perg.taxpayers of all	..60	.	.	.	.	.	58
104 % men16~24 now in school	.	.	.	.	.	.	28
105 % worn.16-24 now In school	.	.	.	.	.	.	39
109 Mean income of farmers	.	.	.	.	.	.	28
110 % 0-14 with high ed.paren	.	.	.	.85	.	.	88
112 No. of pers.killed in tra	.	.	.	.	.	.	22
113 No. of road accidents/cap	.	.	.	.	.	.	09
114 No. of lorries	.55	.	.	.	.	.	67
115 Absence from work	.	.	.	.	.	.	36
117 Physicians per capita	.	.	.	.49	.	.	38
118 Suspected criminals/capit	.	.	.48	.	.	.	40
119 Violent crimes per capita	.	.	.	.	.	.	19

observations. The 36 variables then remaining for which the factors explain less than E!(1% of the variance, one fourth have one coefficient :rE correlation with larger absolute value than ,45. Only 'i.! variables are without any link to the factors.

In the next chapter these variables will be returned to together with the factor scores for the six factors in an attempt to study the determinants of the regional variation of the fertility,,

Summary of social structure in Horway 1970

The picture of the Norwegian social structure emerging from this investigation may be summarized as a structure highly differentiated according to socio-economic networks as compared to family/community networks. Differentiation according to the urban-rural dimension (or at least the density aspects of it) is the same as the differentiation according to resource or income generating potential, 'm this context the SES/URBANIZATION factor is the most important,and its meaning is extended toy two factorss AFFLUENCE*based on the symbols of success in owir society (carvhouso,marriage)jand DEPRIVATION , based oft the symbols of deprivation (crowded housing and the political force of socialism).

That income generating potential is independent of both

the symbols of success and the absence of deprivation is itself an interesting outcome. But it may say more about the degree of specialization and partitioning of activities than for example, about the degree of "equalization" which have been on the political agenda for the last couple of generations. The extent of specialization and partitioning of activities also shows up in specific factors based on female economic activity and manufacturing production.

Compared to the five socio-economic factors the one family factor seems insignificant,, There is however good reason to believe that the data available here underestimate the number of family/community dimensions. Appropriate data are not available»Eve:a the one factor identified as relevant must assume a positive association between number of families with children and volume of community value produced within families.

All told the picture of the Norwegian social structure supplied here can not be considered complete or comprehensive even on its own premises. This must necessarily be kept in mind in the next chapter when the factors will be used in the study of variations in ferility.

A parsimonious definition of the Factors

The theoretical considerations leading up to the

interpretation of the six factors of table 5,1 were among other assumptions based on ths premise that there were just a few theoretically significant and distinct types of relations. It was further assumed possible to infer from a random sample of these relations to the basic nature of the different types of distinct relations[1].

From this it also would follow that once the different major types of relations were identified it would suffice with just a few indicator variables to measure the interesting parameters of the relations (heire the factor scores and the loadings of the variables on each factor).

The question is then? How many variables will it be possible to remove from the (50 variable factorization without changing the factors?

As a point of departure the three variables with highest positive loadings for each factor and the two variables with lowest negative loading; on each factor in table *h2* of Appendix A were selected. Fot the factor FEMALE ECONOMIC ACTIVITY variable 61, "Total commuting rate", was selected instead of 106 since 106 already had been selected for the SES/URBANIZATTON factor.

Factorization of these variable's produced a solution where SES/URBANIZATION collapsed with the AFFLUENCE factor.

Looking at the variables selected to indicate SES/URBANIZATION, it is seen that only one of the variables

indicated urbanization, the rest of them indicated SES. Removing variable 100,-"% tax payers with income above 60,000"* and adding 79, "% dependent on trade", and. 6, "Inhabitants per km'", changed this. Now 3 variables indicated SES and 3 indicated urbanization. Variable 61 did not strengthen the FEMALE ECONOMIC ACTIVITY factoc as intended and vras removed. Still the variable list contained 30 variables. The factorization pcoduced the factor matrix reported in table A3 of Appendix A.

The test of the selected indicators is the degree of similarity between factors computed using 60 variables and factors computed from 30 variables,

• Table A6 of Appendix A reports the coefficients of congruence (suggested by Harraan 1967, pp.270) for the 30 and 60 variable solutions computed on 448 units of 451 communes. In table 5.3 the coefficients larger than .45 are shown. That the same factors emerge seems evident. In addition to computing the coefficient of congruence, the factor scores were correlated. The coefficients of correlation are reported in table A 7 of Appendix A , and the coefficients larger than ,20 are reproduced in table 5.4, Again there can be no doubt that it is the same factors which emerge in the two factorizations.

Appendix C reports on a replication of Sweetser's (1970) Study of "Commune differentiation in Norway, I960"*

TABLE 5.3 COEFFICIENTS OF CONGRUENCE BETWEEN FACTORS. FACTOR LOADINGS FROM THE ANALYSIS **OF 30** VARIABLES **ON** 102 UNITS, FROM THE ANALYSIS OP 30 VARIABLES ON 448 UNITS, AND FROM THE ANALYSIS OF 60 VARIABLES ON 448 UNITS. DECIMAL POINT OMITTED.

ANALYSIS BASED ON 30 VARIABT.ES	NAME OF FACTOR	ANALYSIS BASED ON 448 UNITS											
		SES URBANISM		FAMILISM		MANUFAC. INDUSTRY		DEPRIVA		FEMALE EC. ACT.		APFLU-ENCE	
		ANALYSIS BASED ON-VAR	30 VAR	60 VAR	30 VAR	60 VAR	30 VAR	60 VAR	30 VAR	60 VAR	30 VAR	60 VAR	30 VAR	60 VAR
ANAL-YSXS BASED ON 102 UNITS	SES/URBANISM		98	98									69	69
	FAMILISM				99	99								
	MANUFAC.INDUSTRY						98	99					54	56
	DEPRIVA.								98	97				
	FEMALE EC.ACTIVITY										90	80		
	AFFLUENCE		53	S&			50	47					97	97
ANAL-YSIS BASED ON 448 UNITS	SES/URBANISM			100										84
	FAMILISM					100								
	MANUFAC. INDUSTRY							100?						60
	DEPRIVA.									100				
	FEMALE EC.ACTIVITY											98		
	AFFLUENCE			66				56						100

TABLE 5.4 COEFFICIENTS OF CORRELATION BETWEEN FACTORS. FACTOR SCOftES FROM THE ANALYSIS OF 30,47 AND SO VARIABLES ON 448 UNITS,

	FACTORS BASED **ON 30 VARIABLES**					
	SES/ **ORBAN.**	FAMIL.	**MANUF. INDUS.**	DEP1R.	**FEMALE EC.AC.**	**AFFLU-ENCE**
FACTORS BASED ON 60 **VARIABLES**						
SES/LTRBAW.-	.96	.	.	.	.	.
FAMIA„ISM	.	.98	.	.	.	.
MANUF.INDU.	.	.	**.95**	.	.	.
DEPRIVATION	.	.	.	**.98**	.	.
PEM.aC.AC'ᴷ-	.	.	.	.	**.95**	.
AFFLUENCE	.	.	.	.	.	**.95**
FACTORS BASED ON 47* VARIABLES						
URBAN./S3S	.90	.	.	.	.	**.33**
FAMIIiilISM	.	.96	.	.	.	.
INDUSTRY	.	.	**.76**	.	.	**.54**
•LEFT KJL./DFT'R.	.	.	.	.'34	.	.
PEM.SC.ACT.	-.25	.	.	.	**.82**	**.26**
MIGR«.Q.'ION	.	.	.	.	.	**.20**

	FACTORS BASED ON 60 VARIABLES					
	SES/ URBAN.	FAMIL.	MANUF. INDUS,	DEPR.	FEMALE EC.AC.	AFFLU-ENCE
FACTORS BASED ON 47* VARIABLES						
URBAN, . /SES	.92	.	.	.	.	**.32**
FANILISri	.	,97	.	.	.	.
INDUS1'RY	.	.	.78	.	.	**.56**
LEFT K)L./n-ᴷ'I^	.	.	.	.96	.	.
PEM.EC.ACT.,	.	.	.	.	**.89**	*.26*
MIGRATION	.	.	.	.	.	.

*See Appendix C.

The 47 variables approximating his variable list produced upon factoring factor scores which were correlated with the factor scores from the 30 and. 60 variable, solutions on 448 units (see table &7 cf Appendix A and table 5.4). One genuinely new factor has *been* identified compared to those found by Sweetser for 1960: The AFFLUENCE factor. The appearance of this factor also has changed somewhat the thrust, of the INDUSTRY facto*. The discussion in Appendix C called attention to the declining importance of agriculture between I960 and 1970 together with a weakening association between manufacturing, and urbanization. What, remains here of *;he I960 bipolar INDUSTRY/AGRICULTURE factor is thus a more pure MANUFACTURING INDUSTRIES factor.

The development between 1960 and 1970 illustrates hece the effect of increased specialization and partitioning of activities on the factor structure. The number of factors increase, and they become wore specific. The disappearance of the MIGRATION facto;: may be explained in the same way, At the same time a now major factor (AFFLUENCE) has been identified. This is probably not wholly due to additional data, but must be seen in the light of the processes slowly changing the social structure of the Norwegian society. To what degree structural changes, have occurred or additional data are responsible

will not be possible to tell without securing the same data for I960 and analysing all of it. The stability of the major factors from i960 to 1970 (see Appendix C, table C8), suggests ;;hat the AFFLUENCE factor probably existed in 1960 as welie

This comparison of Norway in 1970 with Norway in 1960 disregards the possible problems of comparison introduced by a reduction in the nun^er of communes from 732 in 1960 to 451 in 1970. The problems are of course exactly like the problems introduced by uoing from 448 units of analysis to 102 units as will be necessary for the study of fertility. But a thorough discussion of the problems of aggregation in factor models does not seem to exist.

Fertility regions and the problem of aggregation in factor models

In order to use the factors in the study of the regional variation in fertility,- factor scores had to be computed for the 102 fertility regions. Besides providing a foundation for the next chapter,; this computation may also be used as a study of the problem of ecological correlations in factor models.

It is a common observation that correlations tend to increase if units are grouped together (see Blalock 1964, and Appendix B pp.212-16} . This also happened here and had

the effect that factor scores could not be computed for the 60 variable factorisation on 102 units,, The correlations had increased to the point where linear dependence in the matrix of correlations precluded the inverting of the matrix. The 30 variable factorization was, however, no problem. The factor matrix is reported in table A4 Of Appendix A . Table 5.3 establish beyond cloubt that it is the. same factors which emerge in the 102 units solution as in the 448 units solutions. The relatively low similarity (.90 and ,80; see table 5.3) between the FEMALE ECONOMIC ACTIVITY factors of different solutions may be linked to a. sensitivity in this factor to changes in area through its dependence on economic activity in agriculture for its definition. The most important variable is probably 59, "% occupied in commune", which of course will be influenced heavily by changing units. In table A4 of Appendix *h* it is seen that the largest difference of the factor loadings on this factor for the 30 variable solution, on 102 units and the 60 variable solution on 448 units is found for just this variable. At the same time variable 59 is one of four indicators used to determine the nature of uhe factor. Rather than casting doubt on the meaning of this factor these considerations suggest that maybe the 102 unit solution contains a more general factor for FEMALL ECONOMIC ACTIVITY with weaker

links to agriculture.

Whether this is so or not, for the other five factors table 5.3 shows the factor loading.[1]:: to be approximately equal whether computed for 448 units or 102 units in spite of the increased coefficients of correlation as the number of units are reduced.

Only by rather complicated investigations into the theoretical foundations and implication;; of aggregation will it be possible to see whether this is reasonable and to be expected. This can hot be undertaken here. For an introduction to the problems see Hannan (1971).

Theoretically a factor analysis .includes two levels of analysis. One level consists of the sum total of the data carrying units, the other consists of trie individual units. Norway may be considered as one unit whether it is split •into 448 units or 102 units of analysis.. The matrix oi factor loadings is a characteristic of the sum total of Norway, and says nothing of any specific commune. The matrix of the factor scores contains the information on each individual commune.

Thus differences between areal divisions show up in factor scores and not in loadings. That the factor scores computed for this study show such differences is

demonstrated by table 5.5.[1] The pattern of differences between scores of different types of units is however not one of a simple or weighted (by coirrtnine size) regression towards the mean as one might have expected;!! no aggregation effects were present. But the scopes on the factors FAMILISM and MANUFACTURING seer, c.o approach such a situation. This is interesting considering that the aggregation was undertaken with the aim o£ maximizing the internal homogeneity of culture anc economic structure (in reality industrial structure, see Appendix B) .

If the factor analysis thus is able to circumvent the problem of aggregation it may be linked both to the way variables are selected for inclusion in the analysis and to the analytic procedures which snake the pattern of intercorrelations more important tha.n the actual sizes of the correlations.

Whether by accident or not, the high coefficients of congruence of five factors show thet the aggregation did

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[1] Table 5.5 also allows a return to the question raised in chapter 4 on how to interpret factor scones on a socio-economic dimension. Without any other evidence than public-appearance it seems reasonable to say that commune 0301 (Oslo) is more heterogenous than ccirruria 0219 (Baerum) . Since 0219 has the higher score on the SF.S,'URBANIZATION factor, the most sensible interpretation of the score seems to be to take it as a measure of the position of the commune within the national stratification system.

not introduce any bias in this case. For the sixth facfcoty FEMALE ECONOMIC ACTIVITY, it may be argued that the aggregation removed a bias. In any case, the conclusion roust be that the interpretation of the factors in essence remain unchanged with the change in units of analysis.

TABLE 5.5 FACTOR SCORES FROM SELECTED UNITS OF THE 102 UNIT **DIVISION**(F.AREAS) AND THE 448 UNIT DIVISION (COMMUNES)

F.ARE& MO	COMMUNE NO	FAMI LISM	AFFL UENC	SES/ URBA	MANU FACT	DEPR IVAT	FEMA LEEC
		FACTORS					
1		-0.94	0.70	-0.01	1.35	0.66	0,54
	0101	-1.12	0.66	0.38	1*44	1.08	0.32
	0124	-0.26	1.09	0.30	1.56	0.84	0.74
13		-2.37	0.13	1.98	-0.67	0.81	2.72
	0301	-2.29	0.38	3.54	-0.36	1.20	1.72
14		0.68	0.75	2.85	-1.24	-1.79	0.88
	0219	0.69	0.92	4.05	-1.09	-0.87	0.94
24		-0.72	0.02	0.87	2.06	0.48	"1,00
	0805	-0.53	0.42	1.03	2.00	0.74	-0.27
28		-0.68	U15	-0.02	0.01	0.66	-C.92
	0532	-1.21	0.65	-0.44	1.53	1.62	-C.16
	0533	0.16	1.10	0.14	-0.72	-0.02	-0.59
	0601	-0.49	1.00	0.26	0.49	1.08	-0.09
66		-0.33	-2.03	-0.70	0.79	-0.91	1..45
	1252+1266[1]	0.17	-0.59	-0.37	-0.57	-0.58	1,13
	1253	0.25	-0.96	-0.24	1.45	-0.28	C.58
	1256	0.61	-0.91	-0.03	0.71	-0.49	0.68
	1260	-0.52	-1.57	-0.05	1.13	0.02	1.57
	1263	-0.25	-1.29	0.51	0.61	-0.39	0.52
	1411	-0.88	-1.02	0.1?.	-0.73	-1,00	1,03
98		0.39	-1.35	-0.86	-0.97	0.96	-1.19
	1925	1.09	0.17	-0.70	-1.41	0.22	-1.25
	1929	0.33	-1.00	-0.98	0.64	0.86	-1.90
	1931	0.59	-0.62	-0.26	-0.46	1.11	-0.96
	1933	0.49	-1.06	-0.87	-0.49	0.64	0.00

[1] See Appendix C on combines of communes used in the analysis.

CHAPTER 6

THE SOCIAL ECOLOGY OF HUMAN FERTILITY IN NORWAY 1970

Chapter 1 introduced the snc-ial determinants of fertility as a problem for sociological i.heory. As a first task it was decided to investigate how far towards an explanation of differential fertility sociological theory might come- as it presents itself today. The subsequent chapters tried to fit together to some Kind of coherence concepts from different approaches to the? understanding of societies. At this point the concept:;; introduced will be brought to bear on the explanation of rcqionai differentials of fertility in the Noirv-joqian society in 1970,

Fertility by region

Measuring the fertility *of.* a regionally defined nopulation may be done in several ways dependinn on the kind of data available (Shryock, S-qojel & al. 1971, pp. 462™548). For the present task a measure of reproduction s-ould be of greatest interest. Measures c£ reproduction will usual ly approximate the average numbos o;. children born to o woman of a population durinn ror lifetime. Direct, measures of this quantity require tine scries of data not available to this s*»idv. The data available cove-rod the

years 1968 to 1971. For each year and each commune oil the country the population at the start of the year and at the end of the year was recorded in one year ago groups. The births were recorded according to the age of the mother at the end of the year. -This permitted computing fertility rates for one year age groups for each commune for each year.

However, the small population of many communes implies that outside the modal ages of childbearing the number of observations from which to compute rates, would be very small, making the estimates of the rates highly unreliable. To overcome this problem two strategies, were used.

First,data were aggregated both across time and across regions. The four years were added together on the assumption that regional differentials would be resistant to short term trends of changing fertility. From table 1.1 this assumption appears reasonable. In addition neighboring communes were added together to form what will be called fertility regions or F-regions. The aggregation of communes was undertaken with a view to maximizing internal homogeneity both culturally and with reqard to economic structure. The problem involved and the resulting fertility regions are discussed in Appendix B.

The second strategy was to employ analytic graduation of the rates. Analytic graduation will, in the same sense

as regression, ignore "roise" in the form of chance fluctuations of data, \"hts primary aim of analytic graduation was, however* to reduce the number of parameters describing a region Ercv- t;!he 36 aqe specific fertility rates to the four parMisters describing the chosen- graduation function.

A discussion of the computation of fertility rates and •the graduation of thesi *fot* the 102 F-tegions of the present study will be found in Appendix D.

Analytic graduation cay t-e thought of as a, strictly nonlinear regression ½?ir.h the chosen graduation function replacing the regression line. The observations surrounding the graduation curve will be- the age specific fertility rates. Age ia thus one axis spanning the graduation curve, number of births per woman ia the other. Instead of the least squares estimates used in linear regression, the estimation procedure is based on a chi-square minimization..

The graduation function chosen is usually called the Hadwiger function (see Cor instance Hoern 1972 or Key fit.-/ 1968). After chanqinq, :;he parameters, the graduation curve was determined by c'.e following four: total fertility rate,, modal aqe of ch.ilcU.-ear ing, mean age o£ ch i Id-bearing, and variance el' tin* age distribution ot child-bearing. These paraiiieters ?;e most easily interpreted

in terms of cohort measures as the average number of children born to a woman of a cohort, the age where the highest number of births occur, the mean age of childbearing for the women of a cohort, and a measure of the degree of variation in the timing of births within the cohort.

With the kind of data available, the measures as presented in Appendix D, can not be interpreted in this way. They are period measures, not cohort measures. Only if the women during the rest of their reproductive years were to continue to bear children in the same way as during the period of observation, will the measures also be cohort measures. Women will certainly not do that. This poses a problem as well as a boon to the present study. It presents a problem in so far as the interpretation of correlations between explanatory variables and fertility parameters must be careful, to take account of the fact that it is not cohort measures which are used.

It represents a boon considering that completed lifetime fertility, despite being a necessary theoretical category ,is never a fixed quantity during the life of most women until they are past their reproductive period and it is too late to do anything about their number of children. This suggests that it might be possible to interpret variations from period to period or from region

to region in the measures used as some kind of aggregate evaluation of the present conditions for raising children, given the history and adaptions to present circumstances for each woman of the population.

The regional differentials of the fertility parameters as they are presented in table D2 of Appendix D are thus seen to reflect differentials in the conditions affecting the decisions of woiaen on the question of having a child during the period of study.

Theoretical discussion of differential fertility

Chapter 1 concluded that in a modern society, as Norway certainly must be considered to be, fertility would depend on how women and families weigh and value alternative life projects. This means that the theoretical considerations have to be applicable to a society with voluntary, individualistic control of fertility. Theoretically it implies that families and women have to be treated as rationally calculating actors.[1]

With regard to fertility the problem then is how couples decide on the number of children they want. Which are

1 This is of course in accord with current research applying economic theory to fertility decisions. See for example Schultz 1976. The theoretical question posed here is not. whether people choose, decide, optimize or not, it is rather what people choose from, what they decide on, and what they optimize.

the alternative courses of action they are choosing from? What are the priorities and decision rules? How do they implement their decisions? Is it possible to formalize the discussion of available alternatives, existing priorities, and the means at hand so as to understand, from the point of view of the actors, the rationale for their decisions as these decisions are revealed by the data presented here?

In 1970 adequate means were available for a fairly immediate response to decisions on whether or not to have a child. It may safely be assumed that if women or families found the experienced pressures from their environment severe enough, they would be able to acquire the means to prevent their number of children from increasing.

Phrased this way the question of what is meant by "environment" and "severe enough" immediately presents itself.

Conceptualizing environment as social structure, pressures may be thought of as the limitations imposed on the actors by being in a particular position within the social structure. The problem will thus be to investigate how children -the arrival and presence of children- influence the positioning of their parents within the social structure. The situation before and after the arrival of a child must be compared in order to see how the limitations

change and weigh the outcome of subsequent decisions.

In terms of affecting the position of a family within the social structure, the arrival of the first child will be fundamentally different from the arrival of later children. But before any children can arrive, the family itself has to be constituted. The discussion of effects of marriage patterns on fertility will, however, be more convenient after a discussion of the decision process within the family.

The first child

The dominant goal of any actor -also women and families- is assumed to be to maximize the return of value. The processes of producing and acquiring value are circumscribed by available resources and structural positions of the actor.

The arrival of the first child is the event with largest impact both on the structure of the family and the structure within which the family operates. It transforms man and wife into parents. New constraints on the allocation of time will be immediately felt and will show up in changed relations with other actors within the system. Material resources have to be diverted to cater to the baby. Alternative use of them becomes impossible.

To procure value actors are assumed to follow a mix of

two kinds of strategies. One type of strategy is directed at obtaining value in goods. The other type ig directed at obtaining value in experiences.

To acquire value in goods the modal strategy will be to pursue a work career. The returns from activities directed at the acquisition of value in goods will be called income.

To acquire value in experiences the modal strategy will be to associate with actors from peer groups.[1] Position in social structure will to a large extent determine which peer group is most easily available and hence channel the building of social networks to particular kinds of peer groups.[2] Important types of peer groups will be family and kinship, class mates from school work mates, and neighbors.

The limitations imposed on activities by the first child have implications for both kinds of strategies of acquiring value. Income will be reduced. One of the parents will have

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[1] Any position in a substructure will contain a peer group by definition.

[2] From the concept of social structure used here this might seem to follow by definition. However, in any specific application one has to consider the intersection and coincidence of different structures as these are defined by various networks. Thus sub-structures based on one type of network may shape the processes building other types of networks.

to tend the baby or else they have to hire someone to do the job. The income foregone by not working or by hiring help is the most obvious cost of having the first child.

Less obvious may be the cost of living to use previous free time for child care. The time necessary to maintain and extend social networks will not be available to the same degree and on the same conditions as before.

Depending on the kind of peer group the network previously was built from, the arrival of a child will have varying consequences. While the network built among class mates from school probably will start deteriorating rapidly, the networks among family and kinships may be strengthened. Networks based on work mates will for those who quit work, be affected negatively to the same degree and for the same reasons as networks based on school mates. If work is continued the consequences for the network will be less obvious. In the long run it probably will suffer, since, on the average, much less time will be available for association outside of work hours. The effect on networks based on neighbors will depend on the number of them having children.

The arrival of the first child will have implications for the internal processes of the family as well. Before the arrival of the first child the two actors, man and woman, will be bonded by relations of exchange and

separated by boundaries created by sex specific experiences. In a sense one may call them dialectically bonded. The relations within the family will map them into different positions.

The arrival of the first child changes this, it maps them both into the position of parent.[1] The parent/child relation is conatitued by a flow of experiences from the child to the parents and a flow of material and social care from the parents to the child. The parents have to weigh their gain from these experiences against the loss from disrupted networks and lowered income. In addition to the direct experiences flowing from a child one also roust consider the value from secondary processing of them. The strengthening of networks based on kinship and fanily will be based on secondary processing of experiences flowing form the child. This may also be a basis for building networks among neighbors having children.

The assumption that actors will seek to maximize returns of value will now imply that the following propositions ought to hold for the arrival ot the first child;

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[1] In an analysis of the structural subntitutabi1ity of fathers compared to mothers with regard to the child th^ outcome would seem to depend on the importance niven to breast feeding. The assumption here is that in the final analysis fathers will be found structurally equivalent to mothers.

1) the larger the loss of income, the le.su likely the child is;

2) the more difficult it is to hiro child rare* tie l<?!:» likely the child isi

3) the more important association with feet: groups i\.'xv school mates and work mates is, the ''ess likely x\\<¢ child is;

4) the more important association with kin ship and family is, the more likely the child :L,?j an›;

5) the larger the proportion of neighbors -*?ith cbildi.ei: is, the more likely the child is.

To the extent these propositions hole l.hey apply to tbu woman and the nuclear family..How will they appear L-:\ aggregate data?

Income and costs

Economic theories of fertility have family incoue and economic costs of children as their main variables, although the theories provide no information about: uh« t.i.gu of the income effect, most economists will assume j.l: t CJ be positive; Higher income will lead to more children •• other things being equal (Cain and Weiningec 1973). Vhi- opposite is assumed to hold for costs. The reason! rs—; ;n?y apply to the family with one income and one of :.ho a-unnts taking care of the cjhildren* If all families were ;>f this

type there would be no problems aggregating the relationship and arriving at a positive relationship between affluence within an area and average number of children for the females residing there.

However, most studies find a negative aggregate relationship between income and number of children controlling for costs. Sometimes a U-shaped relationship have been found and in a few cases positive relationships have been reported (Bernhardt 1971, pp.137, NCBS 1979, pp. 170-176).

What appears to be the problem is the fact that not all families choose the option of having one parent at home on the arrival of the first child. The sequencing of decisions and the transformations of the social structure introduced by earlier adaptations makes the aggregation of family income/fertility relationships difficult.

A closer look at the process creating high income will be necessary.

In Norway in 1970 the single most important determinant of income was hours of work. It explained 28% of the variation of income (Redseth 1977). A main explanation of high income is thus that long hours of work have been devoted to the acquisition of money= Particularly this will be the case for families where individual variations are compounded by the possibilities of one or two incomes.

High family income probably means that both spouses are working. In areas with high family income or high per capita income it means that somehow a large proportion of the femilies have found a way for both spouses to work. This is possible either by postponing the birth of the first child (finally ending up with none) or by hiring someone to care for the child. The rapidly increasing cost of hiring child care as number of children increases[1] suggests that affluent areas will tend to have fewer children per family than less affluent areas*. This must be the case regardless of the relationship between income and fertility at the family/individual-other things being equal-level. Hence it is not possible to conclude anything about the micro-relationship from the existence of a negative aggregate relationship between affluence and fertility.[2]

If affluence does not "cause" fertility, how about poverty or a relative lack of the material standards most people enjoy? If one takes relative abundance of

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[1] The possibility of coopting older children for taking care of their younger siblings, seems rather remote both because of the time and effort it takes to reach that possibility and because of the limitations imposed by schooling etc.

[2] Whether or not an ecological correlation can tell anything about micro-relations seems mostly to depend on the theoretical understanding of the aggregation process which connects the micro-relations and the ecological correlation (Hannan 1971).

unsuccessful wage earners and/or consumers as an indicator of a certain degree of deprivation within an area, one possibility might be that these were unsuccessful because they would rather use their time and effort caring for children than chasing after material goods. This would imply a negative income/fertility relation at the individual/family level. But lack of success is also a consequence of the competition where some do succeed. In one sense the successful competition for scarce goods, such as housing, or for high positions has as a necessary corollary the existence of unsuccessful competitors. The unsuccessful may not even have chosen to compete, but being members of a social system where so many choose to compete they are forced into the position of losers. Here they are subject to the same constraints on having children as everyone and have relatively less resources to meet the costs. A high degree of deprivation within an area ought to indicate a lower fertility.

The choice is probably not a simple choice of using time for acquisition of money or for something else. Some socially defined minimum standards of amentities have to be met before this choice will be considered.

One of the mechanisms making it easier, more rewarding and in time also necessary to use time for the acquisition of money rather than to care for children may be seen in

the aggregate effects of the choice between one or two incomes. The mechanism forcing this choice en people may be the existence of what Hirsch (1977) calls positional goods. In the concepts introduced in earlier chapters, positional goods may both be goods where the symbolic value is significantly more important than the use value as well as postions within a stratification system in so far as acquisition of certain goods or experiences is necessary to enter into a desired position. Spatial location or housing within an urban agglomeration may thus be considered a positional good. Education as a prerequisite for certain jobs is another example. In so far as money can buy the wanted goods, an increasing proportion of two-income families will make it even more necessary for newly established families to have the two incomes to meet the prices fast rising in response to the increased demand from existing two-income families..

The characteristic of positional goods is precisely that they either increase in price to stay scarce or stop being positional. Some of those entering the competition for positional goods have to come out losers.

The general effect of a transition from one-income families to two-income families is thus to make two incomes necessary to maintain the standard of living formerly possible with one income and the caring for children

that much more difficult and expensive.

It would, however, be wrong to conclude that the materialism and spectacular economic success of a few childless couples would be sufficient to start this process colling. The choice between work or no work involves a lot more than just income.

Work and industry

As noted labor force participation has much to do with income and the nature of costs of caring for children. But the organization of work also will influence factors of interest to the study of fertility other than income and costs. Besides income requirements, individuals and families also face a problem of optimizing the return of value in experiences. Here this problem will be considered in relation to the choices between work or no work, and between no children or a first child.

The best choice will depend heavily on the kind of social structure within which it is made. Important characteristics of the social structure will be the availability of work for women and the stability of peer groups used in the production, processing and evaluation of experiences.

These phenomena are not found to be independent even if they easily might be conceived to be. One possible reason

might be the differentials across region and industry of work opportunities for women during a period of transition from family based labor force participation to individual labor force participation.

In areas with work for women easily available, usually urban areas, gross migration tends to be large, Networks based on school mates tend to be difficult to maintain, distances between relatives tend to be long and neighborhoods will often be newly established or have a high turnover. As a consequence of this the potential importance of work mates will increase. In order to maintain a steady return of value in experiences, women ought to choose work regardless of whether they intend to have a child OE not.

In areas with few or no jobs for women available,, usually rural areas, the situation will seem more or less reversed. Women either marry early, take one of the few jobs available or move out to areas with more job opportunitities. For the women remaining, the social networks will not to the same degree as for women in urban areas be based on a particular peer group. Networks based on school mates will coincide with those based an family and kinship. As often as not school mates and relatives are also neighbors. And for those who work, work mates are likely to be members of other peer groups as well.

Clearly such a '"dense" network will not be much affected by the arrival of a child. Indeed, the network most likely will be strengthened since most women in such areas must be expected to have or to have had children. In order to optimize the return of value from experiences women ought to choose the first child regardless of whether they have work, can get work, or have to quit work to care for the baby.

The two types of areas described above clearly lie at opposite ends of some kind of urban-rural dimension, In both kinds of societies the cost of having to quit work to tend a baby will be greater than the cost of hiring someone to do it. In the urban situation this means that the decision on the question of having the first child mostly will depend on the possibilities for arranging child care. Having work is a "must". In the rural situation the possibilities for child care will determine whether to continue work or not. Having children is a "must". The choice is thus not simply between wanting income from work or having to use one's time to care for children because one also wants children.

Different kinds of social structures encourage the development of priorities which imply a particular sequencing of projects The adaptations to the problems of earlier projects determine the feasibility of different.

-alternatives faced in subsequent situations*

The pure form of the urban society described, is a society where having paid work has become an existential necessity to maintain self respect and personal integrity.. The rural society in pure form is a society where being married and having children have the same status.

Real societies will of course be a mix of the two pure forms. Which one of the two possible sequences of choice a. particular sub-structure will tend to encourage, is determined on the one hand by its organization relative t<y sex categories., and on the other hand by the degree of differentiation in space and time of the activities being performed within the local social system.

Agriculture and manufacturing industry have so far favbredl choice of family and children within rural communities and stable small (say up to 10,000 inh.) urban agglomerations. Within larger urban agglomerations and all .rapidly growing agglomerations manufacturing industry and service industries seem to have encouraged the choice of a work career.

Industries practicing sex discrimination against women, will in general favor the choice of family and children. Within societies where choice of work career is being favored by a large and growinq seccor of the economy, the practice of sex discrimination will probably be a waning

principle. The scarcity of qualified workers within a growing economy will see to that, and once started the process may be hard to halt or reverse.

The consequences of female labor force participation and mix of Industry present for the fertility of an area are thus not quite obvious. In so far as variation in labor force participation and mix of industries follow a general urban dimension (as for service industries) a negative relationship between them and fertility must be expected.

Family

The value of the experiences generated by the child and in conjunction with taking care of the child are, with additions from secondary processing of these-experiences within different networks, the only, positive contribution to the family from having the child.

This value has to be balanced not only against the loss of income (discounted by possible benefits in old age)/ but also against the loss of the experiences one might have had, or one believes one might have bad, if time had been allocated otherwise.

The value of experiences one might have derived from an alternative allocation of time depends of course on the type and diversity of activities one can take part in. But of more significance both for the value of experiences

from a child and potential alternatives are the possibilities for secondary processing. This means that the type of experiences typically being chosen by members of the different networks one is a member of, will be the optimal choice. If this also is an experience most people within an area choose, the probability for a random encounter to lead to meaningful exchanges will be the best.

In other words, the secondary processing of experiences is a general process encouraging people to choose the kind of experiences most people choose - or at least the kind of experiences chosen by the people one associates with. Because of this, living in areas where families previously have, chosen childer will by itself encourage the choice of children. In general it may be expected that if fewer people choose to stay home with a child, there will be fewer possibilities tor secondary processing of the experiences. The return of value from experiences with children will be lower. The comparative advantage of family life over alternative allocations of time will be less.

If a life centered around children and family life is called FAMILISM, the best, indicator of this may in fact be the prevalence of families which have or have had children? despite the seemingly circularity of reasoning. Other indicators of the same might be average number of

relatives per family living within the area, and, maybe, low turnover of population.

Children after the first

Additions to the number of children in the family after the first do not change the position of the family within the social structure as does the arrival of *the* first child. But the solutions of dilemmas posed by the arrival of the first child, will weigh the decision on the arrival of the second.

If women do not work, the costs of the second child in terms of money, effort and lost options will be small compared to the first. The return in terms of experiences from the greater variety of combinations within the family may reasonably be assumed to exceed the additional costs. For the third and later children the costs may be assumed to be higher than for the second while the returns from experiences will be declining rapidly, Few would find reasons going beyond the fourth child.

If the woman works, the cost of the second child may easily be larger than the cost of the first, since in addition to hiring care for the second, she also gets the problem of logistics trying to move children here and there for daycare while getting to work.

An optimal strategy in this situation might be either

to have the children with very short intervals so that they can use the same type of cere, or with very long intervals so that just one needs care at any time. For the working mother the return of value in terras of experiences will not be as large as for the one not worKing because she has less time to associate with her children. The marginal cost in time and effort caring for the second child may be just the little extra needed to have a positive return from the first child. Few working mothers might be expected to find it worthwhile to go beyond the second child.

Thus, while labor force participation will do little to affect the number of women wanting children and getting at least one, it will have great impact or the timing of births and the completed life time fertility of women. This has implications for the distribution of families according to size.

The period measure of fertility described previously is thus affected both by the relative sizes of cohorts and by their differences in work experience. Apparently the parameters mean and modal age at childbearing also must be affected by these factors.

Marriage and fertility

The timing of the first birth is closely related to age at marriage. That much is obvious.But does early or late marriage lead to more or fewer children? Does age at marriage affect the level of fertility within a population?

It was argued that labor force participation and industry within an area would affect the timing of births within a marriage. Do these factors also affect the timing of marriage? If so and if marriage does have an effect on fertility, do work participation and industry have both direct effects on fertility and indirect effects through their effects on age at marriage?

Under the old fertility regime it would seem fairly obvious that fertility was affected both by age at marriage and by proportions marrying.

However, having assumed complete individual control of fertility by means of abstinence or use of contraception in response to the socially structured life chances, cwo facts make it rather unlikely that marriage patterns car. have much effect on level of fertility - at least at *the* individual/family level.

First, note that with the decision making process assumed, the type of constraints typically being faced and the probable upper limit of life time fertility,

it will - on the average - matter little for a woman whether she marries at the age of 20 or at the; age of 30. Whether later marriage will lead to one child more or one less seems to be an open question depending mori- on the comparative success of different sequencings of life projects and culturally conditioned evalutations, than on age per se. This suggests the possibility that some of the same structural characteristics which Envoi: low fertility also will encourage high age at marriage, A high zero order correlation between level of fertility and age at marriage would hence be spurious, and ought to disappear as controls for the common causes ace intro-- duced.

For proportion married it is found that after the age of 35 it varies little among regions. In 1970 the mean per cent ever married of women aged 32 was 89.7 (the mean was taken over the F-regions used in Berge 1973) with a standard deviation of 3.4. Most women do get married sooner or later.

The argument that age at marriage really ought to have no effect on level of fertility is, however, not quite conclusive. Even if it really does not have an effect on fertility per se, there may be reasons to expect it tc show an effect nevertheless.

The first reason relates to the way records o£ marriages are collected.

The theoretical reasoning above includes consensual unions among marriages.' In 1970 consensual unions were not a very visible pattern. Yet they seem to have a long-standing history in the Norwegian, society as some kind of trial marriage.[1]

Choice of marriage and avoidance of consensual unions as it shows up in marriage records would be expected to be related to the relative strength of religious fundamentalism within an area. This suggests that the percent of votes for the Christian Peoples Party (KrF) ought to show a positive relationship on early marriage.

A second and perhaps more important argument for the possibility of finding a positive reflation between age at marriage and fertility is based on the possibility that the percent married among young women may be an indicator of a community dimension not otherwise included in the data.

The most obvious cause of a high percent married among young women is a high out migration of unmarried young

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[1] This is implied by Sundt (1855 and 1857), and was to some extent confirmed by the Norwegian Fertility Survey of 1977 (personal communication from Lora Osthby and Turid Noack)i see also Brunborq (1978).

women. A high percent married among young women might ordinarily be expected to lead to a high number of families with children. But if there is a high out migration of unmarried people it will instead be associated with a relative preponderance of old people. Even if all young women are married and have children such areas will probably not get high scores on a family/community dimension based on prevalence of families with children. Yet, importance of kinship and family relations as well as locality based community experiences may be quite as high -and probably higher- as within regions scoring high on the general family dimension.

The processes determining the flow of people from the rural fringe to urban areas will thus circumscribe the production of community value so that proportion married among young women will, despice the reasons indicating that marriage as such does not affect fetitlity, in fact show a positive relationship to level of fertility. Incidentally, the relative strength of religious fundamentalism in the rural fringe areas will reinforce the possibility of finding a positive relationship both because of its effect on the registration of marriages because religion by itself is a process producing community value in a way which maintains a high evaluation of children.

The percent married among young women may thus, be used

as an indicator of a community dimension not revealed by the data included in the factor analysis of chapter 5.

The effect of age at marriage on the age pattern of child bearing is not in question. The problem is to single out the factors responsible for differences in the age at marriage among regions.

The availability of partners is conditioned both by culture and social structure (for effect of group size see McFarland 1970). Within the larger populations studied here, availability of partners might be indicated by age specific sex ratios. One important requirement for the entry into carriage might within the present culture be availability of housing for newly established households.

However, the control of fertility the new contraceptives have made possible, also may have severed the requirement of adequate housing as a prerequisite for entry into marriage. In other words, the link between housing and marriage belongs to the old fertility regime where marriage still was linked to fertility.

The age pattern of child bearing is, however, not a question of age at jsarriage only. As important will be the spacing of births and to some degree also the level of fertility.

Of factors affecting the spacing of births, the

discussion above has identified as especially important labor force participation and type of industry. But the spacing of births also has to be related to the total fertility of a population since more births on average will imply shorter intervals between births. This is partly a c0n3quen.ce of the family building process as it has been detailed above, partly it Is a logical necessity given the biological constraints on fertility.

Empirical results on regional differentials of fertility

The four parameters necessary to describe the level and age pattern of fertility of a population are not independent (see table 6.1), The marriage patterns prevalent in Western societies will for instance imply it may be taken for granted that mean age of childbearing always will, be greater than modal age of childbearing.[1] If modal age of childbearing increases because of increasing age at marriage, also mean age at childbearing must increase. Hence, a positive correlation between mean and mode must be expected. If fertility is increasing , either mean must

[1] This is not inherently the case. Observations from Rotterdam in 1870 show for instance the opposite situation (Gilje 1972)

TABLE 6.1 COEFFICIENT OF CORRELATION BETWEEN FERTILITY PARAMETERS

NAME	MODE	MEAN	VARIANCE
TFR	-.22	.56	.78
MODE		.48	-.42
MEAN			.56

TFR - total fertility rate.

MODE - modal age of childbearing.

MEAN - mean age of childbearing.

VARIANCE - variance of the age distribution of births.

increase or mode decrease or both. Thus a negative correlation between total fertility rate and mode *and* a positive between mean and fertility is as expected. There is, however, no reason to suspect a causal process linking fertility to these parameters. Neither is there reason to suspect a causal interrelation between fertility and the dispersion of births across age even if a higher fertility usually must be expected to entail more years of childbearing and hence a higher variance. From the positive correlation between fertility and variance and the opposite signs of the correlations between fertility and mode and fertility and mean, it seems reasonable to expect opposite signs of the correlations between mode and variance and mean and variance as well,Especially it is reasonable since the difference between, mean and mode might be considered to be a measure of the age dispersion, in its own right and hence be expected to show a high positive correlation with the variance parameter.

The four parameters clearly belong together in a study of factors affecting fertility. For convenience the results will be divided between a presentatior of factors affecting the level of fertility measured by the total fertility rate and a presentation of the factors affecting the age pattern of fertility.

Variables available for causal models of the level and age pattern of fertility

The previous chapter defined and computed six general indicators or dimensions of social structure. They were labeled:

- SOCIO-ECONOMIC STATUS/URBANIZATION,
- AFFLUENCE,
- DEPRIVATION,
- FEMALE ECONOMIC ACTIVITY,
- MANUFACTURING INDUSTRY, and
- FAMILISM.

In addition to these six general variables, 53 variables not included in the factorization might be possible candidates. In table 6.2 the highest intercorrelations between variables and factors are reported. For each variable the sum (over six factors) of squared correlations computed over 102 fertility regions are reported. Variables for which the factors explain more than 50% of its variance, were excluded from consideration. This left 26 variables. Among these were, however, variables no. 5, no. 20, and no. 22 which for reasons explained in chapter 5 ought to be excluded.[1]

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[1] Variable no. 5 was too skewed. For the variables no. 20 and no. 22 there were too many missing observations.

TABLE 6.2 COEFFICIENT OF CORRELATION BETWEEN VARIABLES NOT INCLUDED IN ANY FACTORIZATION AND FACTORS BASED ON THE 30 VARIABLE SOLUTION ON 102 UNITS*

VARIABLES		FACTORS						
NO.	SHORT NAME	SES/ URB.	FAMI LISM	MANU FACT	DEPR IVAT	AFFL UENC	FEM. EDAC	SUM RSQ. 102 UN.
1	Total land area in km^2	-.81	.	.	.	.	.	82
2	Total pop. in dense areas	.69	.	.	.	.	.	76
5	Rate pop. change 1960-70	.	.	.	.	.	.	39
7	No. of agglomerations	.	.	.	.	.	.	30
8	Mean pop. size of agglomer	.74	.	.	.	.	.	80
9	% of pop. in dense areas	.72	.	.	.	.	.	88
10	% small of all farms 10+	.	.	.	.	-.65	.	50
11	% small forest properties	.	.	.	.	.	.	24
17	Men per 100 women	-.69	.	.	.	.	.	69
18	Sex ratio of dense areas	.	.50	.	.	.	.	61
20	SR age 16-39 dense areas	.	.	.	.	.48	.	47
21	SR women 20-24/m.25-29	.46	.	.	.	.	.	46
22	SR 20-24/25-29 dense area	.	.	.	.	.	.	31
23	SR in migrants(men/women)	.	.	.	.	.	.	24
24	SR out migrants(m/women)	.	.	.	.	.	.	21
25	% pupils using "Nynorsk"	.	.	.	-.52	.	.	66
26	% of pop. born abroad	.71	.	.	.	.	.	66
28	% married of women 20-21	.	.	.	.	.	-.45	48
29	% married of men 20-21	.	.	.	.	.	.	51
30	% married of women 25-29	.	.	.	.	.	-.46	64
37	Rate Non-fam.HH/one-famHH	.	.	.	.	.	.	28
38	% old of single population	.	-.51	.49	.	.	.	68
40	% of age-14 in HH w/cabin	.	.	.	.	.	.50	40
41	% of -14 in HH wout/bath	-.62	-.51	.	.	.	.	75
44	% women with own HU	.	.48	.	.	.46	.	62
45	% of all 66+ in privateHH	.	.	.	.	.	.	16
56	No. of cabins per family	.	.	.	.	.	.46	40

TABLE 6.2 COEFFICIENT OF CORRELATION BETWEEN VARIABLES NOT INCLUDED continued IN ANY FACTORIZATION AND FACTORS BASED ON THE 30 VARIABLE SOLUTION ON 102 UNITS *

VARIABLES NO.	SHORT NAME	FACTORS SES/ URB.	FAMI LISM	MANU FACT	DEPR IVAT	AFFL UENC	FEM. ECAC	SUM RSQ. 102 UN.
57	Net migration 1970	.	.48	.	.	.46	.	52
58	Gross migration 1970	.	.	.	.	.	.	46
60	Commuting ratio 1968	.	.	.	.	.	.47	60
64	% economically active	.	.	.	.	.51	.54	66
65	% w16-69 ecac +unpaid wrk	.51	.	.	.	.	.70	93
70	Blue- collar women	.	.	.45	.	.	.	25
72	% women with disability p	.	-.56	.	.	-.52	.	71
74	% of men with disab.p.-60	.	.	.	.	.	.	30
75	Regional development proj	-.55	.	.	.	-.45	.	68
83	No.of corp. in manuf&trade	.	-.56	.	.	.	.	57
84	Investm.pr corp in manuf.	.	.	.45	.	.	.	36
85	Mean volume of trade	.48	.	.	.	.	.	68
96	% votes for KrF(Chr.Peo.P)	.	.	.	-.49	.	.	44
97	% of left votes for left	.	.	.	.45	.	.	33
102	% pers.taxpayers of all	.	.	.	.	.71	.	66
104	% men 16-24 now in school	.53	.	.	.	.	.	48
105	% wom.16-24 now in school	.	.	.	-.50	.	.	50
109	Mean income of farmers	.58	.	.	.	.	.	58
110	% 0-14 with high ed.paren	.89	.	.	.	.	.	94
112	No. of pers.killed in tra.	.	.	.	.	.	.	17
113	No. of road accidents/cap	.	.	.	.	.	.	20
114	No. of lorries	.	.	.	.	.	.	49
115	Absence from work	.	.	.	.46	.	.	65
117	Physicians per capita	.48	.	.	.	.	.	58
118	Suspected criminals/capit	.	.	.	.62	.	.	61
119	Violent crimes per capita	.	.	.	.	.	.	20

* From table A5 of Appendix A.

This left 23 variables. From the theoretical discussion above the variables 21 *sex* ratio w20-24/m25-29, 28 % married of women aged 20-21, and 96, % votes for KrF seemed to be of most interest for the causal models to be estimated. But also the variables 58, gross migration, and 70, blue collar women, might be of interest.

Factors affecting the level of fertility

From the discussion so far it should be apparent that the three general indicator?: SOCIO-ECONOMIC STATUS/ URBANIZATION, AFFLUENCE, and DEPRIVATION will be used as measures of matters pertaining to income and costs. The indicators of FEMALE ECONOMIC ACTIVITY and MANUFACTURING INDUSTRY will be used as measures of labor force participation and one aspect of: the effects from type and structure of industry. Other aspects must be assumed to be measured by the URBANIZATION indicator since prevalence of agriculture or sarvice insdustry is closely related to the definition of this indicator.

The FAMILISM factor, based on numbers of families with children , will of course be the variable measuring the importance of family and family related experiences. Of these indicators the FAMILISM factor ought to show a positive relationship to level of fertility , and the three income and costs indicators ©tight to show a negative

relation. Also the two indicators of FEMALE ECONOMIC ACTIVITY and MANUFACTURING INDUSTRY ought to show negative relationships to level of fertility , if they in fact do have direct effects on it. The theoretical discussion did not resolve tha question of whether they have direct effects or not.'They are,however,expected to show indirect effects through age at marriage. The best indicator available of agts at marriage is the % married of women aged 20-21. By including the two indicators of FEMALE ECONOMIC ACTIVITY and MANUFACTURING INDUSTRY in a regression model with the variable.% married of women aged 20-21, the question way be resolved. Table 6.3 shows that FEMALE ECONOMIC ACTIVITY does not have a direct effect on the. level of fertility as measured by the total fertility rate While MANUFACTURING INDUSTRY has a direct effect. Otherwise table 6.3 confirms the expectations of the previous paragraph.[1]

One. aspect of labor force participation among women is Not included in the FEMALE ECONOMIC ACTIVITY factor. That is the proportion employed in blue collar occupations.The Stability of. different networks used for processing and evaluation of experiences connected with children

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1 The word "confirms" does not quite cover the reality Since the theoretical development was guided by a general knowledge of the results as presented in Berge 1973. The results presented are thus more illustrations of the theory than a test of it.

TABLE 6.3 REGRESSION MODEL OF TOTAL FERTILITY RATE.

EFFECT OF LABOR FORCE PARTICIPATION

VARIABLES IN THE MODEL	B	BETA	F-VALUE
SOCIO-ECONOMIC STATUS/ URBANIZATION	-.142	-.357	133.0
AFFLUENCE	-.264	-.657	473.4
DEPRIVATION	-.075	-.186	37.4
MANUFACTURING INDUSTRY	-.085	-.218	39.4
FEMALE ECONOMIC ACTIVITY	-.013	-.031	0.8
% MARRIED OF WOMEN 20-21	.017	.293	49.2
FAMILISM	.126	.318	100.7
CONSTANT	2.168		
MULTIPLE R SQUARED	.915		
ADJUSTED R SQUARED	.909		
F-VALUE, OVERALL	144.7		

was seen as important. Possibly the stability of these networks might be related to the level of migrations. Gross migration was available for inclusion into the model. Table 6.4 shows that direct effects from these variables are not detectable in the present data.

Percent married of women aged 20-21 is of course primarily an indicator of age at marriage. But above it was argued that it also might be interpreted as an indicator of a community dimension not reveled by the available data. If that is so , one would expect this variable could not entirely be replaced by the variables presumed to cause high or low age at marriage . The variables presumed to affect age at marriage were labor force participation of women and type of industry , availability of partners in different age groups and , in particular regarding the variable % married of women aged 20-21 , percent votes for KrF was supposed to be of importance . In table 6.5 the two possible models are estimated .

The model including % married of women aged 20-21 seems to be slightly better , but the case for

TABLE 6.4 REGRESSION MODEL OF TOTAL FERTILITY RATE. EFFECT OF BLUE COLLAR WOMEN AND GROSS MIGRATION.

VARIABLES IN THE MODEL	B	BETA	F-VALUE
SOCIO-ECONOMIC STATUS/ URBANIZATION	-.138	-.348	109.4
AFFLUENCE	-.263	-.654	432.5
DEPRIVATION	-.073	-.181	34.9
MANUFACTURING INDUSTRY	-.084	-.216	33.0
% MARRIED OF WOMEN 20-21	.018	.313	75.3
FAMILISM	.128	.321	73.7
BLUE COLLAR WOMEN	-.002	-.030	0.7
GROSS MIGRATION	-.002	-.007	0.0
CONSTANT	2.171		
MULTIPLE R SQUARED	.915		
ADJUSTED R SQUARED	.908		
F-VALUE, OVERALL	125.2		

TABLE 6.5 TWO REGRESSION MODELS OF TOTAL FERTILITY RATE.

EFFECT OF INDICATORS OF AGE AT MARRIAGE AND % MARRIED OF WOMEN AGED 20-21

VARIABLES	MODEL I			MODEL II		
IN THE MODEL	B	BETA	F-VALUE	B	BETA	F-VALUE
SOCIO-ECONOMIC STATUS/ URBANIZATION	-.140	-.353	133.0	-.133	-.336	71.1
AFFLUENCE	-.264	-.656	473.8	-.239	-.595	230.6
DEPRIVATION	-.074	-.184	36.9	-.054	-.135	11.2
MANUFACTURING INDUSTRY	-.089	-.229	46.3	-.037	-.094	7.5
FAMILISM	.124	.313	101.1	.125	.314	71.1
% MARRIED WOMEN AGED 20-21	.018	.313	79.2			
% VOTES FOR KRF				.006	.114	6.4
SEX RATIO W20-24/M25-29				-.005	-.172	13.9
FEMALE ECONOMIC ACTIVITY				-.047	-.117	10.2
CONSTANT	2.126			3.281		
MULTIPLE R SQUARED	.914			.895		
ADJUSTED R SQUARED	.909			.886		
F-VALUE ,OVERALL	169.1			99.3		

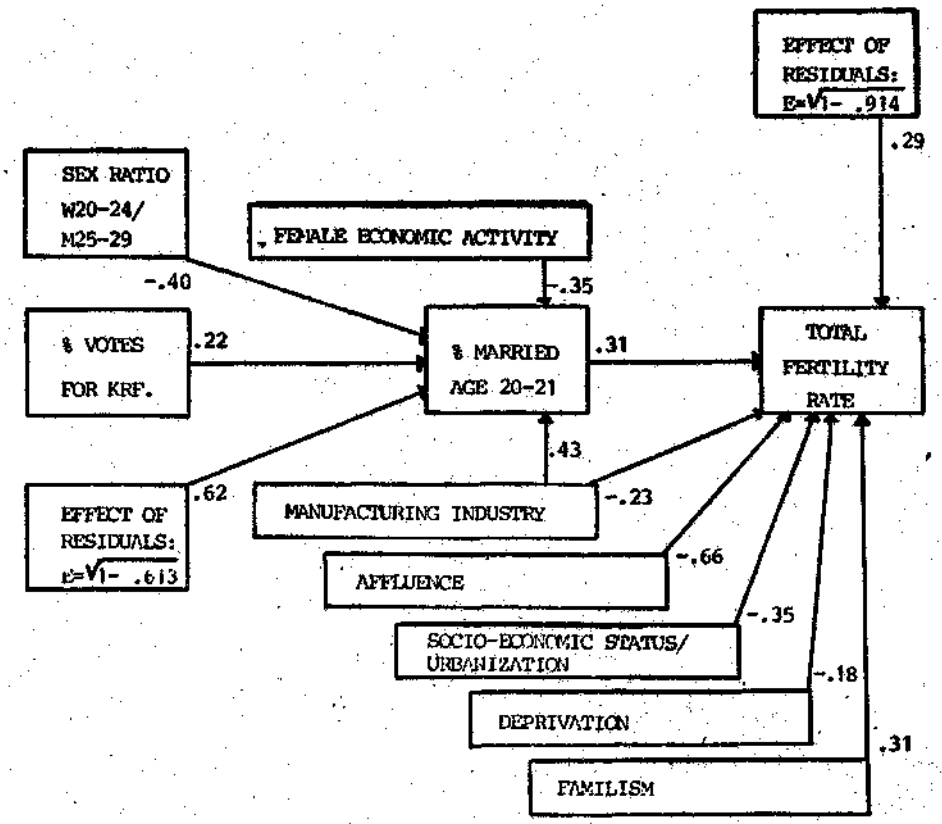
interpreting % married of women aged 20-21 as an indicator of a family/community dimension does not seem to be strengthened.

A more interesting aspect of the two models is the drop in the effect of MANUFACTURING from model i to model II. This drop can be explained by its direct and indirect effects being of opposite signs and of about the same size and the indirect effect working through % married of women aged 20-21. The opposite signs are confirmed by comparing table 6.3 and 6.6 (the indirect effect of MANUFACTURING INDUSTRY is .429*.293=.126 , its direct effect is -.213).Table 6.6 also confirms the indirect effect Of FEMALE ECONOMIC ACTIVITY. Figure 6.1 summarizes the the results on determinants of level of fertility presented so far.

TABLE 6.6 A REGRESSION MODEL OF % MARRIED OF WOMEN AGED 20-21

VARIABLES IN THE MODEL	B	BETA	F-VALUE
SEX RATIO W20-24/M25-29	-.211	-.395	33.9
% VOTES FOR KRF	.202	.222	11.4
FEMALE ECONOMIC ACTIVITY	-2.455	-.348	28.1
MANUFACTURING INDUSTRY	2.940	.429	44.6
CONSTANT	57.457		
MULTIPLE R SQUARED	.613		
ADJUSTED R SQUARED	.597		
F-VALUE, OVERALL	38.357		

Figure 6.1 A DIAGRAM OF THE MODELS OF THE TOTAL FERTILITY RATE AND % MARRIED OF WOMEN AGED 20-21



Factors affecting the age pattern of childbearing

The three parameters jointly describing the age pattern of childbearing were mean and modal age of childbearing and the variance of the age distribution of childbearing.

The variance was of necessity expected to be affected by both the mean and the mode. Table 6.7 not only confirms this expectation , but the relationship is so strong one must suspect that the definition of the variance parameter (see Appendix D) has made the parameter superfluous so that a reparametrization might make the graduation model into a three parameter model. However, investigation of this interesting possibility lies outside the scope of the present study.

TABLE 6.7 REGRESSION MODEL OF THE VARIANCE OF THE AGE DISTRIBUTION OF CHILDBEARING

VARIABLES IN THE MODEL	B	BETA	F-VALUE
MODE	-5.852	-.905	1057.8
MEAN	8.077	.998	1287.9
CONSTANT	-42.628		
MULTIPLE R SQUARED	.941		
ADJUSTED R SQUARED	.940		
F-VALUE, OVERALL	794.1		

Mean age of childbearing obviously has to be affected both by factors determining the start of childbearing and by factors determining the level of fertility. A late start of childbearing will lead to a high mean age of childbearing. A high total fertility rate will lead to the same result.

In our Western industrial culture marriage comes later than in many other cultures (Goode 1963) and childbearing usually starts during the first couple of years after marriage. There are several reasons for this. The most important may be that marriages are deferred until children are wanted or until a large part of the most fecund years of a woman have been spent, (Hence *she* has to hurry

if she wants children). Age at marriage and modal age of childbearing will therefore in our culture be closely related to the start of childbearing. Most of the differences between regions in mean age of childbearing may therefore be predicted from knowledge of modal age of childbearing and total fertility rate.

Of more theoretical interest might be the existence of any effects on the mean age of childbearing when the effects of modal age of childbearing and total fertility rate are controlled. Such effects must clearly be caused by factors affecting the timing of births.

If a better economy will make the acquisition of children easier, one might expect shorter intervals between children the better the economy is. This implies less variance in the age distribution of births and less difference between mode and mean. For fixed values of mode and total fertility one then would expect indicators such as SOCIO-ECONOMIC STATUS/URBANIZATION and AFFLUENCE to show a negative relationship to mean age of childbearing.

However, it is not possible to conclude that for DEPRIVATION the opposite will be the outcome. Above it was argued that DEPRIVATION was not simply the relative lack of income as the opposite of AFFLUENCE should be , b\st the structurally defined outcome of unsuccessful

competition for positional goods. A high degree of DEPRIVATION therefore will not imply that significantly less time and effort have been allocated to the acquisition of money by actors within the population than a high degree of AFFLUENCE implies.

If both a high degree of AFFLUENCE and a high degree of DEPRIVATION are based on a high proportion of the population giving high priority to value in goods, the proper interpretation of their relationship to the timing of births may not be one of facilitating or delaying wanted births, but rather one of minimizing the interfering nuisance from childbearing. That may mean wanting to be done with the childbirth as soon as possible.

Another possibility is that a higher degree of AFFLUENCE and DEPRIVATION corresponds to a higher proportion of one child families. For fixed age at marriage and total fertility this will imply a reduction of the mean age of childbearing. An increase in the number of one child families without reduction of fertility would imply a redistribution of births from two or three child families to families without children.

The different possibilities are not mutually exclusive, but if one has to be chosen, the last interpretation seems most plausible.

For families where community value based on experience:.s

connected with children has high priority, it may at first blush seem reasonable to assume the children would be wanted to arrive as rapidly as possible. However, a closer look at the family building process will show that for optimal return of value from the children, it would seem more reasonable to space them not too closely throughout most of the fecund period of the marriage. A choice of children now instead of going for the more optimal spacing may, however, be quite reasonable given the uncertainties of the future and the increasing probability of infecundity with increasing age of the mother.

With two competing tendencies like this, it is an open question whether indicators associated with high priority of community value such as FAMILISM and % married of women aged 20-21 will in fact show any relationship with a crude indicator of timing of births like the mean age of childbearing.

Percent married of women aged 20-21 is of course not only an indicator of some community dimension. It is primarily an indicator of forces shaping the marriage market. For fixed fertility and modal age of childbearing a higher percentage married among young women must lead to less variance in the age distribution of births and hence to a reduced mean age of childbearing. percent married of women 20-21 will therefore show a negative

relationship to mean age of childbearing despite its relation to a community dimension.

Labor force participation of women was supposed to have an effect on the timing of births. However, two tendencies may tend to weaken the possibility of detecting such effects in the aggregate data available here.

For working women there was *a* choice between two strategies. Either one might choose short birth intervals and be done with childbearing, or one might choose very long intervals. If both strategies are being chosen, - they may average out. Second it must be presumed that rather few working women go beyond the first child.

The result may be that it will be impossible to detect any effect of labor force participation on mean age of childbearing in these data.

Table 6.8 confirms that FEMALE ECONOMIC ACTIVITY and blue collar women do not have any effects on mean age of childbearing. it is also seen that FAMILISM has no effect while % married of women 20-21 does have a substantial effect. The F-values of SES/URBANIZATION and AFFLUENCE indicate that their effects are not significantly different from zero. However, the theoretical discussion indicated they ought to have effects .Conceivably the inclusion of a variable like blue collar women may affect the estimates of their effects.

TABLE 6.8 REGRESSION MODEL OF MEAN AGE OF CHILDBEARING. FACTORS AFFECTING THE TIMING OF BIRTHS; FAMILY/ COMMUNITY FACTORS AND LABOR FORCE PARTICIPATION

VARIABLES IN THE MODEL	B	BETA	F-VALUE
MODAL AGE OF CHILDBEARING	.288	.360	11.64
TOTAL FERTILITY RATE	.754	.547	15.33
SOCIO-ECONOMIC STATUS/ URBANIZATION	-.065	-.119	1.78
AFFLUENCE	-.109	-.197	3.73
DEPRIVATION	-.111	-.201	8.56
FAMILISM	.001	.002	.00
% MARRIED OF WOMEN AGED 20-21	-.024	-.308	13.38
FEMALE ECONOMIC ACTIVITY	.041	.073	1.53
BLUE COLLAR WOMEN	-.001	-.008	.02
CONSTANT	19.210		
MULTIPLE R SQUARED	.808		
ADJUSTED R SQUARED	.789		
F-VALUE, OVERALL	43.019		

Retaining SES/URBANIZATION and AFFLUENCE and removing the other variables not affecting the mean age of childbearing , the re-estimated model in table 6.9 shows all three socio-economic status indicators as well as % married of women aged 20-21 to have negative effects on mean age of childbearing.

TABLE 6.9 REGRESSION MODEL OF MEAN AGE OF CHILDBEARING. FACTORS AFFECTING THE TIMING OF BIRTHS.

VARIABLES IN THE MODEL	B	BETA	F-VALUE
MODAL AGE OF CHILDBEARING	.333	.416	19.81
TOTAL FERTILITY RATE	.737	.534	31.90
SOCIO-ECONOMIC STATUS/ URBANIZATION	-.085	-.156	4.61
AFFLUENCE	-.112	-.202	6.99
DEPRIVATION	-.101	-.182	8.10
% MARRIED OF WOMEN AGED 20-21	-.024	-.310	15.65
CONSTANT	18.197		
MULTIPLE R SQUARED	.805		
ADJUSTED R SQUARED	.792		
F-VALUE, OVERALL	65.164		

The modal age of childbearing has been said to be closely related to age at marriage. For logical reasons it was expected to have a negative relationship to the total fertility rate.

The determinants of modal age of childbearing after the effect of fertility has been controlled is related to the timing of the first birth. This is obviously related to age at marriage* The variable % married of women aged 20-21 must be expected to have a negative relationship to

the mode: The higher the percent of young married women is found to be, the lower the modal age of chiidbearing will be found to be.

Labor force participation of women must in general be expected to postpone marriage, the same must be expected where acquisition of education is important. The indicators of FEMALE ECONOMIC ACTIVITY and SOCIO-ECONOMIC STATUS/ URBANIZATION must hence be expected to have positive effects on the mode.

High priority on value in goods can not be seen to affect age at marriage per se. AFFLUENCE and DEPRIVATION should therefore not be expected to affect age at marriage. However, they may possibly affect the modal age of child-bearing through their possible links to a concentration of the fertility around one child families. For fixed total fertility and % married among young women, concentration of fertility in one child families will imply a lower modal age of chiidbearing as well as lower mean age of chiidbearing. This effect would probably be strongest for the DEPRIVATION indicator since the relative lack of success it implies would be likely to discourage large families far more than the relative success indicated by AFFLUENCE.

The FAMILISM factor can not be seen to affect either age at marriage or timing of the first birfch.

Table 6.10 confirms this. It also shovs that AFFLUENCE has no effect on the mode while DEPRIVATION has an effect.

TABLE 6.10 REGRESSION MODEL OP MODAL AGE OH CHILD-BEARING. FACTORS AFFECTING; AGE AT MARRIAGE AND TIMING OF FIRST BIRTHS : FAMILISM, AFFLUENCE AND DEPRIVATION.

VARIABLES IN THE MODEL	B	BETA	F-VALUE
TOTAL FERTILITY RATE	.321	.186	2.05
% MARRIED OF WOMEN AGED 20-21	-.050	-.505	75.51
FEMALE ECONOMIC ACTIVITY	.168	.242	21.05
SOCIO-ECONOMIC STATUS/ URBANIZATION	.360	.526	61.08
DEPRIVATION	-.288	-.417	63.38
AFFLUENCE	.019	.028	.08
FAMILISM	-.015	-.022	.11

CONSTANT	24.684
MULTIPLE R SQUARED	.809
ADJUSTED R SQUARED	.795
F-VALUE, OVERALL	56.815

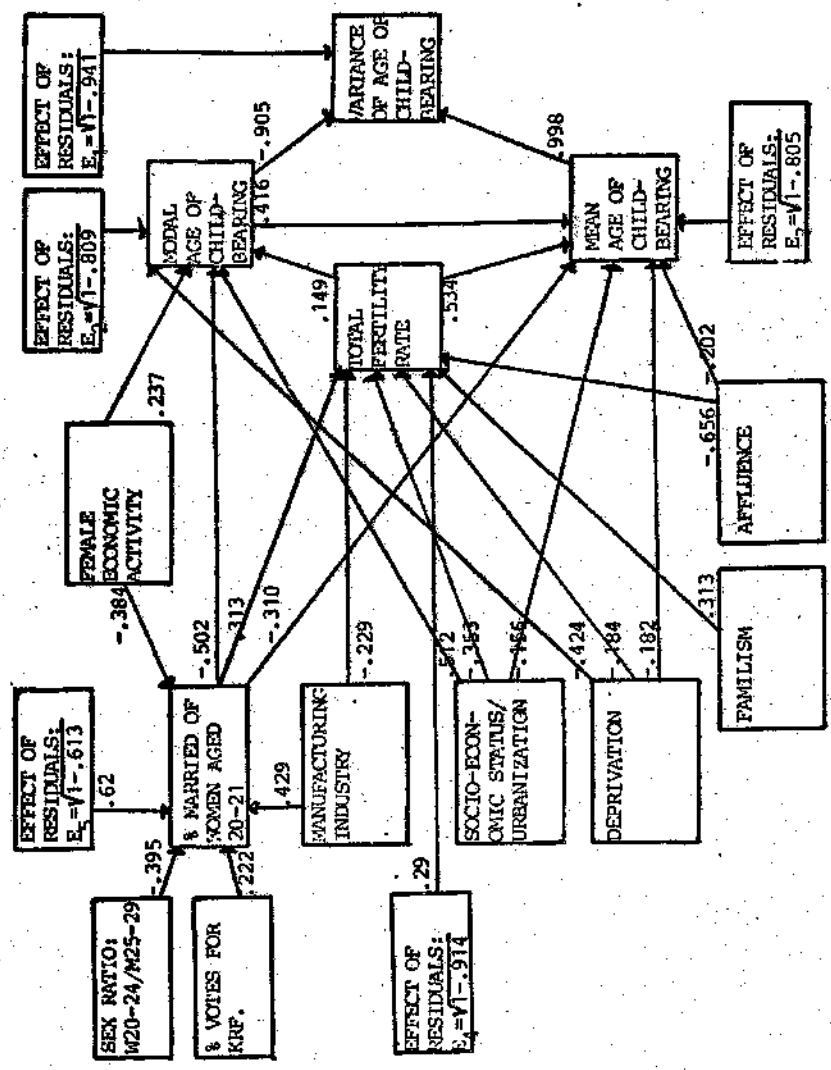
Removing FAMILISM and AFFLUENCE from the model and re-estimating it, table 6.11 presents the regression model of factors affecting age at marriage and timing of first births as these are measured by modal age of childbearing.

The results presented in table 6.5 (model I), 6.6, 6.7, 6.9, and 6.11 can now be summarized in a diagram. This is done in figure 6.2

TABLE 6.11 REGRESSION MODEL OF MODAL AGE OF CHILD-BEARING. FACTORS AFFECTING AGE AT MARRIAGE AND TIMING OF FIRST BIRTHS

VARIABLES IN THE MODEL	B	BETA	F-VALUE
TOTAL FERTILITY RATE	.257	.149	7.33
% MARRIED OF WOMEN AGED 20-21	-.049	-.502	85.36
FEMALE ECONOMIC ACTIVITY	.165	.237	22.24
SOCIO-ECONOMIC STATUS/ URBANIZATION	.351	.512	104.27
DEPRIVATION	-.293	-.424	84.15
CONSTANT	24.850		
MULTIPLE R SQUARED	.809		
ADJUSTED R SQUARED	.799		
F-VALUE, OVERALL	81.107		

Figure 6.2 A DIAGRAM OF THE MODELS OF LEVEL AND AGE **PATTERN OF** FERTILITY



Concluding discussion

The causal model of level and age pattern of fertility illustrated by figure 6.2 explains about 80% of the variance of the estimated fertility parameters.

The theory constructed thus comes very close to explaining the regional, differentials of fertility found in Norway in 1970. To this extent the aim of the study has been reached. With better data on the production and distribution of community value within different types of networks the theory might well have explained even more of the differentials.

But again it needs to be cautioned that the results are in no way a test of the theory. A general outline of the results was known (Berge 1973). The aim of the present work was precisely to construct a theory which might be used to explain those results. To conclude anything about the usefulness of the theoretical considerations one either will have to confront the theory with new data, or compare it with existing theories and published data.

By any standard the amount of materials published on various aspects of fertility is staggering (Freedman 1961 and 1975, Population Index Volume 36 to 45). To scrutinize this material in an attempt at testing the theory would require another volume -at the very least.

However, relying on a review of the literature recently published by the National Central Bureau of Statistics of Sweden (NCBS 1979), the theoretical perspective most akin to this one seems to be the one presented by Hoffman, L.W. and M.L. Hoffman (1973). Based on concepts from social psychology they try to develop a theory of the value of children to parents. Their categories seem to be compatible with the ones used here. Naturally their psychological categories are better developed and more specific than possible counterparts here. Of more significance is the fact that their model clearly is an actor oriented model where actors are motivated to get children. Their motivation is thought to be influenced by five types of variables: 1) the value of children, 2) alternative sources of value, 3) costs of children, 4) factors encouraging children, and 5) factors discouraging children. The model they present, however, does not seem to have been confronted with data.

In the survey of empirical results on the determinants of level of fertility (NCBS 1979, ch.7) any one study seem to involve only a few of the potentially relevant variables. The result is very tentative and sometimes contradictory conclusions. The longstanding discussion of the "real" income/fertility effect may illustrate one important problem difficult to solve this way. The

inconclusive results may be explained partly by insufficient attention to the problem of aggregating relationships valid for individuals to propositions about relationships among aggregate variables, partly by insufficient control of confounding factors.

These problems are of course theoretical problems and point to the necessity of a comprehensive theoretical approach to the study of fertility. The present study is one modest attempt to try just that.

A P P E N D I X A

Tables

TABLE A1 ECOLOGICAL VARIABLES FOR THE STUDY OF SPATIAL DIFFERENTIATION OF SOCIAL STRUCTURE IN NORWAY 1970

VARIABLE NO	DEFINITION	TRANSFORMATIONS
	LAND AND POPULATION	
1	The total land area of the commune in km^2	Log.transformation
2	The absolute number of people living in densely settled areas.	Log.transformation
3	The % of all farms having more than 10 dekar arable land*	
4	The total number of people	Log,transformation
5	The rate of population change from 1960 to 1970.The 1970 population divided by the 1960 population multiplied by hundred.	Log.transformation of a square root transformation
6	The number of inhabitants per km^2 land.	Log.transformation
7	The number of agglomerations in the commune.	
8	The mean population size of the agglomerations.	Log.transformation
9	The % of the population living in densely settled areas.	
10	The % of all farms with more than 10 dekar which have, 20-75 dekar arable land.	
11	The % of all forest properties which are less than 250 dekar in size.	

TABLE Al continued: ECOLOGICAL VARIABLES NORWAY 1970.

VARIABLE NO.	DEFINITION	TRANSPORMATIONS
	AGE AND SEX	
12	The % of the population of age 5 to 14 years.	
13	The % of the population of age 65 years or more.	
Ik	The % of the population aged 20 to 59 years who are 20 to 39 years.	
15	A dependancy ratio:The population under 20 years pluss the population above 59 years divided by the population between 20 and 59 years»all multiplied by hundred.	
16	The % of the women who are of age 20 to 65.	
17	The sex ratio of the total population(men per 100 women).	
18	The sex ratio of the population living in densely settled areas(men per 100 women).	
19	Sex ratio 1:Number of women age 16 to 39 per 100 men age 16 to 39.	
20	Sex ratio 1 for densely settled areas:Number of women age 16 to 39 per 100 men age 16 to 39.	
21	Sex ratio 21Number of women age 20 to *2k* per 100 men age 25 to 29.	

TABLE al continued: ECOLOGICAL VARIABLES NORWAY 1970.

VARIABLE NO, *	DEFINITION	TRANSPORMATIONS
22	Sex ratio 2 for densely settled areas:Number of women age 20 to 24 per 100 men age 25 to 29.	
23	Sex ratio of in-migrants(number of men per 100 women).	
2H	Sex ratio of out-migrants(number of men per 100 women).	
	CULTURE GROUPS	
25	The % of the pupils in the primary educational system using "Nynorsk"*	
26	The % of the population who are born ouside of Norway.	
	FAMILY AND HOUSHOLD	
27	The % of the total population aged 20 or more who are married	
28	The % of the women of age 20 to 21 who are married.	
29	The % of the men of age 20 to 21 who are married.	

TABLE Al continued: ECOLOGICAL VARIABLES, NORWAY 1970,

VARIABLES NO.	DEFINITION	TRANSFORMATIONS
30	The JS of the women of age 25 to 29 who are married.	
31	The % of the men of age 30 to 34 who are married.	
32	The % of the families with more than 1 person who have 4 or more unmarried children.	
33	The child/woman ratio:The number of children age 0 to k per 1000 women age 15 to 44.	
34	The % of all households which have unmarried children and both parents.	
35	The % of the single population(one person families) who are younger than 30 years of age.	
36	The ratio of persons divorced or seperated per 100 persons married and living with spouse.	
37	The ratio of non-family housholds per 100 one family housholds.	Logarithm.
36	The % of the single population(one person families) who are older than 66 years of age.	
39	The % of all occupied housing units which have more than 1.0 persons per room.	
40	The % of all children of age 0 to 14 who live in private housing units where some one ownes a summer house(cabin).	

TABLE Al continued:ECOLOGICAL VARIABLES,NORWAY 1970,.

VARIABLES NO.	DEFINITION	TRANSFORMATIONS
41	The % of all children of age 0 to 14 who live in private housing units without bath.	
42	The % of all children of age 0 to 14 who live in private housing units with more than 1»G persons per room,	
4?	The % of all men older than 15 years who have *"-!k<5i own housing unit.	
44	The % of all women older than 15 years who are married or separated and with their own housing unit.	
45	The % of all persons older than 66 years who live ir* criv2.t-2 households;.	
	HOUSING	
46	The % of all housing units built before 1910,	
47	The ratio of housing units built 1960 to 1970 per 100 occupied housing units.	
48	The % of occupied houaine units not owned by occupant.	
49	The % of occupied housing units rented with 'depositum*	
50	The % of occupied housing units which have bath and WC	

TABLE A 1 continued: ECOLOGICAL VARIABLES.NORWAY 1970.

VARIABLES NO.	DEFINITION	TRANSFORMATIONS
51	The % of all housing units which are in one family structures.	
52	The % of all housing units which are in farm houses.	
53	The % of all households which have at most 2 rooms.	
54	The % of all households which have at least 5 rooms.	
55	The % of all households which have telephone.	
56	The number of summer houses(cabins) per 100 families.	
	MIGRATION AND MOBILITY	
57	Net migration 1970 per 1000 of the total population the 1. of January 1970.	Add 1000 and take logarithm.
58	Gross migration 1970 per 1000 of the total population the 1. of January 1970.	Square root.
59	The % of all persons of age 16 or more who are occupied within commune of residence.	
60	Commuting ratio:Number of in-commuters per 100 out-commuters. Data from 1968.	Square root.

TABLE **Al continued: ECOLOGICAL VARIABLES,NORWAY 1970,**

VARIABLES NO.	DEFINITION	TRANSFORMATIONS
61	Total commuting? Number of (in pluss out) commuters per 100 of the total population.Data from 1968.	Square root
	EMPLOYMENT AND OCCUPATION	
62	The % of the women aged 16 to 59 who have children in the age group 0 to 12 years and who are economically active.	
63	The % of the women aged 20 to 59 who are economically active.	
64	The % of the total population who are economically **active.Logarithm.**	
65	The % of the women aged 16 to *69* who are economically active if we exclude the women working unpaid in family enterprises.	
66	The % of the women with age above 15 who have an occupation in agriculture,forestry or fishing.	
61	The % of the women with age above 15 who have an occupation outside of agriculture,forestry and fishing.	
68	The % of all men aged 16 or more who are occupied in professional or managerial occupations(occupation codes 00-33,60-69).	

TABLE A1 continued: ECOLOGICAL VARIABLES, NORWAY 1970.

VARIABLES NO.	DEFINITION	TRANSFORMATIONS
69	The % of all men aged 16 or more who are occupied in blue-collar occupations(occupation codes 50-59,70-89).	
70	The % of all women aged 16 or more who are occupied in blue-collar occupitions(occupation codes 50-59,70-89).	
71	The % of the economically active population who are self-employed.	
	INDUSTRY	
72	The % of women aged 16 to 69 who get disability pension.	
73	The % of men aged 16 to 69 who get disability pension.	
74	The % of all men with disability pension who are aged 60 or less.	
75	The total number of projects sponsored by "Distriktenes utbygningsfond."(The Fund for Regional Development) up to 1968.	Square root.
76	The number of persons aged 16 or more with main income from work in services(industry codes 811-93) per 100 persons with main income from manufacturing(industry codes 2-3).	Square root.

TABLE A1 continued: **ECOLOGICAL VARIABLES,NORWAY 1970,**

VARIABLES NO.	DEFINITION	TRANSFORMATIONS
77	The % of the total population who are dependent on agriculture for their main income(industry codes 01-02).	
78	The % of the total population who are dependent on manufacturing for their main income(industry codes 11-39» 51-52).	
79	The % of the total population who are dependent on trade for their main income(industry codes 61-66).	
80	The % of the total population who are dependent on services for their main incoue(industry codes 67-69, 81-93).	
81	The number of pensioner per 100 persons economically active.	
82	The % of all farms which are dairy farms.	
83	The total number of corporations in manufacturing and trade(industry codes 20-39,61-66).	**Logarithm.**
84	Investments in 10 000 kr. per corporation in manufacturing(industry codes 20-39).	**Logarithm.**
85	The mean volume of trade in 1000. kr; **per corporation** in trade(industry codes 61-66).	
86	The mean number of workers employed **per corporation** in manufacturing(industry codes 20-39).	**Square root.**

TABLE A1 continued: ECOLOGICAL VARIABLES, NORWAY 1970.

VARIABLES NO,	DEFINITION	TRANSFORMATIONS
87	The total number of shops for alcoholic beverages.	Logarithm.
88-93	Variable numbers not used.	
	POLITICS AND TAXES	
94	The % of all voters casting their vote, for The Labor Party(AP), Socialist Peoples Party(SP), and The Communist Party(K). Storting election 1969.	
95	The % of all voters casting their vote for The Center Party(SP). Storting election 1969.	
96	The % of all voters casting their vote for. The Christian Peoples Party(KrP) or coalitions including KrP. Storting election 1969*	
97	The % of all left votes(AP+SF+K) cast for either Communists(K) or Socialist Peoples Party(SP). Storting election 1969.	
98	Tax to the commune in kr. in 1968 per inhabitant in the commune as of 1/1 1968.	Square root.

TABLE Al continued: ECOLOGICAL VARIABLES, NORWAY 1970.

VARIABLES NO.	DEFINITION	TRANSFORMATIONS
99	Transfers from the state to cover expenditures in the cultural, educational and welfare sectors in kr. per inhabitant aged 16 or more at the end of 1970.	
100	The % of all personal taxpayers with a taxable income of kr 60 000,- or more.	-Square root,
101	The % of all personal taxpayers with a taxable income of kr 12 000,,- or less, "	
102	The % of all taxpayers who are personal taxpayers(i«e» who are paying in advance). Data from 1968.	-
	EDUCATION AND INCOME	
103	The % of all women aged 20-29 who have an education at gymnasium level II, III or higher.	
104	The % of all men aged 16-24 currently In school*	
105	The % of all wor.en aged 16-24 currently In school.	
106	The % of all aged 25-69 who have primary education only.	
10?	The * of all aged 25-69 who have education at gymnasium level II or III.	

TABLE Al continued: ECOLOGICAL VARIABLES, NORWAY 1970.

VARIABLES NO.	DEFINITION	TRANSFORMATIONS
108	The number of pupils per sehoel in the primary educational system*	
109	Mean income in-1000 kr. per farmer in 1969.	Square root.
110	The % of all children aged 0-14 who are living in families where the highest education of the main provider is at gymnasium level II or higher.	
	CARS AND PEOPLE	
111	The number of cars per 100 families.	
112	The total number of persons killed on the roads of the commune in 1969..	Logarithm,
113	The number of accidents on the roads of the commune per 1000 inhabitants aged 16 or more,	
114	The total number of lorries.	Logarithm.

TABLE A1 continued: ECOLOGICAL VARIABLES,NORWAY 1978

VARIABLES NO.	DEFINITION	TRANSFORMATIONS
	HEALTH AND CRIME	
115	The number of days of absence from work because of illness per 100 persons of age 16 or more.	Square root.
116	Index of health care expenditures.The index showes the expenditures in 1969 in relation to the mean expenditures of 1966 with the mean for 1966 equal to 100.	
117	The number of physicians per 1000 population.	Square root.
118	The number of suspected criminals per 1000 of the population aged 16 or above.	
119	The number of violent crimes per 1000 population.	Square root.

TABLE A2 DIMENSIONS OF THE NORWEGIAN SOCIAL STRUCTURE IN 1970.60 VARIABLES ON 448 UNITS OF 451 COMMUNES.VARIMAX ROTATED FACTOR MATRIX OF A PRINCIPAL FACTORS SOLUTION.

VARIABLES		FACTOR COEFFICIENTS						
NO.	SHORT NAME	AFFLUENCE	FAMILISM	DEPRIVAT-ION	SES/ URBANIZ-ATION	MANUFAC-TURING INDUSTRY	FEMALE ECONOMIC ACTIVITY	COMMUNAL-ITY
003	% farms 10+ da	-.51	.01	.08	-.54	-.44	.26	.80
004	Total population	.34	.16	.24	.56	.30	.02	.61
006	Inhabitants per km^2	.27	.16	-.08	.69	.28	-.31	.75
012	% age 5-14	-.34	.82	-.07	-.08	.01	-.11	.81
013	% age 65+	-.02	-.83	-.40	-.27	-.11	.13	.95
014	% age 20-39 of 20-59	-.01	.75	.31	.36	.06	.02	.80
015	Dependency ratio	-.54	-.26	-.54	-.42	-.09	.12	.85
016	% women age 20-65	.50	-.04	-.01	.56	.19	.07	.61
019	Sex ratio:Women/men 16-39	.57	.14	.19	.43	.10	.13	.60
027	% married age 20+	.49	.59	.00	.15	.26	-.32	.78
031	% married men age 30-34	.55	.43	.05	.25	.27	-.05	.63
032	Large families	-.78	.39	-.08	-.26	-.06	.10	.85
033	Child ratio	-.50	.53	-.16	-.23	.01	.00	.61
034	% child families	.09	.89	-.02	.06	.18	-.24	.89
035	Young one pers. families	-.03	.36	.37	.45	.02	.33	.58
036	Rate div.+sep./married	.27	-.16	.37	.63	.06	-.08	.64

TABLE A2 continued DIMENSIONS OF NORWEGIAN SOCIAL STRUCTURE IN 1970

VARIABLES NO.	SHORT NAME	FACTOR COEFFICIENTS AFFLUENCE	EAMILISM	DEPRIVAT-ION	SES/ URBANIZ-ATION	MANUFAC-TURING INDUSTRY	FEMALE ECONOMIC ACTIVITY	OOMMUNAL-ITY
039	Housing units 1.01+ pers	.00	.38	.79	.33	.10	.09	.90
042	Children in HU's 1.01+ p	-.14	.14	.77	.17	.12	-.14	.69
043	% men with own dwelling	.68	.09	-.01	.38	.23	-.07	.68
046	HU's built before 1910	.12	-.48	-.63	-.06	.11	-.02	.66
047	HU's built 1960-70	.19	.69	.34	.36	-.09	.01	.76
048	% HU's not owned by occ.	.32	.02	.33	.67	.26	.33	.84
049	% HU's rented with dep.	.32	.17	.25	.66	.07	.01	.63
050	% HU's with bath & WC	.06	.49	.26	.54	.31	.04	.70
051	% HU's in one family str	-.09	.15	.03	-.29	-.03	-.72	.63
052	% HU's in farm houses	-.17	-.22	-.47	-.60	-.29	.36	.86
053	% households with 1-2 rm	.27	-.11	.58	.48	.20	.28	.78
054	% HH's with 4+ rooms	-.35	-.02	-.73	-.40	-.17	.05	.85
055	% HH's with telephone	-.07	-.13	-.68	.18	-.16	.23	.60
059	% occupied within commun	-.07	-.13	-.03	-.21	.07	.78	.68
061	Total commuting rate	.40	.17	.09	.48	.01	-.35	.55
062	Ec.act.women with childr	-.06	.33	-.18	-.11	-.28	.63	.63
063	% women age 20-59 ec.act	.22	-.03	-.14	.14	-.21	.79	.75
066	% women with primary occ	-.13	-.12	-.33	-.42	-.29	.53	.69

TABLE A 2 continued DIMENSIONS OF NORWEGIAN SOCIAL STRUCTURE IN 1970

VARIABLES		FACTOR COEFFICIENTS						
NO.	SHORT NAME	AFFLUENCE	FAMILISM.	DEPRIVATION	SES/ URBANIZATION	MANUFACTURING INDUSTRY	FEMALE ECONOMIC ACTIVITY	COMMUNALITY
067	% women outside prim.occ	.31	.30	.42	.65	.13	.13	.81
068	% men in prof./manag.occ	.15	.16	.10	.86	-.03	-.16	.82
069	% men in blue collar occ	.40	.05	.28	.03	.70	-.04	.74
071	% men self employed	-.41	-.20	-.33	-.47	-.41	.14	.73
073	% men with disability p.	-.43	-.50	.01	-.33	-.22	-.16	.62
076	Rate occ.in sevic/manuf.	-.18	-.06	.09	.03	-.70	.21	.58
077	% dependent on agricult.	.05	-.15	-.42	-.55	-.38	.44	.84
078	% dep.on manufacturing	.32	.20	.18	.14	.84	-.07	.90
079	% dep.on trade	.43	.26	.23	.69	-.03	-.06	.78
080	% dep.on services	.24	.23	.27	.62	-.31	.13	.68
081	Rate pensioners/ec.activ	-.36	-.74	-.23	-.25	-.14	-.20	.85
082	% dairy farms	-.38	.01	-.16	-.47	-.41	.47	.78
086	Mean no. workers pr firm	.19	.15	.24	.30	.61	.00	.58
087	Vendors of alchohol	.54	-.14	.35	.34	.01	-.03	.55
094	% votes for left parties	.21	-.11	.80	-.14	-.03	-.29	.79
095	% votes for center party	.02	-.07	-.48	-.41	-.11	.46	.63
098	Commune tax per capita	.62	.07	.16	.54	.29	.09	.79

TABLE A2 continued DIMENSIONS OF NORWEGIAN SOCIAL STRUCTURE 1970

VARIABLES NO.	SHORT NAME	FACTOR COEFFICIENTS AFFLUENCE	FAMILISM	DEPRIVATION	SES/URBANIZATION	MANUFACTURING INDUSTRY	FEMALE ECONOMIC ACTIVITY	COMMUNALITY
099	State transfers per res.	-.67	.10	.05	-.33	-.34	.01	.68
100	% tax payers inc.60,000+	.31	.21	.05	.70	.24	-.15	.72
101	% tax payers inc.-12,000	-.54	-.27	-.16	-.51	-.41	.17	.86
103	High educ. women 20-29	.22	-.08	-.14	.61	-.09	.21	.50
106	% with primary school	-.41	-.19	.30	-.56	-.12	-.40	.78
107	High education	.29	.20	-.04	.87	.12	-.03	.89
108	No of pupils per school	.44	.15	.23	.63	.17	-.06	.70
111	No of cars per family	.71	.05	.04	.14	.19	.13	.58
116	Index of health care ex.	-.60	-.15	.07	-.32	-.34	-.22	.65
	FACTOR VARIANCE	8.4	6.9	6.7	12.2	4.7	4.7	

TABLE A3 DIMENSIONS OF THE NORWEGIAN SOCIAL STRUCTURE IN 1970.30 VARIABLES ON 448 UNITS OF 451 COMMUNES.VARIMAX ROTATED FACTOR MATRIX OF A PRINCIPAL FACTORS SOLUTION

VARIABLES		FACTOR COEFFICIENTS											
NO.	SHORT NAME	SES/ URBANIZ-ATION		FAMILISM		DEPRIVAT-ION		MANUFAC-TURING INDUSTRY		AFFLUENCE		FEMALE ECONOMIC ACTIVITY	
		30V	60V[1]	30V	60V[1]	30V	60V[1]	30V	60V[1]	30V	60V[1]	30V	60V[1]
003	% farms 10+ da	-.57	-.54	.01	.01	.03	.08	-.46	-.44	-.48	-.51	.17	.26
006	Inhabitants per km^2	.74	.69	.15	.16	-.03	-.08	.32	.28	.21	.27	-.18	-.31
012	% age 5-14	-.04	-.08	.83	.82	-.09	-.07	.00	.01	-.36	-.34	-.12	-.11
013	% age 65+	-.27	-.27	-.83	-.83	-.39	-.40	-.12	-.11	-.01	-.02	.09	.13
014	% age 20-39 of 20-59	.35	.36	.74	.75	.31	.31	.07	.06	-.01	-.01	.09	.02
032	Large families	-.27	-.26	.40	.39	-.11	-.08	-.09	-.06	-.76	-.78	.05	.10
034	% child families	.13	.06	.88	.89	-.01	-.02	.18	.18	.06	.09	-.21	-.24
039	Housing units 1.01+person	.29	.33	.39	.38	.82	.79	.09	.10	-.03	.00	.16	.09
042	Children in HU's 1.01+per	.16	.17	.14	.14	.82	.77	.10	.12	-.16	-.14	-.09	-.14
043	% men with own dwelling	.38	.38	.08	.09	.03	-.01	.23	.23	.70	.68	-.03	-.07
051	% HU's in one family stru	-.16	-.29	.15	.15	.03	.03	-.02	-.03	-.11	-.09	-.72	-.72
052	% HU's in farm houses	-.59	-.60	-.22	-.22	-.49	-.47	-.28	-.29	-.20	-.17	.29	.36
054	% households with 4+ room	-.38	-.40	-.03	-.02	-.79	-.73	-.17	-.17	-.32	-.35	-.03	-.05
055	% HH's with telephone	.16	.18	-.13	-.13	-.66	-.68	-.18	-.16	-.03	-.07	.26	.23
059	% occupied within commune	-.31	-.21	-.15	-.13	-.08	-.03	.03	.07	-.04	-.07	.65	.78

[1]From table A2

TABLE A3 continued DIMENSIONS OF THE NORWEGIAN SOCIAL STRUCTURE IN 1970

VARIABLES NO.	SHORT NAME	FACTOR COEFFICIENTS SES/ URBANIZ-ATION 30V	SES/ URBANIZ-ATION 60V[1]	FAMILISM 30V	FAMILISM 60V[1]	DEPRIVAT-ION 30V	DEPRIVAT-ION 60V[1]	MANUFAC-TURING INDUSTRY 30V	MANUFAC-TURING INDUSTRY 60V[1]	AFFLUENCE 30V	AFFLUENCE 60V[1]	FEMALE ECONOMIC ACTIVITY 30V	FEMALE ECONOMIC ACTIVITY 60V[1]
062	% ec.act.women with child	-.15	-.11	.31	.33	-.18	-.18	-.24	-.28	-.11	-.06	.69	.63
063	% women age 20-59 ec.act.	.04	.14	-.03	-.03	-.13	-.14	-.15	-.21	.17	.22	.86	.79
068	% men in prof./manag.occ.	.88	.86	.13	.16	.15	.10	-.03	-.03	.15	.15	-.02	-.16
069	% men in blue collar occ.	.00	.03	.06	.05	.30	.28	.69	.70	.40	.40	-.03	-.04
076	Rate occ in serv./manufac	-.04	.03	-.06	-.06	.06	.09	-.69	-.70	-.13	-.18	.17	.21
078	% dependent on manufactur	.13	.14	.20	.20	.20	.18	.89	.84	.28	.32	-.04	-.07
079	% dependent on trade	.70	.69	.25	.26	.26	.23	-.01	-.03	.40	.43	.06	-.06
081	Rate pensioners/ec.active	-.22	-.25	-.73	-.74	-.23	-.23	-.16	-.14	-.33	-.36	-.23	-.20
086	Mean no.workers per firm	.29	.30	.12	.15	.25	.24	.64	.61	.15	.19	.04	.00
094	% votes for left parties	-.15	-.14	-.08	-.11	.77	.80	-.01	-.03	.19	.21	-.29	-.29
098	Commune tax per capita	.45	.54	.08	.07	.18	.16	.29	.29	.67	.62	.15	.09
099	State transfers per resid	-.32	-.33	.10	.10	.04	.05	-.35	-.34	-.70	-.67	-.04	.01
106	% with primary school	-.50	-.56	-.18	-.19	.27	.30	-.13	-.12	-.42	-.41	-.45	-.40
107	High education	.86	.87	.18	.20	.01	-.04	.14	.12	.31	.29	.10	-.03
111	No of cars per family	.08	.14	.06	.05	.05	.04	.20	.19	.72	.71	.15	.13
	FACTOR VARIANCE	4.8		4.0		4.0		3.1		4.0		2.9	

[1] From table A2

TABLE A 4 DIMENSIONS OF THE NORWEGIAN SOCIAL STRUCTURE IN 1970.30 VARIABLES ON 102 UNITS OF 451 COMMUNES.VARIMAX ROTATED FACTOR MATRIX OF A PRINCIPAL FACTORS SOLUTION

VARIABLES		FACTOR COEFFICIENTS											
NO.	SHORT NAME	SES/ URBANIZ-ATION		FAMILISM		DEPRIVAT-ION		MANUFAC-TURING INDUSTRY		AFFLUENCE		FEMALE ECONOMIC ACTIVITY	
		30V	60V[1]	30V	60V[1]	30V	60V[1]	30V	60V[1]	30V	60V[1]	30V	60V[1]
003	% farms 10+ da	-.68	-.54	-.01	.01	-.01	.08	-.46	-.44	-.44	-.51	-.02	.26
006	Inhabitants per km^2	.86	.69	.05	.16	.09	-.08	.28	.28	.14	.27	.05	-.31
012	% age 5-14	-.17	-.08	.84	.82	-.19	-.07	-.04	.01	-.41	-.34	-.18	-.11
013	% age 65+	-.35	-.27	-.87	-.83	-.28	-.40	-.05	-.11	-.03	-.02	.02	.13
014	% age 20-39 of 20-59	.38	.36	.78	.75	.27	.31	-.02	.06	-.03	-.01	.12	.02
032	Large families	-.46	-.26	.36	.39	-.21	-.08	-.16	-.06	-.72	-.78	-.07	.10
034	% child families	.05	.06	.90	.89	-.10	-.02	.18	.18	-.05	.09	-.26	-.24
039	Housing units 1.01+person	.42	.33	.35	.38	.77	.79	.05	.10	.01	.00	.25	.09
042	Children in HU's 1.01+per	.23	.17	.02	.14	.88	.77	.18	.12	-.22	-.14	.04	-.14
043	% men with own dwelling	.54	.38	.12	.09	.14	-.01	.36	.23	.64	.68	.07	-.07
051	% HU's in one family stru	-.40	-.29	.19	.15	-.21	.03	.03	-.03	.01	-.09	-.75	-.72
052	% HU's in farm houses	-.75	-.60	-.17	-.22	-.48	-.47	-.28	-.29	-.19	-.17	-.02	.36
054	% households with 4+ room	-.52	-.40	.05	-.02	-.71	-.73	-.22	-.17	-.32	-.35	-.13	-.05
055	% HH's with telephone	.46	.18	-.16	-.13	-.59	-.68	-.14	-.16	-.19	-.07	.25	.23
059	% occupied within commune	-.47	-.21	-.10	-.13	.01	-.03	.06	.07	-.11	-.07	.32	.78

[1] From table A2

TABLE A4 continued DIMENSIONS OF THE NORWEGIAN SOCIAL STRUCTURE IN 1970

VARIABLES		FACTOR COEFFICIENTS											
NO.	SHORT NAME	SES/ URBANIZ-ATION		FAMILISM		DEPRIVAT-ION		MANUFAC-TURING INDUSTRY		APPLUENCE		FEMALE ECONOMIC ACTIVITY	
		30V	60V[1]	30V	60V[1]	30V	60V[1]	30V	60V[1]	30V	60V[1]	30V	60V[1]
062	% ec.act.women with child	-.25	-.11	.52	.33	-.23	-.18	-.37	-.28	-.07	-.06	.48	.63
063	% women age 20-59 ec.act.	.22	.14	-.01	-.03	-.12	-.14	-.29	-.21	.28	.22	.83	.79
068	% men in prof./manag.occ.	.90	.86	.16	.16	.15	.10	-.15	-.03	.11	.15	.20	-.16
069	% men in blue collar occ.	-.09	.03	-.02	.05	.25	.28	.84	.70	.24	.40	-.10	-.04
076	Rate occ in serv./manufac	.03	.03	.06	-.06	.18	.09	-.82	-.70	-.08	-.18	.20	.21
078	% dependent on manufactur	.13	.14	.16	.20	.14	.18	.95	.84	.20	.32	-.05	-.07
079	% dependent on trade	.77	.69	.22	.26	.25	.23	-.16	-.03	.31	.43	.25	-.06
081	Rate pensioners/ec.active	-.39	-.25	-.77	-.74	-.15	-.23	-.09	-.14	-.34	-.36	-.24	-.20
086	Mean no.workers per firm	.31	.30	.16	.15	.29	.24	.69	.61	.13	.19	.06	.00
094	% votes for left parties	-.22	-.14	-.14	-.11	.76	.80	-.03	-.03	.44	.21	-.23	-.29
098	Commune tax per capita	.70	.54	.02	.07	.18	.16	.26	.29	.53	.62	.23	.09
099	State transfers per resi.	-.55	-.33	.08	.10	-.04	.05	-.39	-.34	-.63	-.67	-.13	.01
106	% with primary school	-.68	-.56	-.26	-.19	.26	.30	-.06	-.12	-.27	-.41	-.43	-.40
107	High education	.92	.87	.20	.20	.02	-.04	.06	.12	.14	.29	.19	-.03
111	No of cars per family	.20	.14	.01	.05	.00	.04	.25	.19	.73	.71	.04	.13
	FACTOR VARIANCE	7.6		4.4		3.8		4.0		3.5		2.4	

[1] From table A2

TABLE A5 COEFFICIENT OF CORRELATION BETWEEN FACTORS AND VARIABLES NOT INCLUDED IN TOE FACTOR ANALYSIS

FACTORS BASED ON 60 VARIABLES AND 448 UNITS AND FACTORS BASED ON 30 VARIABLES AND 102 UNITS

VARIABLES		FACTOR COEFFICIENTS												
NO.	SHORT NAME	SES/URB-ANIZATION		FAMILISM		MANUFACT. INDUSTRY		DEPRIVAT-ION		AFFLUENCE		FEMALE EC ACTIVITY		SUM R^2
		102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102* UNIT
001	Total land area in km^2	-.81	-.47	-.13	-.09	-.32	-.15	.06	.29	-.19	-.11	.02	.42	.82
002	Tot.pop.in densely settled area	.69	.43	.03	.23	.18	.35	.39	.33	.20	.28	.24	-.07	.76
005	Rate of pop.change 1960-70	.43	.34	-.29	.55	-.08	.12	.13	.13	.03	.38	.31	.01	.39
007	No of agglomerations	-.44	.20	.08	.28	-.01	.27	-.07	.20	.04	.28	-.31	-.15	.30
008	Mean pop. size of agglomeration	.74	.44	-.03	.21	.12	.33	.34	.33	.12	.27	.33	-.05	.80
009	% of pop.in densely settled are	.72	.64	.20	.24	.29	.35	.39	.41	.23	.25	.18	-.07	.88
010	% farms of medium size	-.24	-.17	-.08	-.16	-.10	-.04	-.06	-.11	-.65	-.39	.04	.24	.50
011	% small forrest properties	.34	.09	.19	.15	.14	.11	-.10	-.24	-.22	.08	-.11	-.05	.24
017	Sex ratio of tot.population	-.69	-.62	.29	.11	-.09	-.21	-.08	.04	-.19	-.39	-.28	-.10	.69
018	Sex ratio in densely settled ar	-.37	-.30	.50	.40	.06	.07	.05	.23	-.25	-.25	-.39	-.25	.61
020	S.R. dens.areas ages 16-39	.12	.12	-.08	-.15	-.32	-.25	-.03	-.01	.48	.32	.34	.27	.47
021	S.R.women20-24/men25-29	.46	.33	-.32	-.09	.09	.20	.17	.22	.20	.28	.27	.15	.46
022	S.R.w20-24/m25-29 dens.areas	.23	.19	-.38	-.26	-.07	.02	-.04	-.01	.09	.04	.31	.21	.31
023	S.R. of in migrants	.16	.01	.03	.04	.20	-.01	.17	.14	.31	.21	-.21	-.07	.24
024	S.R. of out migrants	.13	-.03	-.01	.03	.26	.00	.21	.15	.24	.14	-.16	-.12	.21

*For sum R^2 on 448 units see table 5.2

TABLE A5 continued — COEFFICIENTS OF CORRELATION BETWEEN FACTORS AND VARIABLES

VARIABLES		FACTOR COEFFICIENTS												
NO.	SHORT NAME	SES/URB-ANIZATION		FAMILISM		MANUFACT. INDUSTRY		DEPRIVAT-ION		AFFLUENCE		FEMALE EC ACTIVITY		SUM R^2
		102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102* UNIT
025	% using "Nynorsk"	-.32	-.10	.10	-.03	.12	.20	-.52	-.46	-.41	-.26	.30	.40	.66
026	% born outside of Norway	.71	.53	.02	.06	.15	.13	-.01	.09	.36	.35	.06	-.09	.66
028	% married of women aged 20-21	-.18	-.09	.24	.18	.42	.28	-.11	-.19	-.06	.10	-.45	-.23	.48
029	% married of men aged 20-21	.34	.25	.24	.19	.40	.40	.18	.07	.37	.40	-.09	-.07	.51
030	% married of women aged 25-29	-.22	-.10	.38	.39	.42	.28	-.22	-.19	.11	.20	-.46	-.26	.64
037	Ratio of non-familyHH/one-famHH	-.40	.01	-.29	-.19	-.14	.02	-.12	-.02	.05	.12	.01	.14	.28
038	% aged 66+ of single population	.27	.15	-.51	-.32	.49	.34	-.15	-.33	.19	.40	-.23	-.25	.68
040	% aged 0-14 in HH's with cabin	.20	.08	-.25	-.26	-.03	.01	.10	.11	.19	.28	.50	.48	.40
041	% aged 0-14 in HU's without bath	-.62	-.53	-.51	-.48	-.15	-.24	-.20	-.15	.05	-.04	-.19	.04	.75
044	% of w15+ marr.or sep.with HU	-.02	-.04	.48	.51	.25	.21	-.04	.01	.46	.47	-.33	-.40	.62
045	% of all 65+ living in priv.HH	-.05	-.12	-.15	-.02	.04	-.03	-.26	-.14	-.21	-.13	-.14	-.03	.16
056	No of cabins per family	.19	.08	-.24	-.21	.06	.04	.18	.17	.24	.35	.46	.45	.40
057	Net migration 1970	.27	.25	.48	.23	.06	.10	-.04	.07	.46	.38	.01	.09	.52
058	Gross migration 1970	.33	.38	.43	.23	-.29	-.20	.10	.28	.23	-.01	.15	.01	.46
060	Ratio of in-commuters to out-com	.43	.46	-.23	-.02	.15	.22	.35	.28	.03	.06	.47	.22	.60
064	% economically active of tot.pop	.25	.17	.05	.10	-.08	-.01	.20	.22	.51	.38	.54	.39	.66

*For sum R^2 on 448 units see table 5.2

TABLE A5 • COEFFICIENTS OF CORRELATION BETWEEN FACTORS AND VARIABLES
continued

VARIABLES		FACTOR COEFFICIENTS												
NO.	SHORT NAME	SES/URB-ANIZATION		FAMILISM		MANUFACT. INDUSTRY		DEPRIVAT-ION		AFFLUENCE		FEMALE EC ACTIVITY		SUM R^2
		102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102* UNIT
065	% of w16-69 ec.act.(like 1960)	.51	.38	.18	.13	-.14	-.05	-.06	.07	.35	.31	.70	.65	.93
070	% of women 16+ in blue coll.occ	.09	.06	.17	.20	.45	.43	.06	.14	.04	-.03	-.04	-.18	.25
072	% of women 16-69 with disb.pens	-.28	-.14	-.56	-.41	-.18	-.15	.10	.02	-.52	-.50	-.06	-.02	.71
074	% of men with disb.pens.aged-60	.09	.02	.34	.12	-.22	-.05	.02	.08	-.35	-.19	-.08	-.04	.30
075	No of development projects	-.55	-.04	-.04	.07	-.41	.04	-.03	.17	-.45	-.27	-.02	.15	.68
083	No of corporations in tradesman	.36	.59	-.56	.00	.04	.38	.16	.26	-.03	.30	.32	.08	.57
084	Investment per corp. in manufac	.12	.21	.23	.11	.45	.42	.26	.27	.14	.18	-.01	.01	.36
085	Volum. of trade per corp.in tra	.48	.40	.19	.24	-.13	.07	.33	.25	.41	.32	.35	.23	.68
096	% of votes for KrF party	.03	.03	.14	.09	.12	.13	-.49	-.52	-.41	-.26	-.01	-.03	.44
097	% of left vote for far left par	.13	.11	.23	.10	.08	.09	.45	.39	.22	.12	-.04	-.10	.33
102	% personal taxp. of all taxpaye	-.32	-.23	-.01	-.05	.00	.00	-.07	.11	.71	.60	.22	.39	.66
104	% of men 16-24 in school	.53	.34	-.09	-.18	-.09	-.02	-.25	-.27	-.04	.10	.35	.22	.48
105	% of women 16-24 in school	.07	.06	-.30	-.31	-.16	-.12	-.50	-.43	-.08	-.01	.35	.30	.50
109	Mean income per farmer	.58	.09	-.05	.27	.26	.12	-.05	-.13	.36	.41	.21	-.03	.58
110	% of age 0-14 in fam.w.high ed.	.89	.85	.20	.16	.01	.10	.03	.03	.26	.35	.21	.00	.94
112	No of deaths in traffic	-.11	.26	-.17	.05	-.07	.09	.13	.20	.32	.32	-.07	.03	.17

*For sum R^2 on 448 units see table 5.2

TABLE A5 COEFFICIENTS OF CORRELATION BETWEEN FACTORS AND VARIABLES continued

VARIABLES		FACTOR COEFFICIENTS												
NO.	SHORT NAME	SES/URB-ANIZATION		FAMILIES		MANUFACT. INDUSTRY		DEPRIVAT-ION		AFFLUENCE		FEMALE EC ACTIVITY		SUM R^2
		102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102 UNIT	448 UNIT	102* UNIT
113	Traffic acc.per 1000inh.16+	.12	.09	-.03	-.01	.20	.08	.00	.06	.38	.27	-.06	.06	.20
114	No of lorries	.17	.44	-.41	.07	-.02	.29	.06	.21	.39	.55	.37	.19	.49
115	Abs.from work from illness	.27	.22	-.42	-.23	.41	.36	.46	.36	.02	-.03	.14	-.01	.65
117	No of physiicians per 1000pop.	.48	.49	-.26	-.21	-.07	.09	.34	.22	.18	.09	.36	.19	.58
118	No of suspected crim.per 1000p	.43	.34	.14	.18	-.01	.04	.62	.48	.04	-.09	.15	-.09	.61
119	No of violent crimes per 1000p	.04	.17	.05	.16	-.04	.10	.43	.34	.08	-.02	.05	-.07	.20

* For sum R^2 on 448 units see table 5.2

TABLE A6 COEFFICIENTS OF CONGRUENCE BETWEEN FACTORS.FACTOR LOADINGS FROM THE ANALYSIS OF 30 VARIABLES ON 102 UNITS AND FROM THE ANALYSIS OF 30 AND 60 VARIABLES ON 448 UNITS

ANALYSIS BASED ON 30 VARIABLES	NAME OF FACTOR	ANALYSIS BASED ON 448 UNITS											
		SES/URB-ANIZATION		FAMILISM		MANUFACT. INDUSTRY		DEPRIVAT-ION		FEMALE EC.ACT.		AFFLUENCE	
	ANALYSIS BASED ON	30 VARS	60 VARS	30 VARS	60 VARS	30 VARS	60 VARS	30 VARS	60 VARS	30 VARS	60 VARS	30 VARS	60 VARS
ANALYSIS BASED ON 102 UNITS	SES/URBANIZATION	.98	.98	.30	.31	.41	.39	.29	.23	.09	-.11	.69	.69
	FAMILISM	.33	.31	.99	.99	.17	.15	.24	.23	.06	-.03	.01	.04
	MANUFACTURING IND.	.33	.32	.14	.14	.98	.99	.31	.28	-.24	-.30	.54	.56
	DEPRIVATION	.36	.38	.21	.20	.32	.32	.98	.97	-.16	-.25	.27	.29
	FEMALE EC.ACTIVITY	.36	.45	.03	.05	-.06	-.09	-.04	-.06	.90	.80	.31	.31
	AFFLUENCE	.53	.56	-.02	-.02	.50	.47	.30	.26	.07	-.05	.97	.97
ANALYSIS BASED ON 448 UNITS	SES/URBANIZATION		1.00		.38		.43		.26		-.20		.64
	FAMILISM		.34		1.00		.24		.31		-.10		.06
	MANUFACTURING IND.		.44		.25		1.00		.31		-.26		.60
	DEPRIVATION		.33		.31		.34		1.00		-.30		.25
	FEMALE EC.ACTIVITY		.10		.00		-.18		-.23		.98		.11
	AFFLUENCE		.66		.04		.56		.18		-.02		1.00

TABLE A7 COEFFICIENTS OF CORRELATION BETWEEN FACTORS BASED ON FACTOR SCORES FROM THE ANALYSIS OF 30, 47*, AND 60 VARS ON 448 UNITS

	FACTORS BASED ON 30 VARIABLES					
	SES/ URBAN.	FAMIL- ISM	MANUF. INDUS.	DEPRI- VATION	FEMALE EC.AC.	AFFLU- ENCE
FACTORS BASED ON 60 VARIABLES						
SES/URBANIZATION	.96	-.01	.00	.06	.14	.07
FAMILISM	.03	.98	.03	.01	.01	-.04
MANUFACTURING IND.	-.01	.02	.95	.01	-.03	.04
DEPRIVATION	-.04	.04	-.01	.98	.00	-.01
FEMALE EC.ACTIVITY	-.14	-.01	-.01	-.02	.95	.01
AFFLUENCE	.05	-.01	.09	.01	.04	.95
FACTORS BASED ON 47* VARIABLES						
SES/URBANIZATION	.90	-.06	.01	.05	.18	.33
FAMILISM	.13	.96	.00	.06	.00	-.14
INDUSTRY	-.09	.09	.76	.06	-.16	.54
LEFT POL./DEPRIVA.	-.02	-.05	-.04	.94	-.16	-.07
FEMALE EC.ACTIVITY	-.25	.04	-.05	.13	.82	.26
MIGRATION	.08	.05	-.16	.06	.09	.20

	FACTORS BASED ON 60 VARIABLES					
	SES/ URBAN.	FAMIL- ISM	MANUF. INDUS.	DEPRI- VATION	FEMALE EC.AC.	AFFLU- ENCE
FACTORS BASED ON 47* VARIABLES						
SES/URBANIZATION	.92	-.06	.00	.01	.06	.32
FAMILISM	.08	.97	.01	.08	-.03	-.12
INDUSTRY	-.10	.09	.78	.04	-.15	.56
LEFT POL./DEPRIVA.	.04	-.07	-.02	.96	-.16	-.09
FEMALE EC.ACTIVITY	-.11	.04	-.04	.16	.89	.26
MIGRATION	.11	.02	-.19	.07	.05	.17

*See Appendix C

A P P E N D I X B .

The units of analysis? The fertility regions,

INTRODUCTION

■ **Data** for ecological analysis are in Norway available for **three** levels? "Fylke" {county), "kommune" (commune or **municipality)**, and "krets" (census tract). In 1970 there **were'** in Norway 20 counties, 451 communes, and 8818 census **tracts.**

Three arguments indicate that communes ought to be **chosen as** the units of analysis. For the first one will **want as** detailed regional specification as possible in **order** to control important variables such as population **Structure**, urbanization, industry, and local culture. **Foe** the second one wants as comprehensive data files as possible for the units selected, and for the third one **wants as** easy access as possible to the data on the chosen **UiattS**. These three considerations all indicate that the ■**communes** ought to be chosen as the units in this analysis.

Hence data were collected for the 451 communes of Norway **as** Of January 1» 1970.

The choice of communes as the units of analysis would **not** ordinarily merit its own appendix. But in order to **estimate** the fertility by means of the methods described in: Appendix D, the population from which the observations **are** gathered must be of a certain minimum size. Most Communes have too small population for reliable estimates Of their fertility. Two approaches riqht overcome this

difficulty. One is to add together communes until the population is large enough. The other is to add together observations on the same commune for several years. If there were no time trend in the fertility of a population, the best solution would be to aggregate observations from several years in order to maintain the largest possible regional variation. The time trend is* however; undisputa-ble (see chapter 1) and would tend to confound the measure of the fertility beyond recovery.

If$_p$ on the other hand, communes were aggregated with observations from only one year, most of the regional detail necessary to the analysis would be lost. The answer is obviously to combine the two approaches.

It was decided to aggregate observations from the four years 1968, 1969, 1970, and 1971. Four years is perhaps much considering the rapidly declining fertility Norway has experienced since about 1967. The considerations on population size (see below) made it clear that 3 years are not enough. The confounding of the fertility measure from the time trend will however be greatly reduced because of the simultaneous decline of the fertility in all parts of Norway (see chapter 1). Using observations from 4 years will reduce the required population size of the analytical units to 1/4 of the one year requirement.

Besides the compelling requirement of population size.

several other considerations ace pertinent. In particular it must be considered how the analytical results may be affected by choosing one criterion to aggregate by instead of another.

POPULATION SIZE

The necessary minimum population size may be approximated either by trials or analytically by agreeing on CHE smallest rates one wants to obtain estimates for.

Experience suggests that the results may be satisfying with as small a population as 12,000-15,000 (Gilje 1968). But this is clearly an absolute lower boundary.

Since a chisquare minimization is used to estimate the fertility, parameters it is recommended to have five births in each age category (see Lindgren1968, pp.326).

If it is required that rates as small as 5 per thousand shall be estimated, a population of a thousand women in each age category will be needed. This will indicate a total population of the unit of about 150,000-180,000 or observations from about 40,000 people each year. If one relaxes the requirement to estimates of rates of 10 per thousand, it is seen that a population of 20,000 will suffice.

Since the fertility rates of the youngest age groups (14, 15, 16, 17, and 18 years) and the oldest age groups

{ages 44 to 50) frequently are as small and smaller, and since these rates are of some importance in the estimation procedure, a population of 20,000 is about the lower acceptable boundary for the analytical units.

But, on the other hand, both the wish to keep as many units in the analysis as possible, as well as the wish to utilize the proposed estimation technique to its full advantage, indicate that there is no point in increasing the population size of the aggregates, say beyond 40,000 people, in case it can be avoided. There is, however, no way to divide the largest of the Norwegian communes. They have to be included in the analysis as they come.

ANALYTICAL EFFECTS OF AGGREGATION

Population size alone is not sufficient to group communes into fertility regions suitable for analysis.

Proximity would be a much used and seemingly natural choice as an additional, criterion. But before using such a criterion one ought to consider how it may affect the relationship between fertility and our explanatory variables.

Blalock (1964, pp.97-114) has an illuminating discussion of this problem. In order to have a baseline for comparison with the proximity grouping, he makes himself three additional groupings and investigates what happens to the

relation between the explanatory variable X and the explained variable Y. In addition to the variables X and Y, his model also contains the nuisance variables U, V, and W. They are causing variation in Y but are assumed to be unrelated to X.

Blalock first assigns his original observations to groups of increasing size at random. Next he assignes them to groups so as to maximize the variation in X, and lastly he groups his observations so as to maximize the variation in Y.

With random groupings the correlation coefficient and the regression coefficients are essentially unchanged. When the grouping maximizes the variation in X, the correlation increases with increasing size of the grouping, but the regression of Y on X is unchanged. Grouping by Y the li^also increases with increasing size of the grouping.

The reason for the different effects of the two grouping criteria is found in the effects the grouping has on the variation of the nuisance variables U, V, and W. If one groups so as to maximize the variation in X,one must expect a range of values of Y for each group, and the same holds true for U, V, and W. Since they are unrelated to X, on must expect to find random variation of U, V, and W within each of the groupings and only random differences between the means of If, V, and W for these groupings*

The analytical result of the grouping so as to maximize the variation of the independent variable is to control for the unidentified variables causing variation in Y independent of X.

When the observations are grouped so as to maximize the variation of the dependent variable, the result must be different. High values on Y do not only go together with high values on X, but also with high values on U, V, and W. Thus not only will the grouping produce little variation of X within groupings and much between, but also the variation of U, V, and W will be small within groupings and large between groupings. In the regression of Y on X the effects of X, U, V, and W are confounded and show up as an increasing regression coefficient for increasing size of the groupings.

Investigating the correlation coefficient and the regression coefficient when he groups his data according to proximity, Blalock finds that for his data a grouping by proximity is closer to a grouping by the independent variable than either to grouping by the dependent variable or random groupings.

However, in other instances a grouping by proximity may be closer to grouping by the dependent variable Y. And if one wants to avoid influence of the "nuisance" variables, one certainly should prefer to group by X. At least

grouping by Y should be avoided.

Unfortunately, the present situation is not as clear cut as this. The dependent variable is fertility; and the reason for grouping communes is that larger populations are needed in order to estimate the fertility. Grouping so as to maximize the variation of the fertility measure is of course not possible whether one should want to do so or not. But the question of whether to avoid grouping by the dependent variable or not is not as straightforward as it might seem. As long as all explanatory variables are not identified, grouping by one or two of them will control out the influence of other possibly important variables. And even if it was possible to group by the fertility variable there are also real nuisance variables which then might really confound the results.

To group by proximity is clearly a solution. But how might proximity relate to fertility? A basic assumption is that the regional variation of the fertility at one point in time is caused by differences in the social structure surrounding the families living in the different regions. More specifically, it is expected that both cultural and economic aspects of the social structure will be identified as important to the level of fertility.

It is known from earlier investigations (Berge 1973$_f$ 1974, and 1977) that neighboring communes will tend to

have similar fertility. It is also known that the spatial distribution of culture will be continuous in the sense that neighboring communes will tend to have similar local cultures. But for economic aspects of social structure one will often find as great differences between neighboring communes as between any two randomly chosen communes.

Grouping the communes by proximity will hence approximate a grouping by fertility and culture. The economic causes of the variation in fertility will tend to be controlled for.

This will consequently lead to underestimation of the effect of economic structure on fertility.

The conclusion must be to introduce an indicator of economic structure into the grouping procedure along with proximity.

GROUPING TO MAXIMIZE VARIATION IN CULTURE

In grouping the communes into fertility regions,proximity of the communes will be used as an approximation to difference in local cultures the closer the two communes are, the more similar,on average,their local cultures will be.

However, there are also cases where evidence exists of clear cultural boundaries separating larger regions, like the separation of the western part of Norway from the

eastern part. Usually such sharp boundaries will follow natural boundaries like mountains, but again not always. **One** indicator of a non-physical boundary is between **different** dialects of the Norwegian language.

In order to ensure a maximisation of the variation of the cultural aspects of social structure, it was decided to use a code for local language in addition to proximity. **This makes** it possible to avoid grouping communes from different sides of the sharper cultural boundaries indicated by boundaries between dialects.

The boundaries between different types of dialects of Norwegian were detenainded from* Helleland and Papazian **(1973**, pp.44-45, See also Haugen **1975).** Each cosine **was** assigned a four digit code giving the commune a complete classification on three levels. The meaning of the different digits is presented in table Bl.

GROUPING TO MAXIMIZE VARIATION IN ECONOMIC STRUCTURE

In order to avoid reduction in the variation of the economic aspects of the social structure, one ought to select neighboring communes with similar economic structure for grouping together rather than neighboring communes with different economic structures.

Data on these aspects of the local social structure are fairly abundant. A convenient summary of much relevant

TABLE Bl CODE FOR DIALECTS OF THE NORWEGIAN LANGUAGE

First digit of code:

i; EAST NORWEGIAN 2: WEST NORWEGIAN

Second digit of code:

1: EASTERN DIALECTS ("Austlandsk")
2: CENTRAL EASTERN DIALECTS {"Midtlandsk")*
3: NORTH EASTERN DIALECTS ("Troendsk")
4: WESTERN DIALECTS ("Vestlandsk")
5: NORTH WESTERN DIALECTS { "IMordlandsk")

Third and fourth digit of code:

01s VIKVAERSK
02? MIDAUSTLANDSK EASTERN DTALFCTS
031 OPPLANDSK EASTERN DIALECTS
04: OESTERDALSK

05: VEST-TELEMAAL
06: AUST-TELEMAAL PFNTRAT FAqTFPN
nTArFrT<3
07: VALDRES/HALLINGDALSK C^{ENTR}AL EASTERN DIALLCIS
08: GUDBRANDSDALSK

09: INNTROENDSK
10: UTTROENDSK NORTH EASTERN DIALECTS
11: NAMDALSK

12: SOERLANDSK
13: SOER-VESTLANDSK WESTERN DIALECTS
14: NORD-VESTLANDSK

15: HELGELANDSMAAL
16: NORDLANDSK NORTH WESTERN DIALECTS
17; TROMSMAAL

data is found in the commune codes of the Central Bureau of Statistics. They have published one detailed basic code for the communes and one more simple one digit code (see Rideng 1974). The two codes will be referred to like this: basic code/type. A fairly detailed description of both of these codes based on Rideng's (1974) description of them follows,

Basic code of commune

The basic code is divided into three parts like this: xx-t-tx where x denotes a letter and t denotes a digit. The first part of the code is a code of industry, the second part is a code of population density, and the third part is a code of centrality.

i. The code of industry..

In the following it shall by service industries be meant trade, finance, communication, and service industry (codes 6100-6999,. 7100-7899, and 8100-9399 xn Central Bureau of Statistics 1960). By primary and secondary industries it shall be meant agriculture/forestry, fishing/ whaling, manufacturing, and mining (codes (HOG-0299, 0400-0699, and 1100-3999 in Central Bureau of Statistics 1960).

CODE

- TT-means that the service industries employ more than twice the number of people employed by primary and secondary industries.
- Tl-means that the service industries employ more people than primary and secondary industries and **that** manufacturing is the largest of the primary **and** secondary industries.
- TP-means that the service industries employ more people than primary and secondary industries and **that** either fishing or agriculture is the largest of **the** primary and secondary industries*

If primary and secondary industries are larger than service industries, then

CODE

- L-means that agriculture employs more than two-thirds of the people employed by primary and secondary industries,
- F-means that fishing employs more than two-thirds of **the** people employed by primary and secondary industries, and
- I-means that manufacturing employs more than two thirds of the people employed by primary and secondary industries or that manufacturing and fishing are the two largest industries with manufacturing

twice as large as fishing.

The combinations LF, FL, LI, IL, IF, and FI indicates first the largest, then the second largest of the primary and secondary industries in the case where none of them dominate.

ii. The code of population density.

If t equals the percentage of the population living in densely populated census tracts then each commune is given a code of density according to the following table.

CO	
0	*i* tit 10
1	•
2	» 20«tft30
3	30*t*40
4	40«t«50
5	50*t*60
6	60*tS70
7	70«t*80
8	80<t±90
9	90<t
⋮	

iii. The code of centrality.

First three levels of urban settlements are defined like this:

An urban settlement of level 3 means that the commune must have:

- a population of more than 50,000 people,
- a university or college

and the commune ought to have:

- regular communication by air to Oslo or to a foreign country,
- very good boat - and/or railroad communication lines,
- a large hospital with specialized wards,
- theatre and large symphony orchestra,
- first quality hotels, restaurants, etc.

The following communes qualify: Oslo, Kristiansand, Stavanger, Bergen, and Trondheim.

An urban settlement of level 2 means that the commune must have:

- a population of more than 10,000 people,
- a teachers college, gymnasium (high school), and vocational schools,
- at least two daily newspapers, and the commune ought to have:
- good communication lines to Oslo or to regional centers (level 3) by railroad, boat or airplanes,
- hospital,
- liquor shop,
- quality hotels and restaurants,
- daily cinema, and
- its own police office and car inspector.

An urban settlement of level 1 means that the commune must have:

- a population of more than 5,000 people, and the commune ought to be:
- a trading center with most types of shops present, and to have
  - fairly many different occupations.

The code of centrality for the commune is based on traveling distance from the point of population concentration within the commune to the nearest urban settlement by fastest public communication which has several daily departures.

The following centrality codes are used:

CENTRALITY CODE

3 s means communes with a traveling time of less than 1 and 1/4 of an hour (1 and 1/2 for Oslo) from an urban settlement of level 3, 2 s means communes with a traveling time of less than 1 hour from an urban settlement of level *2*, 1 : means communes with a traveling time of less than 3/4 hour from an urban settlement of level 1, and 0 % means all other communes.

The centrality code is qualified by either the letter A or the letter B,

A s means that the commune is less than 2 and 1/2 hour traveling distance from an urban settlement of

level 3 (3 hours if it is Oslo), and

B : means that the commune is not that close to a level 3 settlement.

Type of commune.

The type of the commune is based on the basic code. Industry is defined as above. Three levels of centrality are indicated:

a. highly central^means that the commune is a regional center (Oslo, Bergen, Trondheim, Stavanger, and Kristiansand) or lies within a daily commuting distance of such a center (centrality code 3A of the basic code).

b» central_t means that the commune includes an urban settlement with more than 10,000 residents or lies within a daily commuting distance of such a center. In addition the commune must have a "reasonable" travelling time for a day trip to the nearest regional center {centrality code 2A of the basic code)=,

c. communes not satisfying the requirements listed above are considered to be less central.

In the following definitions the location is not taken into consideration for the types 1,4, and 9,

TYPE to AGRICULTURAL COMMUNES

A greater number of residents are employed in primary and secondary industries than in service industries. In addition at least one of the following requirements must be satisfied: (a) more than two thirds of the persons employed in primary and secondary industries are engaged in agriculture and forestry etc., and (b) a greater number of persons are employed in agriculture/ forestry than in fishing$_f$ which again employs more than manufacturing.

TYPE 2. LESS CENTRAL, MIXED AGRICULTURAL AND MANUFACTURING COMMUNES

More residents are employed in primary and secondary industries than i service industries. No single type of the primary and secondary industries employs more than two-thirds of those employed in primary and secondary industries. Among these industries fishing employs the smallest number of residents. The commune is less centrally located.

TYPE 3. CENTRAL MIXED AGRICULTURAL AND MANUFACTURING COMMUNES

This type satisfies the same industrial requirements as type 2. The commune is, however,

centrally located.

TYPE 4. FISHING COMMUNES

More residents are employed in primary and secondary industries than in service industries. Fishing employs more persons than does agriculture/forestry and employs at least half the number of those employed in manufacturing.

TYPE 5. LESS CENTRAL MANUFACTURING COMMUNES

More residents are employed in primary and secondary industries than in service industries. In addition at least one of the following requirements must be satisfied: (a) manufacturing employs more than two thirds of those employed in primary and secondary industries, and (b) manufacturing employs more than twice as many residents as does fishing, which again employs more persons than agriculture and forestry. The commune is less centrally located.

TYPE 6. CENTRAL MANUFACTURING COMMUNES

This type satisfies the same industrial requirements as type 5. The commune is however, centrally located.

TYPE 7. HIGHLY CENTRAL, MIXED SERVICE AND MANUFACTURING COMMUNES.

More residents are employed in service industries than in primary and secondary industries. Manufacturing employs more persons than any primary industry. The commune is highly centrally located.

TYPE 8. OTHER MIXED SERVICE AND MANUFACTURING COMMUNES

This type satisfies the same industrial requirements as type 7. The commune is, however, not highly centrally located.

TYPE 9. OTHER COMMUNES

More residents are employed in service industries than in the primary and secondary industries. Primary industries employ more persons than does manufacturing.

THE FERTILITY REGIONS

Four criteria have been defined to help determine which communes to group together, The fertility regions ought to have a population size of 20-40,000. The regions ought to be one piece of land if possible. They ought not to be divided by major language boundaries. And the economic structure of the communes of a fertility region ought to be as similar as possible.

The 451 communes of Norway as of January 1, 1970 are distributed according to size as shown in table B2(see table B4) .

TABLE B2 THE COMMUNES OF NORWAY 1970 DISTRIBUTED ACCORDING TO POPULATION SIZE

POPULATION SIZE	NUMBER OF COMMUNES
999	19
1,000- 2,499	93
2,500- 4,999	142
5,000- 9,999	113
10,000-24,999	58
25,000-39,999	17
40,000-49,999	3
50,000-99,999	3
100,000+	3
SUM	451

It is seen that at least nine fertility regions made out of the nine largest communes will be larger than desired. It is also possible that considerations for the other criteria will force an acceptance of regions with both more and less people than desired.

As a point of departure for the construction of regions those proposed by Rideng {1973) have been used. The fertility regions proposed by Rideng were based primarely on the basic commune code and with a slightly larger population: 35-50,000 people Rideng ended up with 77 regions

of which only a few were in one piece.

The fertility regions proposed for the present study are defined in table B4. A total, of 102 fertility regions are defined. They have a distribution according

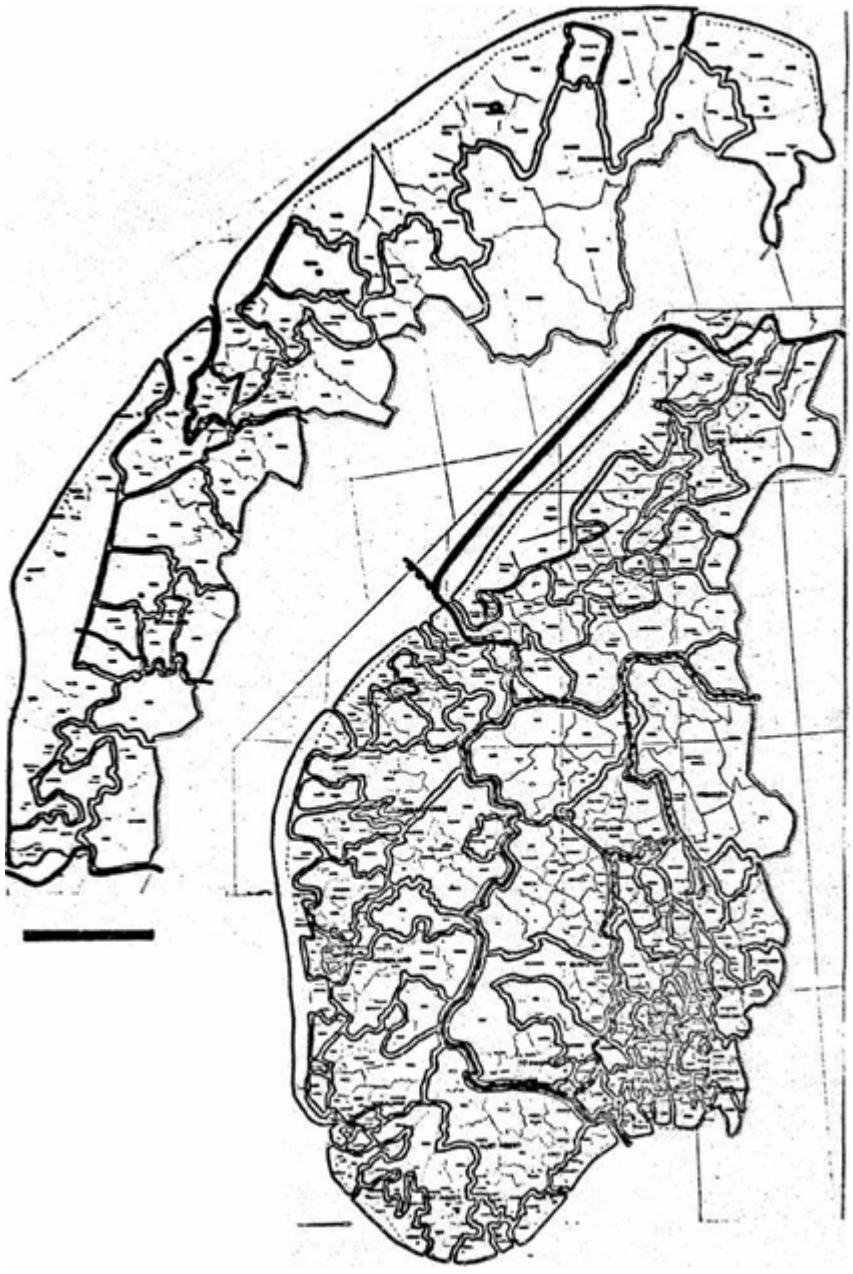
to size as shown in table $B3_f$ and are outlined on the map in figure B.io

TABLE B3 FERTILITY REGIONS IN NORWAY 1970 DISTRIBUTED ACCORDING TO POPULATION SIZE

POPULATION SIZE	NUMBER OF F-REGIONS
-18,000	0
18,001-20,000	3
20,001-24,000	14
24,001-36,000	55
36,001-40,000	15
40,001-42,000	4
42,001-76,000	6
76,001+	5
SUM	102

In addition to the criteria used for grouping the communes, table B4 also contains an estimate of the total fertility rate for the communes based on aggregated data from the years 1968-75. The estimates are not graduated (see appendix D). This means that the number of observations on which to base the computation of the rates

Estimates were made available to the project by the Central Bureau of Statistics,



ought to have been at least 40/000. With observations from 8 years the estimates of rates for the communes with smallest population (less than ca. 5,000) will have rather high variance. From table B2 it is seen that more than half of the communes have less people than 5,000. In addition to this problem it is also known that the time trend of the fertility will tend to confound the measure.

With these reservations in mind the fertility rates presented in table B4 will be used to provide a very pre-liminar test of whether the proposed grouping has increased the variance of the fertility variable.

The F-statistic (the mean between group sum of squares divided by the mean within group sum of squares) as computed by the SPSS's ONEWAY-program is 7.3 and clearly significant (at the 1% level with (30, 60) degrees of freedom the null-hypotheses of no effects is rejected if the F-statistic is greater than 2,03 (table IVb in Lindgren 1968)) .

The F-statistic of 7.3 is, however^ only slightly larger than the comparable value of 6.8 for the grouping used in Berge (1974). The increase is probably due to the larger number of regions in the present grouping (102 compared to 77) .

Thus it may be concluded that the available **information indicates the** proposed F-regions can be used as analytical **units for the** study of the social determinants of fertility.

TABLE B4 FERTILITY REGIONS (F.AREAS) DEFINED BY COMMUNES **INCLUDED. COMMUNES** CHARACTERIZED BY POPULATION **SIZE , CODE** FOR LANGUAGE, AND CBS's COMMUNE **TYPE CODE.**

No., of Stace of'fertility ferfc- area*

■ a r e a

iKo*. and' nasae oF

Popul- ation. Dec ,31*- 1970.	Code' .' fo-r . uage,

CBS's . Wean. eoiwittin'te f ert'il f t y type - ' • tor: code, I96&-75-.

X " **EALSES/ASXZM'**

0101 Balden	.26687	1101	1-7-2A/6	2"253
012* Askin	10604	11.01	I-8-3A/6	216?
H*2 **Sua**	,57291			
Heaa		'■ .1101	6	2210
;. Stand- dev,				• • •
2 12tDRS ISSTFOLD				
011% Yartelg. ■	**1432**	. 1101	**■ IL-1-2A/3**	2121
0X18 Aresarlc	1362	1101	U-0-2A/3	2452
. . 0119 Marker	3309	1101	XJ-3-2A/2.	2587-
0122 Ti*$£$sfead-	4008	1101	U-3-3A/3	2'! 17
0123 Spydeberg	**■3351**	■1101	IL-3-3A/5	2166'.
©125 Eidsberg-	8346	1101	IL-5-3A/5	2206
0127 Skittevedfc	2413	1101	1L-1-2A/3	2581
0128 RaJckestad	6619	1101	**■LI-'3—?4/3**	2480'
013? Viler	2360	1101	M-6-3A/3	2561
0X38 RobfSl .	2975	1101	IL-3-3A/3	?574
31*10 Sua: ■ - '■	. 36675			
.Mean		**.1X01**	5	2415'
Stand, **dev.**				183
5 ' SftRPSBORU ' : '■ ■				
0102 Saros^org	13363	1101	I-9-2A/6	2209
0115 Skjeberg	12525	1101	1-6-2A/6	2306
0130:' Tuae	16032	1101	I-9-2A/6	2303
H»3 *Sum*	41920			
Mean		1101	6	2273
Stand, dev.				55

No.of Nans of fertility **fert-** area. **ility** No. and name of **area** commune.	Popul-ation Dec.31. 1970.	Code for lang-uage.	CBS's commune type code.	Mean fertility for 1968-75/

4 PREDRIKSTAD

0103 Fredrikstad 300 09 1101 TI-9-2A/8 2120

ONS0Y/BORGE				
0111 Hvaler **0113** Borge **0131** Rolvs0y 0133 Krakertfy 0134 Ons0y	2247 9970 4959 7202 1131 3	OO OO O	PI-**1-2** AM I-7-2A/6 I-8-2A/6 I-8-2A/6 I-6-	2336
N*5 Sun Mean Stand, dev.	35691	**1101**	6	2262

6 MOSS

0104 **0135** **0136** **0211**	Moss Rade' Rysge Vestby	25210 4463 9476 5713	1101 **1101** 1101 1101	X-9-3A/6 TI-3-2A/8 TI-6-3A/7	2207
YTRE	Sum **Mean Stand, dev.** FOLLO	44862	**1101**	• 6	2322
0215 **0216** **0217**	Frogn Nesodden Oppegard	7771 9228 133 89	1101 1101 1101	TT-7-3A/7 TT-7-3A/7 TT-9-3A/7	2365
NO	Sum Mean Stand, dev.	30388	1101	7	2260

No.of fertility area.	Name of **fert-ility** No. and name of **area,** commune.	Popul-ation Dec.31. 1970.	Code for lang-uage.	CBS's commune type code.	Mean fertilit for 1968-75.
	INDRE FOLLO				
0213 Ski 0214 As 0229	Eneuakk	15573 9338 5005	**1101 1101** 1102	TT-7-3A/7 TT-5-3A/7 TI-3-3A/7	2301
N=3 Sum Mean Stand, dev.		29916	**1101**	7	2457

2 1 9 **1 3 9** 7 0

9 AURSKOG-H0LAND

0121 R0mskog 2		651	110	LI-0-0A/2	2076
0221 Aurskog-H01and	**11141**	1102		IL-2-3A/3	2253
0236 Nes 2	Sum	30962		IL-2-3A/3	2259
	Mean	12801	110	IL-2-1A/2	2380
0420 Eidskog 2	**Stand, dev.**	6363	110		

1 1 0 2 **3** **2 2 4 2**

10 S0RUM/FET/NANNESTAD

0226 SpJrum 1102		8354		TI-4-3A/7	2288
0227 Pet 1102		6632		I-4-3A/6	2491
0234 Gjerdrum		2509	1102	TI-2-3A/7	2470
0238 N Nannestad = 4	**Sum**	24098		TI-3-3A/7	2126
	Mean	6603	1102		
	Stand, dev.				

1 2 5 2 4 1 9 9 1

No.of fert- ility area.	Name of fertility *area. tio,* and natr.3 of commune.	Popul- ation Dec.31. 1970.	Code for lang- uage .	CBS's commune type code.	Mean fertility for 1968-75.
11	HITTEDAL/LflRENSKOG/aELINGEN				
	0228 Rslingen 023Q Lo*renskog 0233 Mittedal	9712 17236 12027	1102 1102 1102	TT-8-3A/7 TI-9-3A/7 TI-8-3A/7	2346
	N*3 Sum Mean Stand, dev.	38975	1102	7	2423
12	SKEDSMO				
	0231 Skedsmo	31196	1102	TI-9-3A/7	2297
13	OSLO				
	0301 Oslo	481548	1102	TT-9-3A/7	1776
14	BfiRUH				
	0219 Barum	76580	1102	TT-9-3A/7	1958
15	ASKER				
	0220 Asker	31702	1102	TT-6-3A/7	2143

16 LIER/R0YKEN

0626 Lier	15O3M 1102 TI-6-3A/7 2249 10613 1101 TI-7-3A/7 2441				
0627 Rtfyke n					
M=2 Sum Mean Stand, dev,	256 47	1 1 0 2		7 2345	

No.of fert- ility No.	Name of area. and name of area, commune.	Popul- ation Dec.31. 1970.	Code for lang- uage .	CBS's commune type code.	Mean fertility for 1968-75.
	17 DRAMMEN				
	0602 Drammen	49808	1101	TI-9-3A/7	2111
	18 HOLMESTPAND				
	0628 Hurum	6353	1101	I-7-3A/6	2411
	0702 Holmestrand	7396	1101	I-7-3A/6	2140
	Q711 Svelvik	^375	1101	I-7-3A/6	2688
	0713 Sande	5868	1101	I-3-3A/6	2329
	N=4 Sum	23992	1101		2392
	Mean Stand, dev.				2
	19 HORTEN				
	0703 Horten 071? Borre	14252 7156	1101 1101	TI-9-2A/8- TI-7-2A/8	2347 2371
	N=2 Sura Mean Stand, dev.	21408	1101	8	2359 * •«»
	20 SEM				
	0721 Sem	19924	1101	TI-8-2A/8	2187
	21 T0NSBERG				
	0705 T0nsberg 0722 N0tter0y 0723 Tj0me	10862 15924 2890	1101 . 1101 1101	TI-9-2A/8 TI-8-2A/8 TT-3-	1871 2125 2243
	N=3 Sum Mean Stand, dev, *	29676	1101	8	2080 190 |

No. of fertility area.	Name of fertility area.	Population Dec. 31. 1970.	Code for language.	CBS's community type code. 75.	Mean fertility for 1968-
22	SANDEPJORD				
0706	Sandefjord	32066	1101	TI-9-2A/8	2306
0720	Stokke	6630	1101	I-3-2A/6	2394
	Sum	38696	1101		8 2350
	Mean				
	Stand, dev.				
N = 2					
23	**LARVIK**				
0707	**Larvik**	10227	1101	TI-9-2A/8	2056
0708	Stavern	2121	1101	TI-9-2A/8	2362
0725	Tilling	3281	1101	I-6-2A/6	2390
0726	Brunlanes	1667	1101	I-4-2A/6	2304
0727	Hedrum	7836	1101	I-5-2A/6	2145
	Sum	32466	1101		8 2159
	Mean				
	Stand, dev.				
24	PORSGRUNN				
0805	Porsgrunn	31628	1101	I-9-2A/6	2300
25	SKIEN				
0806	Skien	45471	1101	TI-8-2A/8	2220
0819	Nome	7252	1101	I-5-2B/5	2028
N=2	Sum	52723			8 2124
	Mean				
	Stand* dev.				

No.of fertility area.	Name of fert-ility No. and name of area commune.	Polul-ation. Dec.31. 1970.	Code for lang-uage.	CBS's commune type code.	Mean fertilit for 1968-75
26	INDRE VESTPOLD				
	0714 Hof	2255	1101	IL-2-2A/3	2321
	0716 Vale	2962	1101	IL-0-2A/3	2536
	0718 Rarcnes	2751	1101	LI-0-2A/3	2720
	0719 Andebu	3692	1101	IL-0-2A/3	2350
	0728 Lardal	2271	1101	LI-1-0A/2	2279
	0811 Siljan	1624	1101	LI-3-2A/3	2303
	0822 Sauherad	3826	1206	LI-1-1A/2	2439
	N=7 Sum	19381			
	Mean		1101	3	2421
	Stand, dev.				**159**
27	EIKER				
	0623 Modum 0624 Ovre Eiker 0625 Nedre Eiker	11744 13359 14577	1102 1102 1102	I-5-2A/6 I-6-3A/6 I-9-3A/6	2121
	N*3 Sum Mean Stand, dev.	39680	1102	6	2201
	RINGERIKE				
28	0532 Jevnaker 0533 Lunner 0601 Rinserike	5026 5820 29184	1103 1103 1102	1-6-2A/6 TI-3-3A/7 TI-5-	2178
	N=3 Sum Mean Stand, dev.	40030	1102	8	2238

2246692235 2388132147

j

No.of fertility area, commune	Name of area. No. and name of area	Popul- at Dec.31. 1970.	Code for language. ?5«	CBS's commune type code.	Mean fertil for 1968-
29 GRAN/VESTRE TOTEN					
	0529 Vestre Toten 053^ Gran	12068 12078	1103 1103	I-5-2A/6 XL-3-3A/3	2553
	N=2 Sum Mean Stand, dev.	21146	1103	3	2185
30 LAMD/TOTEN					
	0239 Hurdal 0528 0stre Toten 0536 S^ndre Land 0538 Nordre Land	21913713 W7 7065	1102 1103 1103 1103	LI-0-0A/2 IL-2-2A/3 IL-2-0A/2	2238
	N=4 Sum Mean Stand, dev.	29320	1103	3	2240
31 GJ0VIK					
	0502 Gj0vik	25203	1103	I-6-2A/6	2151

32 LILLEHAMMER

0501 Lillehammer	20548	1103	TI-7-2A/8	2029

33 RINGSAKER

0412 Ringsaker	28828	11103	I-3-2A/6	2369

No.of fertility area, commune.	Name of area. No. and name of area.	Popul-ation Dec.31. 1970.	Code for fertility lang-uage. 75*	CBS's costnune type code*	Mean fertil for 1968-
34	HAMAR				
	0401 Hamar 0414 Vang	15777 888 1	1103 1103	TT-9-2A/8 TI-5-2A/8	1902 2049
	N-2 Sum Mean **Stand.** dev» STANGE/L0TEN	24658	**1103**	8	1976 • • • »
35	0415 Ltften 0417 Stange	6214 173 03	1103 1103	IL-3-2A/3 XL-3-2A/3	2054 1994
	N=2 Sum Mean Stand, dev, ULLENSAKER/EIDSVOLL	23517	1103	3	**2024** • •«•
36	0235 Ullensaker 0237 Eidsvoll	15800 133 83	1102 1102	TT-6-3A/7 I-5-3A/6	2333 2262
	11=2 Sum Mean Stand, dev.	29683	**1102**	7	2298 *••0

37 KONGSVINGER/ELVERUM

0402 Kongsvinger 0427 Elverum	13895 14311		1103 2081	TI-5-1A/8	
Sum Mean Stand, dev.		28206	1104 2188 1 1 0 4	TI^5-2A/8 8	2135

No.of fertility area.	Name of area, commune.	Population. Dec.31. 1970.	Code for language.	CBS's commune type code.	Mean fertility for 1968-75.
38	SOL0R				
	0418 Nord-Odal	5245	1103	LT-0-0A/2	2190
	0419 S0r-Odal	69^0	1103	IL-1-1A/2	2268
	0423 Grue	6409	1103	LI-2-1A/2	2116
	0425 Asnes	9244	1103	LI-1-0A/2	2351
	0426 Valer	4830	1103	LI-2-1A/2	2240
	N=5 Sum	32668			
	Mean		1103	2	2233
	Stand, dev.				88
	0STERDALEN				
39	0428 Trysil	7393	1104	LI-2-0B/2	2461
	0429 Amot	4959	1104	IL-3-1B/2	2405
	0430 Stor-Elvdal	3747	1104	LI-2-0B/2	2500
	0432 Rendalen	3282	1104	L-0-03/1	2260
	0434 Engerdal	1760	1104	L-0-0B/1	2732
	0435 Tolga-Os	3.850	1104	L-2-0B/1	2816
	0437 Tynset	5068	1104	L-3-0B/1	2468
	0438 Alvdal	2692	1104	L-2-0B/1	2620
	N=8 Sum	32751			
	Mean		1104	1	2533
	Stand, dev.				181
	OTTADALEN				
	0439 Polldal	2213	1208	IL-3-0B/2	2968
	0511 Dovre	3090	1208	TP-4-0B/9	2550
	0512 Lesja	2566	1208	L-0-0B/1	2524
	0513 Skjclk	. 2567	1208	L-0-0B/1	2518
	0514 Lorn	2896	1208	L-2-0B/1	2401
	0515 Vaga	3987	1208	L-3-0B/1	2665
	0517 Sel	6254	1208	LI-3-03/2	2671
	N=7 Sura	23573			
	Mean		1208	1	2614
	Stand* dev.				182

No.of fertility area.	Name of fert-ility No. and name of area, commune	Popul-ation Dec.31. 1970.	Code for ity lang-uage. 75*	CBS's commune type code.	Mean fertil for 1968-
	GUDBRANDSDA LEN				
	0518 Fron	9423	1208	LI-2-	
	0520 Ringeb u	0B/2 5226	2657 1208	:.L-3-	
	0521 0yer	0B/1 3881	2271 1208	L-1-	
	0522 Gausda l	0B/1 6391	2504 1208	L-2-	1
	Sum	**24921**	**1**		**2**
	Mean		**2**		**5**
	Stand, dev.		**0**		**3**
			8		**0**

42 VALDRES/HALLINGDAL **1**

0540	S0r~Aurdal	3776	1207	L-0-0B/1	2326
0541	Etnedal	1785	1207	L-0-0B/1	2321
0542	Nord-Aurdal	5880	1207	TP-4-0B/9	2167
0543	Vestre Slidre	2361	1207	L-0-0B/1	2693
0544	0vstre Slidre	2762	1207	L-0-0B/1	2304
0545	Vang	1762	1207	L-0-0B/1	2432
0615	**Plfi**	1246	1207	L-0-0A/1	2325
0616	lies	3088	1207	TP-5-03/9	2280
0617	Gol	**3406**	1207	TP-3-0B/9	2385
0618	Hemsedal	**1426**	1207	L-2-0B/1	2597
0619	**Al**	**4299**	1207	TP-3-0B/9	235.4
0620	**Hoi**	**4115**	1207	TP-3-OB/9	1963
N*12	**Sum**	35906			
	Mean		1207	1	**2346**
	Stand., dev.				**186**

43 NORE/VEST-TELEMARK

062l'sigdal 0622 Krtfdsherad	3773	1206	LI-0-0A/2	259
0631 Flesberg	1897	1206	LI-1-0A/2	202
0632 Rollag	2103	1206	LI-0-2A/3	254
0633 More 0£ Uvdal 0321 *B0*	1360	1206	L-0-0A/1	225
0827 Hjartdal	2970	1206	L-1-0B/1	285
	3963	1206	TP-3-0A/1	233
	1680	1206	L-0-0B/1	217
	page			

continued next

No.of fertility area.	Name of Code No. and name	Popul-ation Dec.31. 1970.	for lang-age.	CBS's commune type code* 75.	Mean fertil for 1968-
commune	0828 Seljord	2912 0B/1	1205 2575	L-3-	
	0829 Kvitseid	2964 0B/1	1205 2346	L-1-	
	0833 Tokke	2979 0B/1	1205 2540	L-2-	
	0834 Vinje	3077 0B/1	1205 2598	L-0-	
	N=12 Sum	39876	1205	1	
	Mean		2 0 6		2 4 4 0
	Stand, dev.				

44 KONOSBERO/RJUKAN

0604 Kongsberg	18497	1101	I-7-2A/6	2223
0807 Notodden	13320	1206	I-6-2A/6	2048
0826 Tinn	8358	1206	I-6-0B/5	2217
N=3 Sum	40175			
Mean		1206	6	2163
Stand, dev.				99
45 SETESDAL				
0817 Drangedal	4550	2412	LX-2-0B/2	2678
0830 Nissedal	1459	2412	L-0-0B/1	2726
0831 Fyresdal	1477	2412	TP-2-0B/9	2876
0911 Gjerstad	2555	2412	IL-0-0A/2	2866
0912 Vegardshei	1656	2412	L-0-0A/1	2635
0919 Froland	3344	2412	TI-1-2A/8	2916
0928 Birkenes	3033	2412	LI-3-3A/3	2699
0929 Amli	2131	2412	TP-2-0A/9	2720
0935 Iveland	755	2412	L-0-0A/1	2496
0937 Evje og Hornnes	2933	2412	TP-4-OA/9	2574
0938 Bygland	1548	2412	TP-1-0A/9	2205
0940 Valle	1441	2412	L-0-0B/1	2731
0941 Bykle	471	2412	L-0-0B/1	1558
Ms13 Sum	27353		*	
Mean		2412	2	2591
Stand, dev.				361

No. of fertility area, commune	Name of area. No. and name	Popul-ation at Dec.31< 1970.	Code. for fertility language. 75.	CBS's commune type code.	Mean fertil for 1968-
46 KRAGER0					
0814	Bamble	9393	2	I-7-	2
0815	Kragertf	10108	4	2B/5	6
0901	Ris0r	6192	1	I-6-	6
0914	Tvedestrand	5611	2	1B/5	2
0918	Moland	6297		I-6-	
Ns5	Sum	37601	2	0B/5	
	Mean		4	TI-3-	2
	Stand, dev»		1	2A/8	4
			2	1-5-	2
			4	2A/6	9
			1		5
			2		5
			4		8
			1		27
					4
					01

47 ARENDAL/GRIMSTAD/LILLESAND

0903	Arendal	11769	2412	TT-9-2A/8	2204
0904	Grimstad	2794	?412	TT-9-2A/8	2684 x
0920	0vestad	6758	2412	TI-6-2A/8	2803
0921	Trom0y	3340	2412	TI-5-2A/8	2822
0922	Histfy	3754	2412	TI-8-2A/8	2451
0923	Fiaere	6189	2412	TI-6-2A/8	X
0924	Landvik	2781	2412	LI-2-2A/3	X
0926	Lillesand	5487	2412	TI-5-3A/7	2664
N=8	Sum	42872			
	Mean		2412	8	2625
	Stand, dev.				204

48 KRISTIANSAND

1001	56	2412	TI-9-3A/7	2432
Kristiansand	91			
	4			

Grimstad,Fjaere and Landvik joined the 1« Jan. 1971 to form one commune.Fertility estimate refers to this unit.

No.of fertility area,	Name of area. No. and name of commune.	Popul-ation at Dec.31. 1970	Code for fertility lang-uage.	CBS's Mean commune type for code. 1968-75.	
49 KANDAL					
1002	Mandal	11	2	I-6-3A/6	-
1014	Vennesla	1	4	I-7-3A/6	2
1017	Songdalen	4	1	IL-4-3A/3	7
1018		3	2		2
		9	2	I-5-3A/6	2
	Sun	29094	4		2
	Mean	8	2	6	9
	Stand, dev.	4	4		5
		4	2		8
		3	4		2
		4	2		6
		3	1		.8
		4	2		8

50 INDRE VEST-AGDER

1021	Marnardal	2003	2413	L-0-3A/1	2875
1026	Aseral	890	2413	L-0-0A/1	2386
1027	Audnedal	1395	2413	L-0-0A/1	3329
1029	Lindesnes	3906	2413	IL-O-OA/2	2545
1032	Lyngdal	4614	2413	IL-4-1A/2	3005
1034	Hfegbostad	1502	2413	L-0-0A/1	2658
1037	Kvinesdal	5241	2413	IL-3-0A/2	3C16
1046	Sirdal	1762	2413	L-2-0B/1	2913
1112	Lund	2463	2413	IL-4-1A/2	2994
1114	Bjerkrein	1870	2413	L-1-1A/1	3448
1129	Forsand	897	2413	LI-O-OA/2	3664
N=11	Sum	26543			
	Mean		2413	2	3076
	Stand, dev.				416

51 FARSUND/EIGERSUND

1003	Farsund	8336		TI-5-0A/8	2792
1004	Flekkefjord	8514	2	TI-6-1A/8	2753
1101	Eigersund	10453	&	I-2-2A/6	2632
1111	Sokndal	3480	1	I-6-1A/5	2577
			3		
	Sum	30783	2		
	Mean		4	8	
	Stand, dev.		1		2
			3		6
			2		8
			4		9
			1		1
			3		0
					1

No.of fertility area, commune.	Name of fertility area. No. and name of area,	Popul-ation Dec.31-1970.	Code for language.	CBS's commune type code.	Mean fertil for 1968~7
52 JJBREN					
	1119 H& 1120 Klepo 1121 Time 1122 Gjesdal	10607 . 8878 8124 4442	2413 2413 2413 2413	LI-5-3A/3 IL-4-3A/3 IL-6-3A/3 I-6-	3210
	N*4 Sum Mean Stand, dev.	32051	2413	3	3097
53 SANDNES					
	1102 Sandnes	30705	2413	I-7-3A/6	2582
54 STAVANCER					
	1103 Stavanger	81847	2413	TI-9-3A/7	2368
55 STRAND/SOLA					
	1124 Sola 1127 Randaberg 1130 Strand	9898 4709 6956	2413 2413 2413	TI-5-3A/7 TI-4-3A/7 I-6-0A/5	2913
	N=3 Sum Mean Stand, dev.	21563	2413	7	3016
56 RYPYLKE					

1133 Hjelneland 2639	2413	L-0-0A/1	332
1134 Suldal 3648	2413	L-1-03/1	318
1141 Pinn^y 2588	2413	L-0-0A/1	286
1142 Rennes;5y 2045	2413	L-O-QA/1	328
continued next pace			2

No.	Name of fertility area.	Population	Code for	CBS's commune	Mean fert
ility	No. and na:r.e of commune.	Dec.31. 1970.	language.	type code.	for 1968 -
	1145 Bokn 1146 Tysvtor 1154 Vindafjord 1211 Etne 1214 01en 1216 Sveio	751 5601 4432 3903 2725 3568	2413 2413 2413 2413 2413 2413	LP-O-OA/1 LI-0-2B/2 L-O-OB/1 LI-3-0B/2 LI-2-0B/2 LI-0-2B/2	3240
	N=10 Sum Mean Stand, dev.	31900	2413	2	3178
57	KARM0Y				
	1149 Karntfy	27637	2413	I-6-2A/6	3017
58	HAUGESUHD				
	1106 Kaugesund	27219	2413	TT-9-2A/8	2538

59
B0MLO/STORD

		8276	2413	TI-1-0B/8	3577
1219 Btfmlo		10607	2413	I-8-1A/5	3028
N=2 1221 Stord	Sum Mean Stand, dev.	18883	2413		5 3303

60 HARDANGER

1223 Tysnes	2910	2413	TP-0-0A/9	2905	
1224 Kvinnherad	-12152	2413	IL-3-0B/2	3261	
1227 Jondal	1309	2413	L-O-OB/1	3152	1230
Ullensvanc	4730	2413	L-1-0B/1	2819	1234
Granyin	1013	2413	LI-O-OB/2	2516	

continued next page

No. of area, commune	Name of area. No. and name of commune	Population Dec. 31.	Fertility fert- ility	Code for lang- uage. 75.	CBS's commune type code.	Mean fertil for 1968-
	1238	1970.	8847	2413 IL-4-0A/2	2886	
	Kvara		3818	2413 IL-0-0A/2	3237	
	1241 Pusa					
	Sum Mean Stand, dev.		34779	2413 TI-3-3A/7	2640	2 9 6 8
				2413 TP-0-0A/9	3010	2 6 7
				2413 I-1-3A/6	3165	
				2413 TI-6-3A/7	2903	2 9 3 0
				2413 TT-8-3A/7		2 2 1
				2413 TI-9-3A/7		
				2413 TT-9-3A/7	2344	

61 OS/SOTEA/ASK0Y

1243 os **1245** Sund **1246** Pjell **1247** Ask0y	8162 306 0 693 6
N«4 Sum **Mean Stand, dev.**	32684
***62* FAHA**	
1249 Pana	44059
63 LAKSEVAG	
1248 Laksevag	23350
64 BERGEN	
1301 Bergen	113351

Bergen,Pana,Laksevag,Arna,and Asane joined the l.Jan. 1972 to form one ccrr.niune.The fertility estimate refers to this unit (see figure for Bergen).

No.of fertility area, commune.	Name of area. No. and name	Population Dec.31. 1970.	Code for language, 75.	CBS's commune type code,	Mean fertility for 1968-
65 ARNA/ASANE					
1250	Arna	11476	2413	I-7-3A/6	
1255	Asane	18161	2413	TT-8-3A/7	
	Sum	29637			
	Mean		2413		
	Stand, dev.				

66 NORD-HORDALAND

1252	Modalen	291	2413	L-0-0B/1	2809
1253	Oster0y	5643	2413	I-1-3A/6	3201
1256	Meland	2671	2413	LI-O-3A/3	3417
1260	Radrfy	4224	2413	IL-1-0A/2	3191
1263	Lindas	7733	2413	IL-0-0A/2	3025
1266	Masfjorden	1843	2413	LI-0-0B/2	3247
1411	Culen	2844	2414	L-0-0B/1	3173
M=7	Sura	25249			
	Mean		2413	2	3152
	Stand, dev.				190

67 ODDA/VAKSDAL/ARDAL

113	Sauda	5886	2413	I-8-0B/5	2732
122	Odda	10046	2413	I-8-1B/5	2611
124	Samnanger	2183	2413	I-2-0A/5	2879
125	Vaksdal	5427	2413	I-6-3A/6	2688
1416	Kdvanger	5404	2414	I-5-0B/5	2692
1424	Ardal	7547	2413	I-9-0B/5	2640
Ns g	Sum	36493			
	Mean		2413	5	2707
	Stand* devc				94

Bergen,Fana,Laksevag,Arna,and Asane joined the I.Jan.1972 to form one commune. The fertility estimate refers to this unit
(see figure for Bergen)*

No.of fertility area, No. and name of area, commune.	Name of fertility area, commune.	Population Dec.31. 1970.	Code for language.	CBS's commune type code.	Mean fertility for 1968-75.
68 SOGN					
1417	Vik	27<ao	2413	L-3-0B/1	2635
1118	Balestrand	1862	2413	L-3-0B/1	2529
1419	Leikanger	2688	2413	L-5-0B/1	2861
1420	Sogndal	4474	2413	TP-5-0B/9	2883
1421	Aurland	2374	2413	TP-2-0B/9	2796
1422	Lardal	2144	2413	TP-3-0B/9	2382
1426	Luster	5140	2413	L-0-0B/1	2740
N=7	Sum	21472			
	Mean		2413	1	2689
	Stand, dev.				184
69 VOSS/F0RDS/FLORA					
1233	Ulvik	1371	2413	TP-2-0B/9	2311
1235	Voss	13708	2413	TP-4-1A/9	2499
1401	Flora	8118	2414	TI-5-1B/8	2973
1432	FfSrde	4723	2414	TP-5-0B/9	2629
N = 4	Sum	27925			
	Mean		2413	9	2603
	Stand, dev.				
70 VESTLAHDSKYSTEM					
1144	Kvitstfy	605	2413	FL-6-0A/4	2817
1151	Utsira	304	2413	F-0-0B/4	1377
1222	Fitjar	2504	2413	IL-2-0B/2	3787
1244	Austevoil	3854	2413	F-0-0A/4	3455
1259	0vgarden	2708	2413	FI-0-0A/4	3316
1264	Austrheim	1840	2413	TI-0-0B/8	2699
1265	Fedi e	849	2413	FI-8-0B/4	2804
1412	Solund	1316	2414	F-0-0B/4	2920
1439	Vagstfy	6763	2414	IF-4-03/4	2890
1441	Selje	3393	2414	IP-O-OB/4	3101
NalO	Sum	24145			
	Mean		2413	4	2917
	Stands dev.				640

No., of fertility area.	Name of fei*t- ility No. and name of area, commune.	Population Dec.31. 1970.	Code for language.	CBS's commune type code.	Mean fertility for 1968-75.
71	FJORDAIIE				
1413	Hyllestad	1800	2410	LI-0-LI-1-IL-2-L-0-L-0-L-0-IL-3-LI-2-IP-0-IP-5-IP-1-IF-4-FL-0-IF-4-OB/4	■OB/2•OB/2>0B/2•0B/1OB/2OB/1	2981
H*28	Askvoll	3400	2414			2912
1429	Pjaler					2277
1430	Caular	3492	2414			3330
1431	Jtflster					3064
1433	Naustdal					3033
1438	Bremanger	3504	2414			2922
1443	Eid					2211
1445	Gloppen	47433	2414			3141
1448	Stryn					3497
1524	Norddal	2604	2414			3188
72	SUNNM0RSKYSTEN					2211
1511	Vanylven	3285	2414			3141
1514	Sande	5659	2414			3497
1515	Her0y	8202	2414			3188
1532	Gislce	5045	2414			3199
1545	Hidsund	5656	2414			3181
1546	Sandfy	22358	2414			3211
73	ALESUND					3387
1501	Alesund	39154	2414	TI-8-2B/8	25613	2207
		49584				2035
		61420				3532
		27235				3375
		36321				2026
		10833				2690
		36				

No.of fertility area, commune.	Name of fertility area. No. and name	Population Dec.31< 1970.	Code for language. 75.	CBS^3 commune type code.	Mean fertility for 1968-
74	S0RE				
	SUNNM0RE				
1516	Ulstein	4558	241U	I-6-0B/5	3335
1517	Hareid	3935	2414	I-5-2B/5	2918
1519	Volda	7283	2414	TI-4-1/6	2772
1520	Ørsta	9484	2414	IL-4-1B/2	2834
	Sum	25160			
	Mean		2414		2919
	Stand, dev.		2414		2977
75	INDRE SUNNM0RE				2427
1525	Stranda	4831	2414	I-5-0B/5	2569
1527	Ørskog	4985	2414	IL-3-23/2	2840
1528	Sykkylven	5643	2414	1-4-23/5	2833
1534	Karam	8420	2414	I-3-OB/5	2876
	Sum	23879			
	Mean		2414		2787
	Stand, dev.		2414		2780
76	ROMSDAL				1422
1502	Molde	19186	2414	TI-7-2B/8	2223
1535	Vestnes	5637	2414	I-3-OB/5	2512
1539	Rauma	8041	2414	I-4-OB/5	2453
1547	Aukra	2645	2414	I-0-0B/5	2776
N = 4	Sum	35509			
	Mean		2414		2491
	Stand, dev.		2414		2227

No.of fertility area.	Name of fert- ility Ha. and name of area comm	Popul- ation Dec.31.	Code for ity lane* uage. 75.	CBS's comnune type code.	Mean fertil for 1968-
7	KRISTIANSUMD				
7	1505 Kristiansund **1556 Prei**	18508 2599	1510 1510	TI-9-23/8 I-G-	2223 :
	N=2 Sum Mean Stand, dev.	21107	1310	8	**2531** • %»»

78 M0RE-TR0NDELAGSKYSTEN

1554 Avertfy	5106	1310	IF-0-2B/4	3087
1573 Sntfla	3389	1310	FL-2-03/4	3191
1617 Hitra	4529	1310	LF-0-03/1	3001
1620 Frjiya	5753	131Q	FI-2-0B/4	2945
1633 Osen	1426	131G	FL-0-03/4	2709
1748 Fosnes	901	1311	: L-0-03/1	3913
1749 Flatanger	1616	1311	LI-O-G3/2	3465
1750 Vikna	3740	1311	LF-4-03/1	2946
1751 NarjJv	5916	1311	LI-2-0B/2	2935
1755 Leka	980	1311	L-0-0B/1	2711
N=10 Sum	33356			
Mean		1310	4	3090
Stand, dev.				**364**
NORDKtfRE				
1543 Nesset	3573	2414	IL-1-0B/2	2743
1548 Fraena	7487	2414	LI-1-03/2	3158
1551 Eide	2982	1310	IL-2-03/2	3067
1557 Gjemnes	2859	1310	L-0-0B/1	3299
1560 Tingvoll	3665	1310	LI-2-0B/2	2688
1566 Surnadal	5979	1310	LI-1-03/2	2793
1567 Rindal	2363	1310	L-2-0A/1	2920
1569 Aure	3034	1310	L-0-0B/1	3030
1571 Halsa	2096	1310	LI-1-03/2	2893
1572 Tustna	1213	1310	LI-0-0B/2	2694
N=10 Sum	35251			
Mean		1310	2	2929
Stand, dev.				207

7
9

Mo.of fert- ility	Name of fertility area. No. and name of area, commune.	Popul- ation Dec.31. 1970.	Code for lang- uage.	CBS's commune type code.	Mean fertility for 1968-75.
80	S0R-TR0NDELAG				
	1634 Oppdal	5692	1309	LI-3-0A/2	2459
	1635 Rennebu	2847	1309	L-1-0A/1	3130
	1636 Meldal	4779	1309	IL-4-0A/2	2477
	1644 Alen	1987	1309	L-O-OA/1	2186
	1645 Haltdalen	795	1309	L-O-OA/1	
	1648 Hidtre Gauldal	6122	1309	L1-1-0A/2	2739
	1664 Selbu	3912	1309	L-O-OA/1	2418
	1665 Tydal	986	1309	TP-0-0B/9	2969
	N=8 Sum	27120			
	Mean		1309	2	2570
	Stand, dev.		*		346

81 ORKDAL/MELHUS/MALVIK

1638 Orkdal	9375	1309	IL-6-3A/3	2480	
• 1653 Melhus	9336	1309	TP-1-		
		3A/9	2842		
1657 Skaun "	4448	1309	LI-2-3A/3	2490	
. 1662 Klsbu .	2579	1309	TT-4-3A/7	207.3	
1663 Malvik	7127	1309	TI-7-		
N=5 Sum Mean	32865	3A/7	2666		
Stand,	1	2			
dev.	3	5			
	0	1			
	9	0			

82 TRONDKEIM

				2	
				8	
1601 Trondheim	1275	1309	TT-9-2A/7	2399	6
	95				

83 STJ0RDALEN / LEVAMGF.R

1714 Stj0rdalen	13768	1719	TP-4-	2
Levanger	14839		3A/9	7
			TP-4-	4
N=2 Sum Mean	28607		2A/9	9
Stand,		1		2618
dev,		3		2
		0		4
		9		8
				7

*Haltdalen and Alen joined the l.Jan.1972 to form one commune, The fertility estimate refers to this unit(1644 Holt&len).

No. of fertility-ion-ility	Name of area. No. and name of area, commune	F'opul-at Dec.31. 1970,	Code for language. 75.	CBS*s conununetype code.	Mean fertilit for 1968-
84	SUMNDAL/R0ROS/VERRAN				
	1563 Sunndal	8269	1	1-6-03/5	2
	1640 Rtfros	51*17	3	IL-5-0B/2	4
	1711 Meraker	2907	1	I-1-0A/5	2
	1724 Verran	39/49	0	I-6-0B/5	6
	17*10 Namsskogan	1773	1	1-2-03/5	2
	N=5 Sum	22045	3		1
	Mean		0		5
	Stand, dev.		9		2
			1		24
			3		21
			0		79
			9		3
			9		2
			1		45
			3		14
85	NAMSOS/STEINXJER		1		1
	1621 drland	5284	0310	TT-H-OA/9 2637	2
	1702 Steinkjer	20144	0309	TP-5-2A/9 2621	8
	1703 Namsos	11190	1311	TI-7-1B/8 2500	2
			1		9
	N=3 Sum	36618	3		
	Mean		1		5
	Stand, dev.		1		8
			3		6
			0		
			9		
86	F031IA				7
					5
	1612 Hemne	4	1	IL-3-L-0-L-0-L-0-LI-1-LI-1-LP-0-L-0-	O A/2 0 A/1 0 A/1 0 A/1 O A/2 O B/2
	1613 Snillfiord	0	3		2
	1622 Agdenes	2	1		6
	1624 Rissa 1627	4	0		9
	Bjugn 1630	1	1		3
	Afjord 1632 Roan	3	3		3
	1725 Namdalseid	5	1		3
		9	0		1
		2	1		6
	N*8 Sum	26264	3		2
	Mean	6	1		7
	Stand-dev.	3	9		2
		6	1		1
		5	3		9
		7	0		8
		3	1		2
		4	0		8
		7	1		7
		8	3		2
		6	1		86
		4	0		23
		0	1		7
		1	3		4
		5	1		2
		1	0		3
			1		1
			3		4
			1		1
			0		
			1		

No.of fert- ility area.	Name of fertiltiy area. No. and name of eosssuns.	Popul- ation Dec.31- 1970.	Code for lang- uage.	CBS's commune type code.	Wean fertility Tor 1960-75.
8? NOHD-TR0MDELAQ					
1717	**Prosta**	2605	1309	L-0-0A/1	28!»9
1718	Leksvik	2994	1309	LI-1-0A/2	27 50
1721	Verdai	9950	1309	LI-3-2A/2	*2721*
1723	Mosvik	1074	1309	L-0-0B/1	3094
1729	Inder^y	4853	1309	LI-1-2A/3	27:43
1736	Sn&sa	2893	1309	L-2-2B/1	26-^2
1738	Lierne	1905	1309	L-0-0B/1	2^03
1739	RjSyrvik	558	1311	L-0-0B/1	2 353
17^2	Grong	2776	1311	TP-1-0B/9	22'j2
17*»3	HsSylandet	1412	1311	L-0-0B/1	3136
17*»4	Overhalla	3294	. 1311	LI-1-IB/2	2810
1811	Bindal	2337	1311	IL-3-0B/2	2377
N=12	Sum	36651			
	Mean		**1309**	2	27^0
	Stand, dev.				a 78
ZIIORE KORDLAND					
1822	Leirfjord	2303	2515	L-0-0B/1	2817
1825	Grane	1666	2515	LI-2-0B/2	2:V34
1826	Kattfjelldal	1796	2515	L-2-0B/1	2571
1828	Nesna	1857	2515	LI-4-0B/2	2SP3
1832	Heranes	51^2	2515	IL-4-2B/2	2-'J97
1839	Beiarn	1727	2516	L-0-0B/1	2899
18^2	Skjerstad	1559	2516	L-0-OB/1	3223
1815	S0rfold	2858	2516	LI-0-0B/2	21537
1848	Steigen	4011	2516	LP-0-0B/1	3175
18$9	HamarjJy	2411	2516	TP-O-OB/9	2258
N=10	Sum	25330			
	Mean		2516	1	2755
	Stand, dev.				332

No.	Name of fertility area.	Population Dec.31 1970.	Code for fertility language.	CBS•s commune type code.	Mean fertility for 1968-75.
89	HELGELAND				
	1814 Bronnoy 1820	8590	2515	LI-4-1B/2	2970
	Alstadhaug 1824	649	2515	TT-6-1B/8	2796
	Vefsn	4	2515	TI-7-1B/8	2494
		133			
	N*3 Sum	28464			
	Mean		2515		2753
	Stand, dev.				241
90	RANA				
	1833 Rana	26159	2515	I-8-2B/5	2596
91	BOD0				
	1804 Bod>*	29123	2516	TT-8-2B/8	2427

92 NORDLANDSKYSTEN

1815 Vega	1927	2515	FL-O-OB/4	2981
181S 'Vevelstad	765	2515	LP-0-0B/1	3177
1818 Her0y	2460	2515	P-1-0B/JJ	2935
1827 Dtfnna	2195	2515	LF-0-0B/1	3263
1834 Lurtfy	2659	2515	FL-0-0B/4	3431
1835 Trsna	575	2515	F-O-OB/4	3224
1836 Rf5d;Sy	2221	2515	FL-0-0B/4	3009
1856 Riist	754	2516	F-0-0B/4	2999
1857 Var0y	1092	2516	FI-6-0B/4	3030
I858 Moskenes	3796	2516	F-4-OB/4	3099
i860 Vestvacpy	11268	2516	IP-3-03/U	2802
1867 Bd	4794	2516	FI-0-CB/4	2785
1868 0ksnes	5276	2616	PI-3-0B/1	3092
N*13 Sum	39782			
Mean		2516	4	3064
Stand, dev.				181

No.of fertility area..	Name of area	Population Dec.3 1970.	Code for fertility language. 75.	CBS's commune type code.	Mean fertility for 1968-
93	MELOY/FAUSKE				
1837	Meltfy	7	2	I-3-	2
1838	Gildes	0	5	0B/5	5
kal 1840		1	1	TP-2-	9
Saltdal		5	5	03/9	6
	Fauske			TI-2-	
	Sun Mean	23445	2	0B/8	2
	Stand,	^	5	TI-6-	7
	dev.	3	1	0B/8	25
		7	6		42
			1		9
		4	2		2
NARVIK		3	5		2
			1		3
1805	Narvik	13181	2516	TT-8-2B/8	2341*
1850	Tysfjord	2903	2516	I-4-0B/5	3085
1853	Evenes	1772	2516	LI-3-0B/2	2706
1854	Ballangen	3238	2516	TP-2-0B/9	3061
1855	Ankenes	6815	2516	TT-5-2B/8	
N=5	Sum	27909			
	Mean		2516	8	2707
	Stand, dev.				366
INDRE LOFOTEN					
1851	L^dingen	3048	2516	TT-6-0B/9	2962
1852	Tjeldsund	1999	2516	TT-2-0B/9	2738
I865	V&gan	9490	2516	TI-6-1B/8	2752
1866	Hadsel	8705	2516	TI-4-03/8	2497
1870	Sortland	7100	2516	TI-4-0B/8	2730
1871	Andtfy	8060	2516	TP-6-03/9	2792
N=6	Sum	38402			
	Mean		2516	8	2745
	Stand, dev.				149

Narvik and Ankenes joined the I.Jan.1974 to form one commune. The fertility estimate refers to this unit.

No.of fertility area.	Name of area, No. and name of commu	Popul-ation Dec.31.	Code for fert-ility lang-uage. 75.	CBS's commune type code.	Mean fertil for 1968-
9	HARSTAD				
6	1901 Harstad	19986	2517	TT-7-2B/8	2560
	1911 Kvaefjord	3672	2517	TP-4-2B/9	2083
	N=2 Sum	23658			
	Mean		2517	8	2322
	Stand, dev*				• • •»
	INDRE TROMS				
9 7	1913 Skanland	2975	2517	TP-1-0B/9	2671
	1919 Gratangen	1878	2517	TP-O-OB/9	2907
	1921 Salangen	3728	2517	TP-1-0B/9	2991
	1922 Bardu	3923	2517	TT-5-0B/9	2794
	1924 Malselv	8025	2517	TT-4-0B/9	2915
	1939 Storfjord	1743	2517	TP-0-0B/9	3170
	1940 Kafjord	3279	2517	LI-1-0B/2	3486
	1942 Nordreisa	2711	2517	TP-3-0B/9	3023
	N=8 Sum	28262			
	Mean		2517	9	2995
	Stand, dev.				248

98 LEMVIK/BALSPJORD

1925 Stfrreisa.	3131	2517	TI-2-0B/8	2897
1929 Berp	1441	2517	FI-6-OB/4	3205
1931 Lenvik	10576	2517	TI-3-0B/8	295[11]
1933 Balsfjord	6734	2517	LI-1-0B/2	3007
Sum	21882			
Mean		2517		3016
Stand, dev.				134

No.of fertility area,	Nans of area. No. and name of commune.	Population Dec.31. 1970.	Code for language. 75.	CBS's commune type code.	Mean fertility for 1968-
99 TROMS/PIMNMARKSKYSTEM					
1915	Bjark^y	995	2517	FL-0-0B/4	2640
1917	Ibestad	2912	2517	FL-1-O3/4	2793
1926	Dyr0y	1951	2517	LP-0-0B/1	3038
1927	Tranjziy	2237	2517	LF-0-0B/1	3077
1928	Torsken	1772	2517	FI-7-0BA	2827
1936	Karls0y	3060	2517	LF-0-0BM	3156
1938	Lyngen	3893	2517	FL-1-0B/4	3161
1941	Skjerv0y	4948	2517	PI-4-OB/ft	3150
19^3	Kvasnangen	2090	2517	IF-O-0BM	3016
2014	Loppa	2231	2517	FI-2-OB/^	3^73
2015	Hasvik	1625	2517	FI-6-OB/it	3028
2016	S{5r?ivsund	2230	2517	FI-^-OB/A	3000
2017	Kval3und	1777	2517	TP-2-0B/9	3281
2018	Mas^y	2887	2517	FI-6-0BM	3188
2022	Lebesby	2244	2517	FI-6-OB/if	3081
2023	Gamvik	1682	2517	IF-8-0B/4	2767
N«l6	Sun	38534			
	Mean		2517	T+	3042
	Stand, dev.				209
100 TROMS0					
1902	Tromsd	39115	2517	TT-7-2B/8	2604

101 PIIINMARKSVIDDA

2011	Kautokeino	2578	2517	L-4-0B/1	3573
2012	Alta	11210	2517	TI-5-1B/8	.
2020	Porsanger	3907	2517	TT-2-0B/9	2801
2021	Karasjok	2542	2517	TP-4-03/9	3162
2025	Tana	3111	2517	TP-C-03/9	3563
2027	Nesseby	1193	2517	LF-0-0B/1	2984
N«6	Sum	24541			
	Mean		2517	9	3233
	Stand, dev.				311

No.of fertility area.	Name of fertility area, commune.	Population Dec.31. 1970.	Code for lang-uage.	CBS's commune type code.	Mean fertility rate for commune type, 1968-75.
102 HAMMERPEST/VARANGER					
2001	Hammerfest	7136	2517	TT-9-IB/8	2H87
2002	Vards*	4095	2517	TI-9-0B/8	2809
2003	Vadstf	5570	2517	TT-8-1B/8	2898
2019	Nordkapp	5161	2517,	TI-9-1B/8	2846
2024	Berlevag	I84ei	2517	1-8-0B/5	2616
2028	Batsfjord	2805	2517	1-9-0B/5	2859
2030	S0r-Varanger	10482	2517	TI-7-1B/8	2621
N=7	Sum	37094			
	Mean		2517	8	?. 734
	Stand, dev.				158

A P P E N D I X C

A comparison of the factorial ecology of Norway in t!MsO and the factorial ecology of Norway in 1970.

INTRODUCTION

In 1970 Prank L« Sweetser conducted an inquiry into the dimensions differentiating the Norwegian communes in 1960 {see Sweetser 1970 and 1974). The study was based on data from the census of 1960 and other public records.

A replication of this study is of interest by itself at the same time as it will provide a convenient starting point for the present endeavour to describe in a quantitative language the relative differences between the social structures of small areas like communes or groups of communes.

The most interesting aspect of a comparison between 1960 and 1970 in this respect is of course the problem of the stability of the derived factors through time. If the factorial description of the social structure indeed reveals basic dimensions of the social structure one must expect that they will change but slowly.

From the assumption that one is dealing with basic dimensions there also follow two other important propositions. The factors ought substantially to be invariant under substitutions and variations in the definitions of the variables going into the factor analysis. Likewise the factors ought to be substantially invariant under various divisions and aggregations of the units of the analysis as long as the units cover completely the

social structure studied.

The units used in the analyses both in 1960 and 1970 were communes. But from 1960 to 1970 the number of communes was almost halved. The number was reduced from 732 in 1960 to 451 in 1970. Nor is the replication of variables exact. The difficulties were caused by differences in the access to data. Some items disappear from the statistics while the definitions of others are changed. The most conspicuous of the changes in definitions concern economic activity. The change is to the effect that women working as unpaid workers in family enterprises now in 1970 are counted as economically active while they were not so counted in 1960.

While the theoretical assumption leads one to expect that a high degree of factor similarity between 1960 and 1970 will be found, at least for the most important factors, the considerations above imply that if any descrepancies between the factors of 1960 and 1970 are observed there will be difficulties identifying the sources of the descrepancies.

But since one then will have to question the assumption that what is found are basic dimensions, the sources of any descrepancies may not be that interesting any more.

In fact, the assumption seems to be substantiated. The coefficients of factor congruence for the three most

important factors urbanism/socio-economic status, familism **and** industry are .90, .91, and .86 respectively.

THE UNITS OF ANALYSIS

In 1970 Norway was divided into 451 communes compared to 732 in 1960, The distribution of the communes according to population size as of December **31, 1970** is as **follows:**

TABLE Cl THE COMMUNES OF NORWAY IN 1970 DISTRIBUTED ACCORDING TO SIZE

POPULATION SIZE	NUMBER OF COMMUNES
0- 499	**3**
500- 999	**16**
1000- 4999	**235**
5000- 9999	**113**
10000-49999	**78**
50000-	**6**
SUM	**451**

In **order** to avoid the statistical uncertainties introduced into any analysis by small populations, Sweetser **excluded** 2 small island communes and added 7 others to neighboring communes so that no commune had a population

less than 500. This added up to 723 analytical units in the 1960 analysis.

In the decade between 1960 and 1970 Norway had a major revision of the boundaries of the communes. This almost halved the number of communes, Only three were left with a population less than 500. Adopting the same criterion as Sweetser, neighboring communes were combined as follows:

assigned to new unit	of old unit		of old commune	of new combination
991	940 942	Valle Bykle	1441 471	1912
1191	1144 1151	Kvitsoy Utsira	605 304	909
1291	1252 1266	Modalen Masfjorden	291 1843	2134

One of the communes excluded by Sweetser was Utsira. Here it is included in combination with Kvitsoy,a slightly larger island commune not very far from Utsira. The other commune excluded by Sweetser, Grip, is today a part of 1503 Kristiansund.

Information on actual changes may most easily be obtained as a table printout from The Norwegian Social Science Data Archives (NSD) , Bergen,, Appraisals and further references are found in Henrichsen and Rokkan 1977, and in Lie and Taylor 1977.

The three combinations of communes are also constructed so that they are part of the same fertility region as these are defined in Appendix B.

Thus the analysis of 1970 data will be based on variables computed for 448 analytical units.

DEFINITION OF VARIABLES

The problem encountered at. this point is to match a.ʳi closely as possible the variables used analysing the *M-60* data. The definitions of the variables used in the previous study are found in table 9 in Sweetser (1970) and reproduced below in table C2 as "original definition" of variable. The number used to identify the variables js the same as the number of the variable in Sweetser's table 9.

Table C2 contains the heading "present definition" :Cis those cases where present definition is identical to original definition nothing is written out here. Only where differences are noted does the column "present definition" contain information. Some of the changes noted are rather obviously necessary (as in variable-5 where rate of population change 50-60 is changed to rate of population change 60-70). Other changes are small and deemed to be of no consequence for the analysis {. as in variable 15 where percentage of women of age

20-65 had to be changed to percentage of women of age **20-64).**

For twelve variables the changes are more important **and** have to be considered in more detail. In five cases comparable information was not available so that substitutes had to be defined. This involves the variables 28, 36, 37, 38, and %\. The remaining seven variables were matched nominally , but the meaning of the variables changed since the defining characteristics in the census were changed. This affected the variables 20, 23, 26, 42, 43, 48, and 49.

The substitute variables

The original definition of variable 28 was percentage of housing units with central heat. Information on heating system was not collected in the 1970 census. The variable tell something about the quality of the housing units, but perhaps more about the type of houses in the commune since larger houses with several housing units are more likely to have central heating. The variable was expected to and did load high on the urbanism/socio-economic status factor (.67).

The available information on housing did not offer more than one possibility for approximation to this aspect of the original variable. The substitutes "percentage of: the

TABLE C2 ECOLOGICAL VARIABLES : COHMUI5E DIFPEREHTIATIOII IK 1970.
REPLICATION OF A STUDY OP COMMUNE DIFEKREUTIATIOli **III** l$bO.
See table 9 in 3weetser(1970):"Commune differentiation in ilorway,1960.".

VARIABLE 110.	ORIGINAL DEFINITION	PRESKIIT DEFINITION*	NOTE
1	Total land area in km^2 (loc)	Total area in km^2 **(log)**	Includes lakes
3	% farirs with 10+ dekars		Data fron. 1969
il	Total population (Ice)		—
5	Rate population+$_s$'5O-6O(sqrt)	Rate population*,'60-"70(sqrt)	
6	lio. of inhabitants per km land(sqrt)		
7	ilo. of acElcrr.erations in commune(sqrt)		
8	Mean size of acc3-$^{oir'e}$**at ion (sort)		
9	% of pop. in agglomerations	% of pop. in densely settled areas **("kretser")**	
10	% age 5-1^ years	_____	_____ .....

*;able continued next pace

xIf nothing else is indicated the present definition is identical **to the original.**

VARIABLE	110. ORIGINAL DEFINITION	PRESENT DEFINITION	NOTE
	% age 65 years and over		
1	% of ace 20-59 years who are 20-39		
3	(population under 20 years + population 60+)/population 20-59<x100)		
I	% women of age 20-65 % % age	women of age 20-6*}	
k	20+ married(male*female)		
	IJo. age O-Jj/femaies 15-		
1	% households with W(x1OOO) unmarried children + 2 parents	% **families with unmarried** children ♦ 2 parents	The definition of household and family was changed from 1960 to 1970 See text.
5			
2	Divorced and separated /		
1	married with spuse(x1OO)		
2			
7			
2	Non-family households/family	Families in institutional households/ families in	See note to variable 20.
3	households except multi fam. (x1OO)	**one-** family private households **(x1OO)**	
1			
2			
9	% of "occupied housing units with 1.01+ persons per room		
5			

table continued next page % see first page of table

VARIABLE NO.	ORIGINAL DEFINITION	PRESENT DEFINITION[3]	NOTE
26	% housing units built before 1900	% housing units built before 1910	The definition of the age of the house was changed from I960 to 1970.See text.
2	Housing units built '51-'60/ no.of housing units(xlOO)	Housing units built '60-'70/ no.of housing units(xlOO)	
7	% housing units with central heating	% housing units not owned by occupant	Information on heating was not collected in 1970.
	% occupied housing units with bath and WC		
2	% housing units in farm houses		
8	% households with max. 2 rooms		
	% households with at least 5 rooms		
30	Net migration '51-'59/1960 population(sqrt)	Net migration 1970/1970 population(xlOOO)	
3	Gross migration '51-'59 /1960 population(xlOO)	Gross migration 1970/1970 population(xlOOO)	

table continued next page * see first page of table

2

3

3

3

4

3

6

3

7

VARIABLE HO.	ORIGINAL DEFINITION	PRESENT DEFINITION	NOTE
38	% born in commune of residence	% of age 16+ occupied within commune of residence	
	% economically active of total population		The definition of economically active was chanced from I960 to 1970. This concernes mostly married women working as unpaid family workers. See text.
	% economically active women of 20-65	% economically *native* women of 16+ excluding carried women working unpaid in family enterprises	
	* economically active males in professional/managerial occ		Occupation codes 00-33,60-69.
	% economically active males in blue collar occupations		Occupation codes 50-59,70-89.
	% economically active women in blue collar occupations		Occupation codes 50-59.70-89. See *note* to variable.
	% economically active? population who are.self-employed		See note to vari able J»2.

able continued next page

x see first page of table

VARIABLE NO.	ORIGINAL DEFINITION	PRESENT DEFINITION	NOTE
53	% population dependent on agriculture		
54	% population dependent on manufacturing		
55	% population dependent on **trade**		
56	% population dependent on services, including public and military		
57	Ratio of pensioners to economically active(x100)		
58	% votes for Labor-,Communist-, and Socialist Peoples(SF) parties in 1961	**% votes for Labor-,Communist-, and Socialist Peoples(SF) parties in 1969**	
59	% votes for Center party,**1961**	% votes **for Center party,1969**	
60	Commune tax per capita **1961** (square root)	Commune tax per capita **1968** (square root)	
61	Tax reimbursements per resident age 15+ ,1960	Transfers from state to education,culture,and social welfare per resident 16+ ,1970	

table continued next page * see first page of table

VARIABLE NO.	ORIGINAL DEFINITION	PRESENT DEFINITION	NOTE
62	Assessed income per resident 15+ (square root}	Assessed income 1968 per resident 16+ 1970	
65	% age 25+ with primary school only		
66	% age 25+ with Gymnasium education	% age 25+ with education at Gymnasium levels II and III	

* see first page of table

housing units not owned by occupant" became the new variable 28. Since it is more likely the occupant will own his housing unit the smaller the house is, it is expected that the new variable 28 will load high end positive on the urbanism/socio-economic status factor.,

The variables 36 and 37 told about net and gross migration during the decade 50 to 60. Comparable information for 60 to 70 was not available. A natural substitute seemed to be net and gross migration for 1970. A square root transformation was used on the net migration 51-59 to improve its distributional properties. Net migration for 1970 contained negative numbers (net loss of population from the commune). The square root transformation was therefore dropped.

Variable 38 contained information on percentage of the population living in the commune who actually had been born in the commune. Comparable information was not available. The variable tells something about the stability of the existing social milieu. But everything from stable and prosperous communes to poor and dwindeling communes may give rise to a high value on this variable. A substitute is not easy to find. The one selected, "percentage of those living within commune who are occupied within commune", is not particularly good since it for obvious reasons will be heavily influenced by the distribution of the communes according to size.

The last' of the variables needing **substitution was 61: Tax reimbursement per resident age 15+,1960.**

In 1936 a law established that some of the taxes collected by the communes shall go to a special fund called "Skattefordelingsfondet". (literally: The Tax distribution fund), The funds thus collected are redistributed **by** the state to the communes according to indicators **showing** their need. Thus a high value on this variable **usually** means the commune is a particularly poor commune.

The selected substitute: transfers from the state to **cover** expenses in the educational, cultural, and social **welfare** sectors, has some of the same properties. But it is **far** from **a** close approximation. Much of the expenses **in** these sectors are determined by laws defining the state's proportion of the expenses of the services the **state** has defined as the obligation of the commune.

Changing content of variables

Several census characteristics were changed from 1960 to 1970. Three of the changes affects variables used **here and** have to be considered in more detail.

More information on the differences between the 1960 census and the 1970 census is found in "Principles and Definitions" **in** Central Bureau of Statistics,1975: "Population and Housing Census 1970."

Variables 20 and 21 are affected by the changes in the

definitions of family and household. Variable 26 is affected by the change in the definition of age of a house. Variables 42, 43, 48, and 49 are affected by the change in the definition of an economically active person.

In the 1960 census a private household was defined as a housekeeping unit within a private dwelling. Consequently, one may in the 1960 census find two or more private households in the same dwelling. In the 1970 census private household and dwelling coincides in the sense that all persons living within the same dwelling are counted in the same household.

The definition of a family is the same in 1970 and 1960 except that in 1970 single persons without connection to any family nucleus are also counted as families. Thus one gets a new type of family, the one-person family, in addition to the four types common to the two censuses. The four types are couple without unmarried children, couples with unmarried children, mother with unmarried children, and father with unmarried children.

The changes noted imply that family in 1970 will be closer to the 1960 definition of household than the 1970 definition of household will be. Hence the changes introduced in the definition of variable 20. But how close the approximation is seems difficult to judge.

The change in the definition of household had even greater implications for the counting of institutional households. In 1960 an institutional household was administratively defined in the sense that all persons registered as resident by an institution were counted in the same household irrespective of the fact whether the persons were occupying one or more houses. In 1970 the inmates of each house constituted an institutional household. Personnel of institutional households were in 1970 always classified to private households. In 1960 some of the institutional personnel were included among the resident population of the institutional household/ and a few of the inmates of the institutions, who according to the 1970 rules would have been counted in the institutional household, were classified in private households. .

Replication of variable 23, "non-family households/ family households except multi family households (x100)", was difficult. And particularly so since the machine readable files contained information only on families in institutions {with one-person families dominating of course). The resulting variable 23, families in institutional households/families in one-family private households (x100), may$_y$ however, measure the relative strength of institutions compared to normal family life better than the 1960 variable did.

Variable 26 computes the percentage of housing units built before 1900 (for 1960 data, and before 1910 for 1970 data). In 1970 the age of the house was counted from the year when most of the dwellings within the house was finished. In 1960 the same criterion was used except if the house had had a major reconstruction. Then the age of the house was cdunted from the year of the reconstruction. It does not seem likely that this change will have any significant influence on the substantive content of the variable.

The variables 42 to 49 are concerned with various aspects of the economically active population.

In 1970 married women working as unpaid family workers are considered as economically active. In 1960 they were not. In 1970 this concernes about 29,000 women.

Compulsory military service is counted as economic activity in 1970. In 1960 soldiers were considered econnomically active only if they had had income from own work as main source of livelihood before starting military service,, This change concernes about 10,000 soldiers in 1970.

Even if the total numbers are relatively small the regional distribution may cause significant changes in the correlations. Neither did there seem to be any feasible way to correct for the additional economically active

persons in all variables.

However, variables 46 and 47, economically active males in professional/managerial occupation and males in blue collar occupations, are probably not much affected. Of the remaining variables, 43, and 48 report specifically on female economic activity* In the 1960 data variable 43 was defined as % economically active of all women 20-65 years old. Since data were available on the number of married women age 16 and above who were working without pay in family enterprises, it was decided to exclude these in variable 43. Hence variable 43 is defined as % economically active women 16 years and older excluding married women working unpaid in family enterprises.

Variable 48 is defined as % economically active women in blue collar occupations (occupational codes 50-59 and 70-89). This variable is probably less affected by the change in the definition of economic activity than variable 43. The same holds true for variable 42, % economically active of the total population, and for variable 49, % of economically active population who are self-employed It was decided not to try to "correct" these variables.

For details on the occupational codes see Arbeidsdirektoratet 1965* For details on the codes for industry see Central Bureau of Statistics 1972.

The changes from 1960 to 1970 have obviously strengthened the aspects within our set of variables dealing with **the** sexual division of the labor force. How this will influence the factors remains to be seen.

THE QUALITY OF THE DATA

The data used in this analysis derive mostly from the **population** and housing census of 1970.**Data** were obtained either directly from the Central Bureau of Statistics or **through the** Norwegian Social Science Data Services (NSD).

The quality of the data has to be discussed at two **levels.** The first problem is whether the tables prepared by **the** CBS actually contain the information they purport to contain. The second problem is whether the transfer **from the** CBS publications and files to the project files has introduced new errors.

The first problem is addressed by the Central Bureau of Statistics in volume VI of the Population and Housing **Census 1970.** The main results here indicates that:

1. **the** number of persons with 10 years in school or less has been underestimated in the census,
2. **the** number of persons with vocational education seems to be underestimated in the census (the evaluation **survey** found about 8% more),

3. the number of persons with less working time than 1000 hours seems to be underestimated with progressively increasing underestimation with less working time. The underestimation is significantly greater for women than for men.

Only the underestimation of persons with nothing beyond primary education seems to affect any of the variables defined above. The values on variable 65 will be lower than they "really" ought to be. The regional distribution of the under-enumeration is not known. But it may be that the underestimation increases with decreasing number of people with nothing beyond primary education, if there exists socially defined standards of acceptable educational levels. This may increase the ability of the variable to differentiate between rural and urban communities. It may also be that the underestimation of this educational category is greater now in 1970 than it was in 1960, both since the general educational level has increased and since the significance of education for obtaining social status has increased. If these assumtions are true, one ought to "find that variable 65 correlates higher with an urbanism/socio-economic status dimension in 1970 than in 1960. This is also the case. The correlation increased from -.45 in 1960 to -.63 in 1970,

But in general there is no reason to expect that the 1970 census is better or worse than the 1960 census.

The second data quality problem is both more trivial and more important. It is of course important to have as good data as possible. And in this case it simply means to take over data from the Central Bureau of Statistics without introducing new errors. The problem is trivial because what is required, just is a bit of hard work checking,,

The data obtained directly from the CBS are on a tape copy of a file prepared for the Norwegian level of living study. Introduction of new errors were not possible.

The rest of the data were obtained from the commune data bank of the NSD. This data bank contains not only census data, but all sorts of data collected by government agencies at the commune level. As data are added to their files, NSD employs standard procedures for machine checking like inclusion of redundant information enabling cross-checking and proof reading of sums for "fylke". As data are used and errors reported, corrections are incorporated. In some cases their data are better than the original source-tables, In general the quality of the files from NSD are judged to be good.

The control procedures of the project were therefore restricted to the inspection of skewness, kurtosis and

range of the computed relative variables. This control procedure **not** only uncovered a few errors in the definitions of the relative variables, but also some errors in the raw data obtained from NSD.

It appeared that in one instance the internal control procedures of NSD had been skipped. A more extensive search through the raw data failed to uncover more errors of this kind.

The general judgement of good quality of the data was upheld.

THE FACTORIAL ECOLOGY OF NORWAY 1970

The 47 variables defined in table C2 were computed for the 448 analytical units defined above. The resulting file with relative variables was converted to an SPSS-file **which** was analysed using the factor analysis program in SPSS(Nie et al. 1975).

The factor analysis program of SPSS has five different factoring methods; 1) principal factoring without iteration, 2) principal factoring with iterations, 3) Rao's canonical factoring, 4) alpha factoring, and 5) image factoring. Four alternative rotational methods may be applied to the various factoring solutions, three being orthogonal and one oblique. The three orthogonal solutions are varimax? quartirr.ax, and equimax. The oblique solution is

based on the direct oblimin method with the possibility for the researcher to control the obliqueness of the solution.

In order to replicate the factor analysis of the 1960 data, the first factoring method with varimax rotation of the principal components solution had to be chosen.

The data contained eight principal components with eigenvalues above unity. Rotations of solutions retaining 8, 7, *6,* and 5 factors were produced and inspected for the interpretability of the factors. The tentative conclusions may be summarized as follows.

Tentative label of factor	Number of factors retained for rotation: 5	6	7	8
URBANISM-	X	X	X	X
SES	X	X	X	X
FAMILISM	X	X	X	X
LEFT POLITICS/ DEPREIVATION	X	X	X	X
INDUSTRY	X	X	X	X
WORKING WOMEN		X	X	X
MIGRATION				X
SIZE			X	X
UNDERFINED				

In the 8 factor solution variable 1, total land area, defined a factor of its own. In the 7 factor solution

the size factor disappeared and variable 1 loaded high on the urbanism-ses and working women factors. But the undefined factor found in the 8 factor solution was still included in the 7 factor solution. The migration factor found in the 6, 7, and 8 factor solutions, but disappearing in the 5 factor solution was defined by the two substitute variables 36 and 37, net and gross migration 1970, and variable 23, institutional families/private families. In the 5 factor solution the communality of these variables dropped close to zero. Hence the data indicated **that 6** factors were needed to account for the intercor-relations among the variables. The six factors account **for** 74% of the variance of the original data.

The factor matrix from the 6 factor solution containing the weights needed to estimate the variables from the factors and with the weights identical to the correlation between a variable and a factor)$_e$ is reported in table C3. A more thorough interpretation of the factors than that reported above will be undertaken in conjunction with the comparison between the factorial ecology of 1960 and the factorial ecology of 1970.

TABLE C3 DIMENSIONS DIFFERENTIATING AMONG NORV/EGIAN COMMUNES IN 1970.
47 VARIABLES. 448 UNl'i'S.VARIMAX ROTATION OP PRIHSIPAL COMPONENTS SOLUTION.

VARIABLES NO, SHORT NAME	S E					
			JSTR	: LEFT PO-LITICS/ DEPRIV.	FEMLE ECONOMIC ACTIVITY	MIGRATION	8<i
01 TOT.AREA(log)	.50	-.10	.14	,26	.59	-.04	.70
03 LARC-E FARMS (| .62)	.03	60	09	• 23	-.08	.82
04 TOT.POPULATION log) (| .64)	.19	37	.22	.11	-.10	.66
05 P0P.CHA1IGE RATIO(sqri)	.30	.51	.28	.00	.07	.34	54
06 PERS.PR.KM2(eqrt) (| .82)	.00	09	05	-.24	-.05	75
07 NO.OF AGGLOM.(sqrt)	.26	.29	49	26	02	02	47
08 MEAN POP.OF AGGLOM.(sqrt)(| .79)	.05	.12	27	09	-.11	73
09 POP.IN AGGLOMERATIONS (| .68)	.28	36	38	. .01	00	82
10 AGE 5-H	.23	(.84)	• 09	-.10	-.17	-.10	.82
12 AGE 65+	.20	(-.86)	17	-.35	04	-.07	.93
13 YOUi;G MIDDLE AGE	.28	(.80)	07	22	03	24	.83
14 DEPENDENCY RATIO	.52	-.27	33	-. "jo	-.10	-.21	80
15 V/0H21I OF MIDDLE AGE (| .71)	-.07	• 34	-.08	.07	.06	.64
17 MARRIED,AGE 20+	.25	.56	55	-.04	-.19	-.11	73
19 FERTILITY	.37	.59	24	-.19	-.11	-.15	62
20 FAMILIES WITH CHILDREN	.02	(.87)	.30	-.07	-.18	-.01	.89
22 DIVORCED/SEPARATED (| .72)	-.12	09	41	-.05	08	72
23 KON-FAMILY	.11	-.20	05	00	00	(.78)	67
25 ROOM CROWING	.29	.46	.09 .12	(.71) (-.64)	.17 -.14	.08 .06	.84 76
26 OLD HOUSING	.01	-.56	07	26	11	26	79
27 MEW HOUSING	.33	(.73)	.26	.26	-32	.10	
28 NON-OWNERS OF DV/SLLING (| .74)	.05	.25	.23	.04	.00	1.2
30 BATII&V/C	.50	.55	.34	-.50	.25	-,02	.86
.32 FARM HOUSES (■ | .59)	-.28					

table continued next page

TABLE C3 CONTINUED

FACTOR COEFFICIENTS

VARIABLES NO.	SHORT NAME	UREANISK SES ECONOMIC	FAMILISM	INDUSTRY	LEFT LITICS/ DEPRIV	J>0«	FEMALE	MIGRATION		
33	SMALL DWELLINGS	.55	-.07	.22	52	32			.12	.74
34	LARGE DV/ELLINGS	-.48	-.07	-.31	(-.68)	-.09			- 09	.31
36	NET MIGRATION 1970	.22	.19	.33	- 02	08			•79)	.82
37	GROGS MIGRATION 1970	.25	.27	-.17	.23	- 06			.73)	«76
38	OCCUPIED V/ITHIN COMM.	-.15	-.15	-.09	-.15	(.77)			- 15	•70
42	ECON.ACTIVE	.25	.09	.13	14	53			.08	.39
43	ECO!J.ACTIVE WOMEN	.45	-.11	-.02	- 06	(61)			26	66
46	MALE PROF./HGR.	(.83)	.24	-.02	12	- 20			13	.81
47	MALE BLUE COLLAR	.09	.00	(.85)	.22	.07			• 11	79
48	WOMEN P-LUE COLLAR	.01	.21	.42	15	- 21			- 14	.30
49	SELF EMPLOYED	-.51	-.21	-.58	-•31	.04			- 14	75
53	DSP,Oil AGRICULTURE	-.45	-.24	-.31	- 48	42			- .02	77
54	DEP.ON MANUFACTURING	.20	.18	(.85)	14	- 01			- 07	.82
55	DEP*OH TRADE	(.78)	.30	.15	.20	.02			.09	.77
56	DEP.ON SERVICES	(.64)	.27	-.19	.22	.18			- .31	.69
57	PENSIONERS	-.33	(-.72)	-.31	- .12	- .34			.01	.86
58	LEFT VOTE	-.08	-.09	.19	(.85)	-.06			.03	.77
59	CENTER VOTE	-.33	-.14	-.14	- 58	44			- 08	69
60	COMMUNE TAX' sart)	(.66)	.04	.53	11	22			18	.81
61	TRANSFERS FROM STATE	-.51	.15	(-.62)	11	- 09			- .13	.70
62	ASSL3S5D INCOMS(Bqrt)	(.67)	.13	.51	.11	.17			.06	77
65	LOW EDUCATION	(-.63)	-.17	-.20	• 42	- .37			- 22	.83
66	HIGH EDUCATION	(.87)	.24	. 18	- 05	- 06			• 17	.88
	FACTOR VARIANCE	1 1 , 6	6 . 8	5 . 6	5 . 1	3 . 0			2.6	

COMPARING THE FACTORIAL ECOLOGY OP NORWAY IN 1960 AND 1970

Comparing the factor matrix of 1970 in table C3 with the factor matrix of 1960 reported by Sweetser (1970, table 10), the similarities are obvious and striking. The coefficients of factor congruence for. the three most important factors are «,90 for the urbanism/ses factor, .91 for the familism factor, and .86 for the industry factor (see Harman 1968, page 270, for the computation of the coefi-cient of congruence). Later the matrix of coefficients of congruence will be investigated in more detail. First the differences between 1960 and 1970 will be inspected more closely for each factor«

The urbanism/socio-economic status factor

The strongest and most important factor found in the 1960 data was an urbanism/socio-economic status factor. This factor alone accounted for 23% of the variance of the raw data. The corresponding factor in 1970 data accounts for 24% of the variance.

In order to see the differences between the two factors, those variables which have factor coefficients of -.45 or higher in either analysis were picked and rearranged according to size. The result is presented in table C4.

TABLE C4 COMPARISON OF THE URBAN I»^SOCIO-ECNCMJ:C STATUS FACTORS OF **1960** AND 1970

VARIABLE	**FACTOR**	COEFF	INDICATING:		
vruAAnuuM	**SOC.EC.**	STAT	UR3ANISM		
NO. SHORT NAME	**1960**	1970	1960	1970	
66 HIGH EDUCATION	**.76**	.87			
46 MALE PROF./MGR.	**.78**	83			
06 PERS.PR.KM2(sqrt)			.78	.82	
08 MEAN POP. OF AGGLOM. (sqrt)			60	79	*
55 DEP. ON TRADE			75	78	
28 **1960:** CENTRAL HEAT			67		
1970: NON-OWNER OF DWELLING				74	
22 DIVORCED/SEPERATED			.64	.72	
15 WOMEN OF MIDDLE AGE			60	71	
09 POP. IN AGGLOM			.62	.68	
62 ASSESSED INCOME {sqrt}	.52	67			*
60 COM&JNE TAX (sqrt)	.35	66			*
04 TOT. POPULATION(log)			.34	.64	*
56 DEP. ON SERVICES			73	64	
33 SMALL DWELLINGS			64	55	
30 BATH&WC	.63	50			
43 EC.ACT.WQMENtUNPAID FAM.WORKERS			.78	.45	*
42 BOON. ACTIVE			.48	25	*
37 1960: GROSS MIGRATION 1951-59			52		
1970: GROSS MIGRATION 1970				25	
20 FAMILIES WITH CHILDREN			- 45	02	*
23 NON-FAMILY			.66	- 11	*
38 **1960:** BORN IN COMMUNE			- 53		
1970: OCCUPIED WITHIN COMMUNE				- 15	
53 DEP. ON AGRICULTURE			- 37	- 45	
34 LARGE DWELLINGS			- 56	- 48	
01 TOT. AREA (log)			-.55	-.50	
61 1960: TAX REIMBURSEMENT	- 16				
1970: TRANSFERS FROM STATE		- 51			
49 SELF EMPLOYMENT			- 38	- 51	
14 DEPENDENCY RATIO			- 32	- 52	*
32 FARM HOUSES			- 48	- 59	
03 LARGE FARMS			- 41	- 62	*
65 LOW EDUCATION	-.45	-,63			*
COEFFICIENT OF CONGRUENCE BETWEEN	1960 AND	1970		.90	

* Asterisk indicates d5+ difference between 1960 and 197a

In the 1960 analysis the urbanism/ses factor had 23 variables with factor coefficients of -.45 or higher. Of these variables 18 accentuated urbanism, while 5 associate higher socio-economic status with the factor. In the data from 1970 25 variables with factor coefficients of -.45 or higher are found. Of these 7 are taken to indicate socio-economic status and 18 variables indicate high or low degree of urbanization.

Despite the high degree of similarity between the two factors, differences between them are of considerable interest since they presumably will tell something about the changes which have occurred in the Norwegian society between 1960 and 1970.

In table C4,11 variables are found where the difference between the 1960 and the 1970 coefficients is . 15 or high-ecThe largest change is found in the coefficient for variable 23, institutional families/private families, which dropped from .66 to -.11. The change of content for this variable from 1960 to 1970 is probably the main reason for the difference. The same explanation will apply to the variables 42 and 43, economically active and economically active women minus unpaid family workers.

Examining other urbanism relevant differences , the coefficient of variable 8, mean population size of agglomeration, has increased from .60 to .79. It is known that

during the decade 1960 to 1970, Norway had a rapid local concentration of the population into agglomerations (Gjestland and Salomon 1975). The size of the agglomerations within a commune is apparently of increasing importance as an indicator of urbanization.

The change in the coefficient of variable 4, total population, from .34 in 1960 to .64 in 1970, is, however, probably more affected by the changes in the commune boundaries than by the concentration of the population to local centers,

A fairly large change is found in variable 20, families with children, with a change in size of .47 from -.45 to «.02« While rural communes in 1960 were apt to contain many famlies with children, it is found in 1970 that families with children are more evenly distributed along the urban-rural dimension. A simple explanation of this maybe linked to the local concentration of the population. The excess of young couples locate their home 1) where they find houses, and 2) close to their jobs. This means that they are not found in the more rural communes, because there are no jobs, neither are they found in the larger cities,because there are few available dwellings.

In 1974 Oslo had 39% of its population in families with all children younger than 17 years. For Norway the figure was 53%. Semi-rural/manufacturing communes may have more

than 60% of its population in families with children (commune 1528,Sykkylven had 62% in 1974). But the more rural communes with agriculture as the main industry are again below the national average.

These changes in the distribution of families **are** also closely linked to the change in the factor coefficient of variable 14, dependency ratio, which increased from -.32 to -.52. The out migration of young people from the rural communes and the relatively higher fertility of the couples remaining, causes a high dependency ratio* At **the** same time it is found that the in-flow of young unmarried people to the cities and the out-flow of families with children to the suburbs, causes a lower dependency ratio in the more urbanized communes.

It appears that on the basis of the changes in the factor coefficients of the variables 8, 4, 20, and 14 one may conclude that the differentials in population structure between urban and rural communes is more clear-cut in 1970 than in 1960.

Another aspect of the changing social structure of Norway is indicated by the increase in the factor coefficient of variable 3, large farms (and substantiated by the change in variable 32, farm houses), from -.41 in 1960 to »-62 in 1970e

This change is probably a reflection of the structural

changes of the industries, particularly the loss of jobs on small farms either by long distance commuting or to manufacturing firms expanding outside the more crowded cities. The result is that the larger farms are more characteristic of rural communes in 1970 than in 1960.

Three of the variables with changes larger than .15 are taken to indicate socio-economic status. Of these the change in variable 65, low education, has already been commented on. Its increased correlation with low socio-economic status was explained by the under-enumeration of people with low education.

The other two variables, 62 and 60, assessed income and commune tax, also have increased their correlation with high socio-economic status. There are two possible explanations for this. One possibility is that the regional differentials of income have increased from 1960 to 1970. The other possibility is that changes in the taxation rules have made it more difficult for those with high income to reduce their taxable income.

Which of the explanations to accept as the more likely one, can not be determined without a separate investigation.

Of the variables not included in table C4(i.e. those with factor coefficients below -.45 in both the 1960 analysis and in the 1970 analysis), two show change greater than .30.

Variable 17, married age 20+, increases its factor coefficient from -.10 to .25 from 1960 to 1970, and variable 48, blue collar women? decreases its factor coefficient from .34 to .01. The latter of these changes is clearly connected with the above-mentioned trend of jobs within manufacturing industries to migrate out of the cities. **The** cause of the change of sign in the coefficient of variable 17 is probably found in the decline in the dependency ratio noted above together with the low fertility of the more urban communes.

The familism factor

The second most important factor in table C3 is a familism factor. The factor accounts for 14% of the variance in the raw data. The corresponding factor in the 1960 analysis was then the third most important factor and accounted for 19% of the variance. In table C5 it is found a list of the variables having factor coefficients of -.45 or larger in either analysis.

The coefficient of congruence of .91 for the familism factors Is about the same as the coefficient for the urban-ism/socio-economic status factors. Still,inspect ion of the differences between the two familism factors may reveal important changes in the Norwegian society.

For 6 of the variables listed in table CS the difference

TABLE C5 COMPARISON OF THE FAMILISM FACTORS OF 1960 AND 1970

VARIABLE NO	SHORT NAME	FACTOR COEFFICIENTS FAMILISM 1960	FAMILISM 1970
20	FAMILIES WITH CHILDREN	77	.87
10	AGE 5-14	58	.84
13	YOUNG MIDDLE AGE	82	.80
27	NEW HOUSING	83	.73
19	FERTILITY	35	.59
17	MARRIED, AGE 20+	47	.56
30	BATH&WC	32	.55
05	POP. CHANGE RATIO{sqrt)	66	.51
25	ROOM CROWDING	55	.46
36	1960:NET MIGRATION 1951-59 (sqrt)	51	
	1970:NET MIGRATION 1970		.19
23	NON-FAMILY	53	-.20
26	OLD HOUSING	76	-.56
57	PENSIONER	82	-.72
12	AGE 65+	87	-.86

COEFFICIENT OF CONGRUENCE BETWEEN 1960 and 1970 .91

* Asterisk indicates .15+ difference between 1960 and 1970,

between the 1960 and the 1970 coefficient is .15 or larger.

The largest difference is found for variable 23 and must be caused by the changes in the meaning of this variable {see table C2) . The changes in variable 10 and 19$_r$ age 5-14 and fertility, both increasing their importance for the factor, indicate that the factor in 1970 is more clearly related to the reproductive aspects of family life than in 1960.

Larger differentials in the spatial distribution of families with children might explain this. Such a change in the distribution of families with children is also in agreement with the increased importance of population structure for the urbanism/ses factor.

For variable 30, bath&wc, the factor coefficient increases from .32 to .55. This is probably also linked to the increased skewness in the distribution of families with children. The increased standards of post-world-war II dwellings together with localization of families with children to suburbs and communes with expanding manufacturing industries, will explain the increased coefficient for variable 30. The same explanation may also hold for the simultaneous decrease in importance of both new and old housing (variables 27 and 26).

The decrease of the coefficient for variable 5, population change ratio, indicates that the above noted

redistribution of families with children, although associated with higher population growth is. increasingly reached through a substitution of families with children for single persons or childless families.

Three of the variables not included in table C5 show substantial changes, They are variable 1, total[fr] area, variable 33, small dwellings, and variable 58, left vote. All three change from positive factor coefficients to negative ones with changes larger than .30.

The change in variable 1 is probably linked to the changes in the commune boundaries between 1960 and 1970. The changes in the other two variables are linked to the redistribution process of families with children indicated above.

The industry/agriculture factor of 1960 and the industry factor of 1970

The second most important factor in the 1960 analysis was a bi-polar industry/agriculture factor accounting for 19% of the variance of the observations. In the 1970 analysis the agricultural, aspects of this factor are much weaker, though still existing. Even if the coefficient of congruence between the two factors is as high as .86, it seemed appropriate to drop agriculture from the factor

label and call the 1970 factor only industry. The industry factor of 1970 is the third most important factor of the six factors derived accounting for 12% of the variance of the observations,

In table C6 all variables with factor coefficients of t.45 or larger in either of the analyses are listed.

The declining importance of agriculture shows up in the variables 59, 53, 32, 14, 49, and 3. This decline is not only a result of the declining importance of agriculture as an industry for the Norwegian society (the number of men with agriculture as their main industry declined from 176,175 in 1960 to 100,794 in 1970$_f$ the percentage decline was from 13.4 to 7.1, based on all men), but also to some degree on the changes in the commune boundaries.

The joining of small communes makes them more heterogenous with a less clearly defined cleavage between agricultural and manufacturing communes.

The effect of the changes in commune boundaries is also seen in the changed coefficient for variable 1, total area.

Besides these,three other variables in table C6 show changes in their factor coefficients above .15. The increase in the coefficient for variable 60% commune tax, attests to the increasing importance of manufacturing for the income of the communes. The decline of the coefficient

TABLE C6 COMPARISON OF THE INDUSTRY/AGRICULTURE FACTOR OF 1960 **AND THE** INDUSTRY FACTOR OF **1970**

VARIABLE NO SHORT NAME	fBGTOR CQEFF, INDUSTRY **1960**		INDICATING : AGRICULTUR		
54 DEP. ON MANUFACTURING	.78	.85			
47 MALE BLUE COLLAR	.74	.85			
17 MARRIED, AGE 20+	.67	.55			
60 COMMUNE TAX (sqrt)	.30	.53			*
62 ASSESSED INCOME (sqrt)	.54	.51			
07 NO.OF AGGLOMERATIONS (sqrt)	.58	.49			
09 POP. IN AGGLOMERATIONS	.65	.36			*
36 **1960:** NEE MIGRATION '51-	.48				
1970: NET MIGRATION 1970		.33			
30 BATH&WC	.49	.25			*
38 1960: BORN IN COMMUNE			-.53		
1970: OCC.WITHIN COMM. OF				-	
59 CENTER VOTE			-.63	-.14	*
01 TOTAL AREA (log)			-.49	-.14	*
53 DEP.ON AGRICULTURE			-.78	-.31	*
32 FARM HOUSES			-.76	-.34	
14 DEPENDENCY RATIO			-.48	-.38	
49 SELF EMPLOYMENT			-.74	-.58	*
03 LARGE FARMS			-.76	-.60	*
61 **I960:** TAX REIMBURSEMENT	-.37				
1970; TRANSFERS FROM STATE		-.62			
COEFFICIENT OF CONGRUENCE BETWEEN	1960 AND	1970		.86	

♦Asterisk indicates .15+ difference between 1960 and 1970.

of variable 30, bath and we, is consistent with the decline of the coefficient for this variable on the urban-ism/ses factor and the increase of the coefficient for the familism factor. The explanation is the general increase in the housing standards together with the relative shift of families with children towards suburban communes or communes with expanding secondary or tertiary sectors.

Variable 9_r population in agglomerations, also shows a decline of its factor coefficient. The change can only mean that industry in 1970 not is associated with concentration of the population to the same degree as it was in 1960. This seems consistent with the above note trend of a relative decline of the importance of manufacturing within the more urbanized communes (perhaps more caused by the growth of the tertiary sector than by any actual decline of the secondary sector).

Three of the variables of table C3 not listed in table C6 show a change in their factor coefficients of more than .30.

The declines of variable 6, persons pr. km^{o}, from .42 to .09 and of variable 46, male professional/managerial occupations, from .40 to -.02, are both consistent with the just mentioned process weakening the link between urbanization and industry. The change in the coefficient

of variable 37, gross migration, is obviously caused mainly by the change in its definition.

The left politics; factor of 1960, the deprivation factor of 1960 and the left politics/deprivation factor of 11370

Besides the three major factors urbanism/socio-economic status,industry/agriculture and familism, two minor factors appeared in the 1960 data, labeled left politics and deprivation each accounting for 8% of the variance. In the 1970 data these two factors seem to have merged to form one stronger factor accounting for 11% of the variance.: The coefficient of congruence between the 1960 factor left politics and the combined 1970 factor was ,66. The same coefficient for the deprivation factor of 1960 is only .28, and it might seem they are not even remotely connected. However, of the 6 variables defining the deprivation factor in 1960 (the variables 25, 65, 37, 61 * 62, and 59»see table C7), 3 still have high factor coefficients on the combined 1970 factor. Two of the 6 (variable 37 and 61) change coefficient as a result of a change in their definition. The change in the coefficient of the last one, variable 62, assessed income, implies only that the deprivation aspects of the factor have weakened or that deprivation is not directly related to taxable income any more.

TABLE C7 COMPARISON OF THE LEFT POLITICS FACTOR OF I960 AND THE DEPRIVATION FACTOR OF 1960 WITH THE LEFT POLITICS, DEPRIVATION FACTOR OF 1970

VARIABLE NO SHORT NAME	FACTOR DEPRIV. 1960	COEFFICIENT LEFT POL. I960	INDICATING L,IOL/DEP
58 LEFT VOTE	.34	(.61)	,35
25 ROOM CROWDING	< .63)	.06	.71
33 SMALL DWELLINGS	.36	.35	.52
65 LOW EDUCATION	(.73)	.10	.12
37 1960: GROSS MIGR, 851-59	(-.49)	.03	
1970s GROSS MIGR. 1970			.23
42 ECONOMICALLY ACTIVE	-.08	(.66)	.14
61 1960: TAX REIMBURSEMENT	(.68)	-.25	
1970: TRANSFERS FROM			.11
62 ASSESSED INCOME	(-.46)	.29	[illegible]
10 AGE 5-14	.28	(-.50)	[illegible]
19 FERTILITY	.04	(-.63)	-.19
53 DEP. ON AGRICULTURE	-.18	-.06	-.48
32 FARM HOUSES	.10	-.16	-.30
14 DEPENDENCY RATIO	.25	(-.61)	-.50
59 CENTER VOTES	(-.45)	-.09	-.58
26 OLD HOUSING	-.26	-.17	-.64
34 LARGE DWELLINGS	-.18	-.42	-.68
COEFFICIENT OF CONGRUENCE BETWEEN 1960 AND 1970	.28	.66	

Hence, even if the coefficient of congruence between the deprivation factor of 1960 and the left politics/ deprivation factor of 1970 is the lowest of all coefficients for the 1970 factors{see table C8) , the defining characteristics of the deprivation factors show that a relation exists. This indicates that the coefficient of congruence is not of much help in cases where factors ■ merge. The merging of two formerly orthogonal factors must necessarily introduce some changes in some of the factor coefficients. Some of the changes in the coefficients of the variables defining the deprivation factor have already been commented on. Of the rest, two of the changes in the coefficients of the variables defining the left politics factor are of interest. Both for variable 10, age 5-14, and variable 19, fertility, the coefficient drops from a high negative value to almost zero. This indicates that the existence of children is not related to political cleavages in the same way as before. The larger absolute declines in the fertility of the rural communes may be part of the explanation, but the distribution of young families across industries and communes also is of significance.

The decline of importance of some of the defining variables for the left politics/deprivation factor in 1960 has its counterpart in the appearance of new variables

with high loadings. The political aspects of the 1970 factor are strengthened by new high factor coefficients for the variables 53, dependent on agriculture, and 32, farm houses.

The deprivation aspects of the factor are strengthened by new high factor coefficients for the variables 33, small dwellings, 26, old houses, and 34, large dwellings.

The migration factor and the female economic activity factor of 1970

The last two factors appearing in the 1970 analysis are clearly minor factors. Each account for 6% of the variance.

The migration factor has three variables with factor coefficients larger than -.45 « The factor coefficient of variable 36, net migration 1970,. is .79, for variable 23, non-family, it is .78, and for variable 37, gross migration 1970, the factor coefficient is .73. It is seen that all three are substitute variables or variables with changed content due to changes in the census definitions.

The female economic activity factor has 4 variables with factor coefficients above -.50, and 6 above -.40. Listing the 6 variables with factor coefficients:

38 occupied within commune ,77,

43 economically active women ,61,

01 total area .. 5i),

42 economically active ,53.

59 center votes „4 4?

53 dependent on agriculture ,42,

it is seen that the rural aspects of female economic activity dominate the factor. This is precisely those aspects which are at the hub of the changes In the definition of economic activity in the 1970 census.,

It appears that rather than change the that of the established factors, new aspects of the input variables determine new dimensions within the data.

This is in agreement with studies showing that ecological factors are stable across substitutions of variables (see Sweetser 1965).

The factorial ecology of Norway in 1960 and in 1970

The matrix of coefficients of congruence between all factors in 1960 and all factors in 1970 is reported in table C8.

It was noted above that, an important reason for the changes in the factorial ecology from 19 60 to 1970 seemed to be the clearer regional separation of the population according to age and family cycle in conjunction with the

TABLE **C8 FACTORIAL ECOLOGY OF NORWAY 1960 AND 1970 . COEFFICIENTS OF CONGRUENCE**

			FACTORS IN 1970				FACTOR		
FACTORS IN 1960	URBANISM	FAMILISM	INDUSTRY	LEFT PO-	FEMALE	MIGRATION			
	SES			LITICS/	ECONOMIC				
				DEPRIV;	ACTIVITY		ABS.		
INDUSTRY/AGRICULTURE	.76	.ft2	.86	.5ft	-.2ft	.32	9.1	19	
URI3AlII3M/3i.3	.90	.26	.50		.07	• 5ft	10.6	23	
FAMILISM	.33	.91	.36	.52	.09	.19	7.1	15	
LEFT POLITICS	56	-.01	56	66	.fto	33	3 3	8	L
DEPRIVATION	-.ftl	-.05	-.ftl	.28	-.09	-.ft8	3.8	8	O
FACTOR VARIANCE ABS.	11.65	6.78	5.59	5.05	3.05	2.60			
s	2ft.7	lft.ft	11.9	10.7	6,ft	5.5			

structural changes and distribution of the primary, secondary and tertiary industries.

The similarity of the 1960 factor industry/agriculture to both the urbanism/ses and the industry factor of 1970 therefore seems reasonable as well as the slight relation to the left politics/deprivation factor.

However, the meaning of and internal relations between the urbanism/ses factor and the industry factor have changed. This shows up also in the coefficients of congruence.

Assuming no change in the meaning and interrelations of the two factors one would expect about the same coefficient for urbanism/ses 1960 to industry 1970 as for urbanism/ses 1970 to industry/agriculture 1960. The first of the coefficients is .50 the latter is .76. The difference between these coefficients again points to the already mentioned separation of manufacturing industries (which is the main meaning of the 1970 industry factor) from its historical association with urbanization.

The similarities of the urbanism/ses factors and the familism factors for the two points in time are' unquestionable. The many medium sized coefficients for the 1970 left politics/deprivation factor are a consequence of the two 1960 factors, and the emergence of this factor as a fourth major factor of the Norwegian social ecology. The

need for four factors in 1970 also supports the assumptions of greater heterogeneity in the spatial distribution of the Norwegian social structure. Or in other words: the Norwegian communes have started to specialize and differentiate along more lines than was the case in 1960.

Still, a basic result of the analysis is obviously the stability of the three major factors found in 1960. A basic assumption in factorial ecology is that the results reveal fundamental dimensions in the spatial organization of a social structure. If this assumption is true one should expect to find a fairly high stability of the factors from one point in time to the next. This is precisely the result.

But before accepting this result unqualified one more question needs to be answered satisfactorily. Is the stability of the results merely an art,ifact caused by the use of method? If the factor structure not only is stable over time but also stable across different factoring methods, one may confidently conclude that what has been revealed are basic dimensions of a social structure.

THE STABILITY OF FACTORS ACROSS DIFFERENT METHODS OF FACTORIZATION

The SPSS factor analysis program allows five methods of factorization to be used:

1) principal components (PA1),
2) principal factors (PA2),
3) Rao's method (RAO),
4) alpha factors (ALPHA), and
5) image factors (IMAGE).

Strictly speaking the first of these methods, the principal components, is not a factor analysis method. But the technique has been widely used, and, as will be seen, the substantial results do not differ to any significant degree from the principal factors method which it most resembles.

The computational difference between the principal components solution and the principal factors solution is that while PA1 uses 1's in the diagonal of the correlation matrix, the PA2 method uses estimates of the communality with iterative improvement of the estimate to obtain an optimal solution. Rao's factoring method is based on the assumption that all relevant variables have been included in the analysis, but the cases included are only a sample, In the alpha factoring method this assumption has been reversed. All relevant cases have been included, but only

a sample of all relevant variables. Since the latter assumption most closely resembles the present situation, it was decided to use the alpha factoring method and not the Rao factoring method. The image factoring method does not differ from the principal factors and Rao's methods in the estimates of communalities. All three 'use the squared multiple correlation between a variable and the rest of the variables in the data as an initial estimate of the communality of the variable.

The differences of the assumptions of the various methods are based on, show up in the iterative improvement of the communality estimates. However, it will not be necessary to go into this rather technical problem here. Image Factoring does, however, differ from the other three factorization procedures in a way which has more immediate consequences for the analysis. While one in the other three methods may control the number of factors, one will in the image factoring method get all factors with eigenvalue above unity.

Of the five possible methods of factorization only Rao's method was excluded. It was decided to test out the other four against each other.

Given a factorization of a data set* the problem of rotation has to be faced,SPSS offers the choice among four

methods, three giving orthogonal solutions and one giving an oblique solution.

The theoretically most compelling question is the choice between orthogonal and oblique solutions. A priori it seems natural to expect that some of the basic dimensions of the spatial distribution of a social structure ought to be correlated. But analytically there are good reasons to use orthogonal variables if possible, and it is far from inconceivable that the differentiation of communes in a modern industrial society will proceed in different directions more or less without one line of development influencing the other. Hence both the vari-max and the oblique rotation procedure were chosen for application on the four different factorizations which were to be developed.

The task then is to derive the six factors described above by the four different factorization methods and the two different rotation methods and then compare the 8 different versions of the same factor.

Using coefficients of congruence as a measure of the similarity between two different derivations of a factor, one must compute 28 coefficients of congruence for each factor. The results are presented in the tables C9-C14, and are close to amazing, at least for the four major factors.

Of the 8 different derivations of the four major factors, 7 are as close to identical as one possibly might wish. The one factor solution not conforming is the oblique rotation of the image factorization.

The image factorization of the data gave 28 factors. The resulting structure matrix after oblique rotation to simple structure was difficult to irterprete. Several of the factors seemed to resemble each other very closely and only the four major factors could be identified with any confidence at all. This result must obviously be caused by the number of factors retained for rotation. With 28 factors and allowing correlated factors, the structure matrix must be about as difficult to interpret, as the original correlation matrix.

It seems permissible to disregard the deviant result for the oblique image solution on these grounds.

The other results substantiate the assumption that the factor analysis procedures derive basic dimensions of the spatial differentiation of a social structure.

The theoretically most interesting result besides,, is the similarity between the oblique and orthogonal solutions for the four major factors. This implies that the spatial differentiation of the Norwegian social structure in one direction is not influenced by differentiation in another direction. In practical terms this means that a

commune high on industry is as likely to have a population with relatively many families and children as the opposite. A commune high on urbanization is as likely to be dominated by bourgeois politics as by left wing politics. It also implies that the theoretical loss caused by the use of orthogonal factors is negligible. It may be concluded that the varimax rotation of the principal components factorization used in this comparison of the Norwegian factorial ecology in 1960 and 1970 gives a good estimate of the actual dimensions differentiating among Norwegian communes.

TABLE C9 COEFFICIENTS OF CONGRUENCE FOR THE URBANISM/SES **FACTOR** DERIVED BY DIFFERENT METHODS

I.IETII OD OJ HOTATIO N	vahit tax 2	ci: o?	ODLIC U3 ROTATION C?		
PACTGIilZ- PAl atioii	PA2 ALPHA BUGS PA1				ALPHA IKA&E
PA 2 AL PH A	**l^OOO** .999 .992 **X** 1.000 .993 **X ,391 X**	.990 .699 .990 .65S .989 ».6S0	.989 .988 *S8o	.988 - .988 - .98S	
PA1 PA2 ALPH A		**.991** **.717**	**1,000** **1.000 X 1,000 X**	.989 -	.. 6 3 4 .. 6 8 4 •.
II.IAG3					

TABLE CIO COEFFICIENTS OF CONGRUENCE FOR THE FAMILISM FACTOR DERIVED BY DIFFERENT METHODS

ID32H03 OP ROTAl'ION	VAREuAX ROTATION OF	0J3I-I		H02ASI0N 0?	
PACTCEIZ-ATIOH	PAl PA2 ALPHA EIAGE	PAl	PA2	ALrHA :	CSAGB
VAHH.IAX:					
PAl PA2 ALPHA ILIAGE	X ■ 1.000 1.000 .996 **X** 1.000 .593 **X .997 X**	.995 .936 *1*997	.993	.994 .595 .9 95 **.9**	.684 . 6 3 5
PAl PA2 ALPHA IMAGE		**X**	**.999**	**.999** **.999 X**	**.646** .646 **.650 X** . 2 3 2
				.9 9 7	. 6 7 4

TABLE Cll COEFFICIENTS OF CONGRUENCE FOR THE INDUSTRY **FACTOR** DERIVED BY DIFFERENT METHODS

METHOD OF B0TA2IGN	VARHJAX	HOTATION OP		OBLIQUE		HOTATION OF	
FACTORIZATION	PAl PA2	ALPHA	IMAGE	PAl	PA2	ALPHA	IMAGE
PAl PA2	**X** .999 **X**	.999	.989	.958	.949	.952	**-.754**
ALPHA		.998	.9	.963	.955	.957	-.7
IAHGE		**X**	9	.958	.949	.953	6
			2	**.952**	.945	.946	1
			.9				-
PAl			8				.7
PA2			8	**X**	**1.000**	1.000	5
ALPHA			**X**		**X**	1.000 X	6
BIAG5							**-**
							.7
							1
							7

TABLE C12 COEFFICIENTS OF CONGRUENCE FOR THE LEFT.POLITICS/ **DEPRIVATION** FACTORS DERIVED BY DIFFERENT METHODS

EBSHQD OF H0TATI 01+ **ATION**	VAimiAX ROTATION 07 PAl ?A2 ALPHA IMAGE	OBLIQUE UOTATIOH OP PAl PA2 ALPHA I1.IAGE
PA 1	l.OUO .999 .957 -.935 -.976 -.971 -	.631
PA 2	X 1.000 .955 -.987 -.980 -.975	-.632
AL PH A	X .953 -.989 -.982 -.977	-.637
	X -.923 -.907 -.8^8	-.595
PA 1	X .999 .997 .663	
PA 2	' X 1.000	
AL PH A IM AG 2	.663 X .666	
	X	

-.707 -
.7
0
4
-
.7
0
3
X

TABLE C13 COEFFICIENTS OF CONGRUENCE FOR THE FEMALE ECONOMIC **ACTIVITY** FACTOR DERIVED BY DIFFERENT METHODS

E22H03
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ROTATI
ON
PAC202
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A2I0E

VARII'AX HOi'ASIOH OP 03LI0U3 NOTATION OP

PA2 ALPHA IMAGE ?Al rA2 ALPHA BIAG3

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PA
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AG
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.992 .990
.731 .855 .835 .8.2 *
X .999 *660 .803 .775 .732 *
X .670 .801 .774 .733 *
X .909 .909 .920 *

X .998
.998 X
.999 .
X X

Factor did not emerge in this run.

TABLE C14 COEFFICIENTS OF CONGRUENCE FOR THE MIGRATION **FACTOR** DERIVED BY DIFFERENT METHODS

MEiHOD OP	VAHIMAX		HOTATICN 0?		03L I		DOTATION	GP
ATIOK	PAl	PA2	ALPHA ILIAGE		PAl	PA2	aLI-HA II	
VA2H.IAIC:								
PAl	X	.997 X	.995 ♦ 998 X	.980 .972 .977. X	.861 .86S .859 .810	.840 .852 .842 .786	.838 .849 .842 .787	*
ALPHA HUGE								
OBLIE£UE:_								a
PAl PA2 ALPHA IUAGE					X	.998 X	.991 .997 X	a
								к X

*The factor did not emerge in this run.

APPENDIX D

Fertility Rates and Analytic Graduation of Fertility Rates for 102 Fertility Regions in Norway 1968 to 1971.

INTRODUCTION

Terms like natality, fecundity and fertility are used among demographers to denote various aspects of the reproduction of human populations.

The reproductive potential of a population is called fecundity. The terms natality and fertility refer to actual numbers of offspring produced by the members of a population.

Shryock and Siegel (1971) use natality to denote all aspects of the study of the actual reproduction of a population, while they will use fertility in conjunction. with the more refined analysis of natality. It is in this sense the term fertility will be used here,

Demographers, and social scientists of various other breeds, have invested much effort in refining the measures of the fertility of a population, usually expressed as a rate (number of offspring from a suitably selected base population).

But before the fertility rates used in the present study are defined, it may be useful *to* consider why one has to refine the simple rate constructed from a count of births and a count of people exposed to the risk of giving birth.

The way this question is framed gives half the answer. The problem is to find how the risk of giving birth varies from person to person. It is fairly obvious that there

are strong biological determinants, and characteristics like sex and age were the first to be introduced into the analysis of fertility. Also there are strong social determinants of the "risk of giving birth". Marital status and geographical location are examples of characteristics often used.

By cross-classifying the population according to the most important of the determinants of the "risk of giving birth" and computing birth rates for each sub-population, one is, presumably, getting closer to basic characteristics of the population in the sense that the new more refined rates are likely to vary less than the old.

So far all which has been said is that the fertility of a population measured as a rate is determined by one vector, 8., of biological characteristics and one vector, 2» of social characteristics. For short one may denote this fertility as f(6,, 9_2) .

The important biological determinants are few and fairly well studied (see Llewellyn-Jones 1974^ at least compared to the social determinants. Not only are the social determinants of fertility more numerous than the biological determinants,but the identification of them is also complicated by the double determination of fertility. Either the two types of determinants will tend to confound the study of each other or the number of separate fertility

rates will multiply beyond comprehension after just a few cross-classifications.

One solution to this problem is to define a small number of what shall be called fertility parameters, so that the vector of fertility parameters, 9', may replace the vector of social determinants ($©_2$=g(9')). By selecting a suitable f and specifying the biological determinants of the fertility, one will be able to estimate the fertility parameters. This is called analytic graduation. From the estimates of the fertility parameters one may go on to study the connection between them and the social determinants of fertility without a confounding influence from the biological determinants.

The biological determinants of fertility

Even though there are no logical reasons to confine the study of fertility to the female population, the practical reasons are compelling enough. Custom will be followed by estimating the fertility of the female population only. The other important biological determinant of fertility, which will be controlled for, is age. There are three aspects of this variable. The first two of these are the age at puberty and the age at menopause. The third is the age interval over which one may assume fertility to be constant.

Observations so far seem to indicate that fertility is a

smooth continous function of age. This means that the age interval over which fertility may be assumed to be constant ought to be as short as possible. Again practical considerations suggest that one year ought to be selected.

During the first and last years of their reproductive period the women of a population have very few births. This means that an exact estimate of the age at puberty and age at menopause is unnecessary. In this study age at puberty will be assumed to be 15 and age at menopause to be 50. More than 99.9% of all births are within this age interval (the few recorded outside are all for ages below 15).

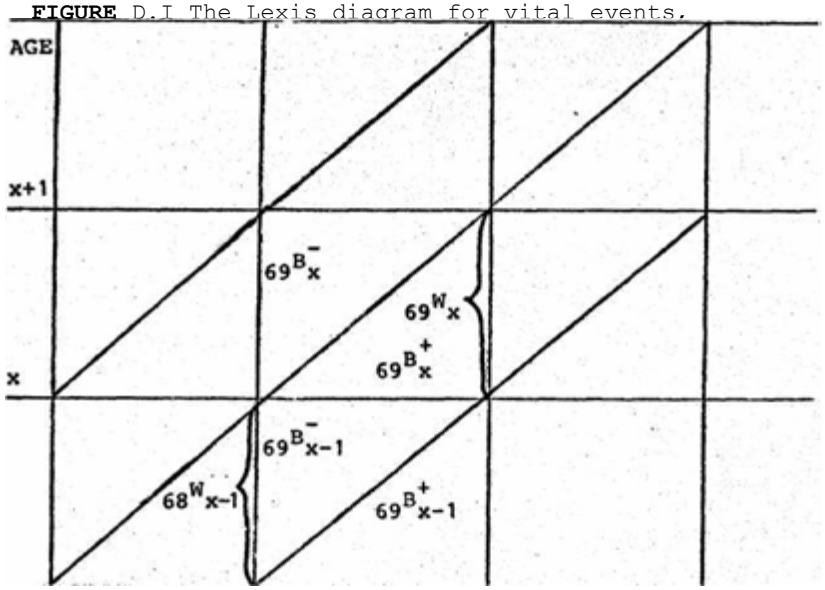
Fertility rates

The first step then is to compute single year fertility rates for females from age 15 to age 50.

In computing fertility rates one must take care to match the *count* of births to the count of women. The various possibilities are best seen in a Lexis diagram :

The Lexis diagram is also known as Becker's diagram or Becker-Zeuner's diagram. (Hoem 1968). The diagram is also used without any special name (Shryock & Siegel 1971}

FIGURE D.I The Lexis diagram for vital events.



Y	**1**	**1**	**1**	**1971**
E	**9**	**9**	**9**	
A	**6**	**6**	**7**	
R	**8**	**9**	**0**	

In figure D.I one may in principle draw a line for each **person in** the population under observation. The line starts at the time of birth for the person or at the time of entry (immigration) into the population. The **line** stops at the time the person dies or leaves the population (emigration). The lines go diagonally in the figure so that they cross the x-line at the time the persons celebrate their x-th birthday. At the end of the year 1969 one then may observe $_{gg}w$ x year old women in

the population, and at the end of 1968 $68W_x$-i $^{x\sim1}$ year old women are observed.

During the year 1969 there also will have been observed ($_{69}B_x$^$_1$ + $_{69}B_{x—1}$} births among x»i year old

women and ($_{g9}B_x$ + $_{g9}B_x$) births among x year old women How observations are recorded is usually the deciding factor for the choice of how to approximate the ideal rate of number of actual births among x year old women divided by number of possible births among x year old women.

In Norway births are recorded by the age of the mother at the time of birth. The total population is registered according to sex and age at the end of the year. From this, one must try to match the ideal rate as well as possible.

If it is assumed that each woman usually will be able to produce one birth a year (even if this is a bit high the final results would only have to be divided by whatever fraction of a birth which happens to be the true maximum possible to produce during a year), the number of possible births to x year old women may be approximated byW_x.

The true maximum of possible births might then be obtained by adding together all the life-lines of the women in the population as these were recorded in a Lexis

diagram measured in full years or fractions of years. Lacking the data to compute this measure, one may approximate the influence of deaths and migrations by taking 1/2 (W , + W) as the total number of births it might be possible to produce for those women who are x years old at the end of the year.

Since births are recorded with the age of the mother at the time of birth,it is not possible simply to take the number of births born to x year old women. Some will bear their children before their own birthday and will be x+1 years at the end of the year if they were x years at the time of the birth. Hence it must be distinguished between those born before their mother's birthday by B~ and those born after their mother's birthday by B . It is then seen that the women who are registered as x years old at the end of the year actually .have born (B~ - + B^{+}) children.

X™* I X

Hence the fertility rate for x year old women during the calendar year n will be computed as 2(B~_.,+ B^{+})/ *n-1^{W}x-1^{+}n^{W}x'* For the period 1968 to 1971 tne following rates have to be computed $\sum_{n=1968}^{2} ({}_{n}B^{-}_{x-1} + {}_{n}B^{+}_{x})$ area (see Appendix B:

. 1

X1 1971

n=1968

for ages x=15, 16,....,50 and for fertility areas no. i^mt, 2,.....102. These rates are presented in table Dl.

Ages 46, 47,..,50 had to be left out, but are included in the SUM row and of course also in later analyses.

The fertility parameters

To denote the fertility of a population it was decided to write *£(Qy&$_2$)* with *9^* as a vector of biological determinants and *&$_2$* [a] vector of social determinants of the fertility. If the study is confined to female populations, one may simplify the above expression to f(x,9_2), with x as the age of the women.

The identification of the elements of the vector 0_2 is one of the principle aims of this study. They are not sufficiently well known to enter directly into the expression f(x,9~). Hence it is assumed that one may substitute g{&)=8_2 where 9 is a vector of fertility parameters selected together with f so that estimates of them become possible. With 9 known the principal study will be the relation 9-g™ (9~) where the effects of sex and age are removed from the fertility measure.

The fertility rates defined above and presented in table Dl **are** estimates of the function value of f(x,9) for each age x=15,...,50 for each of the 102 fertility areas.

These numbers will be referred to as f .(x,9.) with o

TABLE Dl FERTILITY RATES FUR 102 FERTILITY Rfc(5ION$,OBSEKYATIONS FROM THE YEAWS 1968-1971

	F-REGION	F-REGION	**F-REGION**	F-Rt(ilON	**F-REGION**	F-RtGION	**F-REGION**		F-REGION	
AGF	NO. 1	NO. 2	*NO.* 3	NO. 4	NU. 5	NO. 6	NU.	f	NO.	6
15	d.000	• B73	2,495	0,000	.896	• 727	0.	009	**Z**	
16	1,91?	6.087	5,044	1.257	5.626	4,277	5.	**77?**	2	
17	31.617	17.145	28.84?	2*.961	18,100	28,746	13.	632	**17**	
18	^9,743	57.50?	75.535	40.207	70.043	52,593	42,	06b	43	,30
19	1?1.1?*	91.082	127.641	8b,624	97.023	94.811	72.	368	86	.898
33	147.881	116.977	150.415	110.487	143.2/0	129.754	122.	919	109	•
3.1	158.371	162.654	162.810	I?/.434	187,737	161.702	134.	319	153	.374
3?	■ 177,305	185.300	172,524	12H.917	177,686	171.141	168.	421	162	.979
?3	163,467	194.819	192,9*1	15/.356	200.82**	181.758	165.	239	212	.2*
34	1^7,343	185.759	181,532	159.647	159,692	186.031	194.	891	212	.093
35	1*6.541	188.?48	168.163	15/.658	196.098	177.826	202.	21b	189	.07t
36	164.779	174.458	172.338	160.103	171.186	175.302	191.	712	214	.079
?7	139,587	168.168	131.451	13b.878	151.Obi	169.549	150.	706	Ib9	.629
?8	137.632	148.694	134,950	13H,bl4	136.669	140.320	170.	34/	178	.196
39	1??,715	138.311	93.468	130.395	124.031	141.251	122.	699	130	.149
*>3	119,670	130.383	101.48?	100.b39	87.546	98,300	154.	690	139	.620
11	53.39^	93.250	102.063	84.034	99.7/1	96.920	99.	738	118	.501
13	73,591	85,044	69.255	6^.966	80.796	95.281	87.	600	31	.685
IT	91.97°	76.577	66.310	70.659	61.b38	65.359	75.	630	78	,b04
14	76.290	59.4?1	55.525	70.974	49.Z91	65.314	60.	684	93	,12
15	^6.061	60.032	53.540	40.146	42.581	38.906	50.	104.	59	.46
16	63.375	53.691	42.?.a9	48.043	41.667	bQ .294	41.	88b	55	.99
"»7	37.370	40.874	40.237	4^.838	43.912	40.966	48.	811	59	.11
tfi	?3,047	41.499	27.226	1^.231	36.686	35.000	31.	*?8H*	34	.33
~*9			36.889	20.888	16.H31	21.092	26.510	23.	909	20	.95
4 0	9.513	16.529	10.215	14 . 7 p 1	21.416	10.918	16.	78b	18	.78
41	9,593	18.088	8.312	10.963	8.480	8.222	10.	56d	13	.51
43	4.706	10.019	7.265	16,047	6.024	12c612		9^576	2	.93
41	5.609	7.449	4,310	• 2.901	8.373	9.193	2.	719	7	.09
44	U084	4.762	1.064	2.H33	3,538	2.805	8.	174		
45	1.036	3»?27	1.031	2.736	0.000	.907	4.	178	1	.46
SUM©	?446.5gg	?552.715	?413.038	2173,330	2453.768	2474.166	2483.	702		.88

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TABLE Dl	FERTILITY	RATES FOR	10? FERTILITY KtGlONS.OriStRVAriONS FROM				THE YEARS	1968-1971
continued								
	F-PEGION	F-REGION	F-REGION	F-Rfc4ilON	¥-REGION	F-HEGION	F-REGION	F-REGION
AGE	MU<, 17	NU. 18	NO. 19	NO. 20	NO. 21	NO. 22	NO. 23	NO. 24 ,
TS	OoOOO	2.6S3	1.606	0.003	1 175	1.688	o.oou	1.049
16	4.087	4.252	8.117	3.00B	5.869	8.514	• 909	4.147
17	?0.03?	19.310	28.846	!J.bfl5	26.452	19.709	23.441	29.bl'7
jft	6-3. 948	8?«,993	80.353	61.6R8	56.9bl	46.187	59.67J	64.220
19	66 ,,78=;	117.S62	112.510	6'.bl6	62.099	114.635	77.651	114.345,
?3	95.11*	163.?65	130.886	116.105	98.584	154.649	123.572	164.93H
?1	115.447	163.418	212.264	17^.104	113.613	155.984	155.818	163.4b7
??	114.4<S7	17?.389	193.309	166.832	129.678	190.556	H3.25d	170.279
?3	16?.220	?26.727	207.363	1flb.J66	160.314	170.875	189.091	185*/65
?4	175.246	S93.407	208.799	200.385	175.299	181.345	202.944	173*459
J>5	1*5.670	1R5.07S	169.059	15^.489	176.123	190.299	190.80b	187.181
?6	160.904	164.3H4	165.005	16^.077	167.776	164.324	168.056	**176.722 £**
?7	16P 1R7	149.279	180.266	178.218	145.533	170.890	169.96J	152.797 -
?8	14?.114	137.955	137.566	1?4.176	124.214	138.053	148.786	146.269
5>9	136 073	107.996	127.524	11J.636	123.7 79	101.633	118.694	134.46 7
ID	U7.313	114.345	101.695	13H.132	89.256	141.461	111.208	85.S26
31	RS.166	84.783	106.610	13<^.b97	85.667	79.690	92.49J	102.439
-»?	66.448	8C.435	69.114	96.296	84.556	93.975	78.16/	94.51b ,
13	70.658	71.882	81.140	66./28	75.666	74.486	74.386	65.348
"*4	60,514	60.335	62,291	6J.790	47.945	62.538	51.243	60.177
15	*»8.05>7	39.216	55.614	60.041	49.470	54.777	60.32b	49.091
16	35,73"*	46.053	38.741	44.583	33.228	61.050	39.943	41.026
	?5,505	34.858	37.221	3t>.638	3H.16H	40.367	35.386	41.08b
IB	12,340	- 30.9?8	22.556	19./Q0	29.828	42.679	20.661	2i.db8
19	?6e38f>	**r-,109**	19.778	14.??8	23.324	28.152	17,10b	16.165
40	11.289	??.6R0	14.035	29.213	19.787	29.575	19.16b	27.982
&1	10.0R7	18,519	11.481	1/.b63	10.550	14.406	12.212	12.b3b
4?	J?.150	5*780	6.-969	1J.086	8,996	7.009	11.400	9.485
&3	4.4P7	7.505	2.358	■ «.840	8.689	6.098	6.101	5.155
44.	*.9j6	5.464	4.545	4.149	0.000	3.462	5.84b	1.211
45	**c.eoo**	Io699	0.000	0.000	1.295	1.124	3.266	3.392
SUM*	?:J03,?50	2500,191	2600.3B1	?4fib<,792	2175.104	2551.318	2443.659	2507.707

TABLE DI FERTILITY RATES FOR 102 FERTILITY REGIONS.OBSERVATIONS FROH THE YEARS 1968-1971 continued . '■ '' . '• • ,

F-REGION F-REGION F-REGION F-Rfc(il ON F-REGION F-REGION F-REGION F-REGION

\1 !"t¤? W<526 0.000 0.000 1.255 0.000 l.?B9 0.000

•1*» 3»784 3.?io 6.470 4.050 6.P50 ilo36 2 %%A T

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{J 3#SK n-?2-" 29.506 ^i64 at:5? i«:?89 2; ,:

13 6^.851 39,146 48,700 67,144 75,137 63,102 47,916 12m.495

19 68,171 ?10,966 167,386 166,b97 191,883 113,169 18l,45i 150,349 138,472

20 183,461 162,249 200,240 183,821 212,799 174,086 141,347

?4 1«4.6?4 183.099 166,526 19M,G46 196.982 210.384 183,599 186.704

>5 17?.961 182,208 199,374 194.615 173.175 144.374 156.716 153.846

*A i«5A,317 165.517 171.457 I6b»bll 192.081 165,138 141.864 168.081

143,517 195,349 158*335 t^.an? 17".,.iiT 1^7 cq/. *->* ».-^ «... ---

195,349 158,305 l4*.402 175.313 137.584 128.12b 138.739 £

?§ 145,6?1 122.449 128,994 143.404 130.112 134.217 117.073 165.756

59 l?i,591 144,573 118.437 l?i,005 139,US 124,004 129.939 129.S77

■*0 lD9.7p 11?.45(? 107.294 92.4! 7 ilUUi 125.957 117.647 95*703

■»! 9S,391 90.776 105.009 99.214 105.769 89.451 82.216 116.684

75#5lt'I2i|! ^#S ?>*f? *md<il* 78.725 73.427 46.070

75.2^1 65»574 66.454 77.771 77,711 «fii« 87,866 wiiha 83.186 cu 8n ' an 58,«076 ; 80^990

14 53,758 73.136 53,743 74,816 55,914 65.259 58.8/8 48./a0

-»5 49,771 94,840 47,865 5i,2?7 72.917 71.625 61,338 59.770

16 40.715 57#061 48,366 47,745 57,377 67.126 35.92a 54,b4tj

17 11.408 37,838 31,427 34,b?5 50V3&2 ' ' 3^,128 38,132 33,595 -,0 «>»»i

34>09l 24,Id4 26,916 25,267 43.261 29.93b 34,261

'-f*-..- 28.646 14.294 26,244 23,794 29.13b 37,607 32\.rfb4

41 Mia S*?!S ?M^ 1%SH33 ^ 11W353 11,804 iJllJr 21 ^84

4> n#i?7 ^ "S *'^ «^6, 7.339: 14,052 26.439 17,544,

41 7*l«- ^*n7! 15.839 lt,4Q5 «.929 22.272 7.48b 3.961}

t2 1*6^ 'l/'^ 5.233 '9.288 ^ff 16S9 4,283 3.019 9 6^53

45 3*49R "a"Sp ■Ii?i ff, 3,231 A*«e.. 2,901. 0,000

sum. **^4;,?;. ^3g„,-.i§ ^s;^;.^** wlJ:gs..;«J:gi «3S^!.**

TABLE Dl FERTILITY RATES FOR 102 FERTILITY RE6IONS.08SERVATf.ONS FROM TriE YEARS 1968-1971

F-REGION F-REGION F*RE6ION F-RtGiON F-REGION F-RE&ION F-REGION F-REG10N
AfiE NU. 31 NO. 34 NO, 35 NO, 36 NO, 37 NO. 38 NO. 39 NO. 40
15 1

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A «*n « «««

70,764 39,72? 57.652 24.494 44.352 124,845 91.519 122,353
95.238 92*989 97.940 137.300 148,615 99.299 164.083 |12.450
147.971

r\ ■ 166,44*1 *^-».t to i*+-3.jhu i"»ii.v»vti i^/_a<-,^ 17«. -jcfl »^e «ia 1M4 4QO

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?9 147.187 l?1f43i 115,686

S9.98& 137,525 lli.«98 ^fei ilS UMH it^'

11 ■«• qQ, II:'oc?'- !^*of5 »0*^7 74#SJ34 71.368 122,271
L ^9^!! 5?.854 63.319 **8U.0S9-** 74.836 69.0S2 **108.** *?Qd*

It Sl-II3; ' ^'f4! ^a75 55.514 56,210 50.043 92.234 eH.

^ S*S2 ^ict ti*^9 49,9?? 56.518 50.84? 68.241 85 c3J
16 A-6,.9««5 16.750 38,46? 46,512 46.916 33.085 29.540 72 316

l li:i pr :s m.
&«! ilk l

'.i 15.972 0.000 4,773 2.424

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19 34.6^1 >?.9?7R »7.«9 23,3d? ?151.979 2280.150 2571.354 2318.46B 2482.215 2758.53*J 2942laa
2b,074 11,985 20.4?5 25.514 36,474
16.794 13.245 15.707

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TABLE Dl	FERTILITY	RATES FOR	102 FERTILITY RfcGlONS.OdSERVATIONS				THE YEARS	1968-1971
continued		F-REGION	F-REGION	F-RtfiiON	F-REGION	F-HEGION	F-REGION	F-REGION
A^E	iyJO$_{e}$ 40	N0$_{\wedge}$ SO	MO. 51	NO, 52	NO. 53	NO. 54	NO. 5b	NO. 56
15	1 e^{1})^?	2*217	2,024	0.000	0.000	1.135	0,000	0.000
16	?.07^{c}»	2*259	2.01?	3.714	3.583	5.207	5.380	1.738
17	?2.449	13.072	8.230	27,179	18.257	21.760	25,714	
13	$^{B;}$7$_{C}$9?7	51 .8^1	46.39?	70.342	55.634	48.246	73.11b	35.990
19	35.291	95.R90	91,842	110.3?4	88.292	81.370	123.642	89.863
?0	I'6.0'1	13'.988	130.461	161.832	130.906	101.813	166.514	125.i41
'1	172.946	1R?.1?8	168.14?	175.682	145,526	112,268	229.358	161,601
??	2C3.18?	235.192	206.767	?5b,976	210.475	171.390	246.914	210.443
23	'13.96?	105.616	209.699	231.365	193.214	166.404	240.137	262,036
?$_{U}$	'41.1R0	232.945	218.466	244,19?	219.iv\	185.736	266.460	252,153
'5	'06.579	184,116	205.507	239,b83	204.22b	185.068	215.498	238,431
'6	'06.944	??3.553	185.915	230,487	173.729	170.101	231.454	224,737 **»
?-7	'13.--6R	179.46?	1H8.563	187.148	183.133	169.540	204.596	215.054 £
29	1R1.295	173.554	157.895	17J.913	173.522	155.884	192,661	209.129
'9	1Qi>,694	154,786	176.271	169.C51	138.667	142.779	147.488	173.391
10	148,545	147.624	138.117	139.082	107.725	127.092	137,812	153.425
11	121.93?	145.570	88.083	16H.876	119.658	103.528	124,034	168.651
IP	i'i.7?4	14?.703	115.146	130.435	112.024	96.648	135.444	175.983
33	96.4?9	89.686	84,776	11 /•199	85.862	106.847	102.004	115.464
la	78.411	104.664	61.736	1?b.O99	92.056	83.333	100.289	121,to88
"*5	71 ,55"*	R4.306	75.608	103.834	60.842	60.834	. 87.80b	87,361
36	63.^71	65.116	80.209	86.601	67,365	58,476	71.146	98,5 78
17	72.787	41.522	69.505	81.385	47,112	44.870	46.170	72.072
18	42.94C!	59.565	30.54H	6b.163	39.068	32.557	44.761	H5.7W
19	14,797	51,685	34,996	54,b?6	32,023	32.206	40.SI*	55.111
f»0	47.059	39.648	49.111	RJ.219	17,910	27,347	27.807	43,478
41	?8«f;07	44.025	29*925	35.146	30,000	23.586	25.397	36,458
4?	17.391	16.211	21.164	27,610	19.444	10.655	15.086	31.142
43	12.204	25.024	15.954	■ 2J.549	16.382	9,597	17.149	15,025
44	7.587	12.545	11.536	14,694	6.821	5.265	4.396	16.897
45	2.915	9.94?	1.408	4.732	4.158	2.494	8.820	2.835
SUM »	3114,945	3145-.952	2909.917	351b.186	P802.694	2545.863	3361.998	3494.423

TABLE Dl FERTILITY continued:

RATES FOR

102 FERTILITY REGIONS,OBSERVATIONS FROM THE YEARS 1968-1971

	F-REIUON' NO, 57	F-REGION NO, 58	F-REGION NO, 59	F-RtGiON NO,	f-^£61 04 WO« 61	F-REGION NO. 62	F-REGION NO, 63	F- NO,	64
1	•F-099	1.133	©•000	60	0,000	• 666	0.00	1	.01
5	3.314	A,538	0,000	0,	i.739	2.007	LI	3	.34
1	.14,50'	?7.-	IS.	00	17.391	11.498	3.16b	17	.28
6	1 •	165v	129	3H.	.U:	31,399	27.620	42	,17
1	87,374.	46,025	62,50	061	6O.S50	77.832	55.9,4	89	• MO1
7	155.5	97,650	0	71	-;	95.141	4		•
i	56	124,145	n	42	100,44	134,76	108.72	139,	.15
?a	197,3	166.163	a	21	3	6	7	160,	,452
31	37	180.967	n	3	164,87	157.23	1^*4.7	165,	750
?9	?7i>,0	196,256		157,	5 ■'■	J	72	167,	,66b
6	4?	177,400		248.	185.57 7.	1B6.65	164.25	164,	.50
	240.43	201.602		306.	239.00	8	1	155,	,55
?	4	181.180		252.	0	195.21	196.07	150,	»683
7	1,893?	164.948		192.	227,74	8	a	142,	,80
	,616	127.378		S37	1	184.02	191.73	117,	,850
2	'2.2?? ■	143.246		210.	230*62	3	6	i11.	,943
8	?07.1?	106.047		616	0	193*67	219.26	99.	,63
	4	110.454		191.	.221.2	7	9	72.	,69
?	195,95	86,789		/81	4.4	204.70	205.84	65,	253
9	1	89.695		159.	167,99	4	9	54.	.59
	175.26	94.050		236	1	151.84	216.73	50.	.68
1	5	82.031		140.	208.10	0	0	43,	,399
0	164.75	86.796		239	0	142.78	178.05	35..	578
1	6	49.149		10«J	188.35	8	4	29,	,20
9	1??,65	43.519		.235	8	134.76	175.59	18,	380
3	53,	37.838		86.1	159^06	3	b	14.	865
1	761	39.042		09	1	,110.2	163.58		o A /a.
4	133,83	15.267		91.5	160.90	68	0	i** e	070
0	5,9,	14.634		03	4	96.241	130.57	3	130
1	549,	9.53"9		S/.2	139.15	96.677	j	1 •	241
2	127191	9,288		48	4	69.825	131.33	2311	
4	021,	1 *455		104.	U9.84Q	60.874	8		
1	1,8873	2718.00		363	99.Q80	71.161	93.506		
3	7 ,	1		60.0	74.738	55.1.0	85.79A		
4	869496			3572.5	«I,	4	68.01b		
?	921901			14	020	41.723	60.662		
■	763294			16	85.691	.	49.336		
^	4?1741			59.8	62.969	31.929	39.643		
4	63,694			22	43*344	23.173	32.258		
1	;			36.5	3&.T90	20.481	37.886		
1	3			58	40.27*	11.265	30.85a		
4	8			3-	*	.5.423	17.964		
4	7			3.67	23Vl17	3.548	15.16b		
1	8			5	■·■ 18	,2.594	5.623		
5	0			lh.6	..^?3'	2607.9	5.792		
1	3			16	21*260	69	7.678		
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TABLE Dl FERTILITY RATES FOR 102 FERTILITY REGIONS,OBSERVATIONS FROM THE YEAKS 1968-1971

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F- REfilON AGE NO, ftl 15 0,965 \f> 6,965 17 ?i

F- HEGIO N NO* 8? 1.637 5.941

F M

F - R I N O .

>-REGION F- HEGION NO, 8b NO*

F- REGIO N NO, 6f

F- HEGIO N NO,

61, 94? 105 .60 ? 1*7 .23 1 174. 307

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9.00 0 4,11 9 28,6 78 58.1 1958 122. 068 125. 196 156 174, 716 126* 184. 683 593

0. 00 0 60. 484 163. 606 1 Q I .111)3

164. 683

0.086 0 4.50 8 20.6 92 59,8 22 103. 605 146. 628 1 no i -»-» 206.8 65 233.8 75

76.9 76

So,. ?U0 60e7? 9 36.34 0 16.064 .966 16.355 .346 8.173 3.442 3,Si& 102 2821.543 .912

0, 00 0 3, 11 5 217.665 P38/ 2294 2?2 2,329 ? 939 164, 26 556 149. 301 200, 177

0.000 4.533 33.81 8 69.82 8 106.6 93 151.6 41 160. 518

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16. 694 20. 9B5 24. 596 ?9?0 S53

3 5.^ S« 23.0 77 1f.1 59

57 e 650 44 22 21. IP. 5. 3250

30.2i b 13.73 6 21.19 2 9.484 { 298 3-30b 3058 S»174

54, 920 49. 09J P7- 4H4 19* 802

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TABLE DI FERTILITY RATES FOR 102 FERTILITY REGIONS,OBSERVATIONS FROM THE YEARS 1968-1971 continued

	F-REfilON NO. 89	F-REGION NO. 90	F-REGION NO. 91	F-REG1ON NO* 92	F-REGION NO. 93	F-REGION NO, 94	F-REGION NO. 9b	F-REGION NO, 9b
1 5	0.000	3.075	1.104	0.000 73. 863 864	1.136	0,003 64	0.000	1.2
1 6	5.405	30.0	2*32?	ft 1P56	3.431	1.948 00	4.828	0.0
1 7	17.84*	19B.?	23.108	.292	23.909	15.682 95	19.730	26.1
1 9	61,215	011 40.?	59.385	18^ 283 234	90.179	56.776 25	62.693	68.2
3 0 1	194.	195.13	99.565	814	99.723	103.448 76	121.082	103.5
?	m.5	639 103.	129.810	940 340	159.265	171.838 20	166,512	152.1
3	910	213 350	167.965	189 181	182.421	192.547 92	209.291	177.b
3	170 79	581	197,774	096	228.479	201.511 78	205,769	180,7
4	779	156. 200:	199.912	436 336	18/.248	189,290 00	227,666	198.5
4 0 5	161,66	534 334	183.274	393	217.247	179,688 538	.224,915	189.
4 1 2	158 1	187. 858	172.348	125 705	176.930	202.324 37	190.523	181,9
6 4 3	1Q8.7	1R9. 968	195.000	7.2	16?.?57	45.000 33	46,994	52,9
4	141 965	158. 091	160,423	58/	16?.4?1	142.020 79	163.694	162,5
3	990 337.50	73 141. 4	148.520	113 114	15?.?4?0	40,498 48	46.196	37.J
	379	??7 95		547	14?.?62	139.803 79	179.262	197.J
	784	130. 71		880 180	11?.?605	15.291 68	33.079	19.2
	139 316.93	335 54		163 61.	29?4.120	147.034 57	179.56/	142.8
	98 «5	103. 64		897 5j	97?.?205	13,413	22,222	17.5
	3	^48 .7 91		7	12?.?100	135,823	130,744	109,2
	45.896	57 ,6 43		1?J 9J.	119.?617	150,079	15.569	34.2
	4.819	46.957		.50 7	76.923	26963,653	J058.338	2149,382
		28.716		4 59	78.283	149,993	7.9 If	13-
		45.016		2	67.308	117.117 97	135.640	102,0
		27.464		30.		117.002 16	105.941	103.5
		11.504		no		86.548 59	101.523	94.3
		13.167		16.466		45.283 55	87.732	66.9
				16,101		72,897 33	77,884	59.9
				42.644 23.73 2.2 7.140 24.440 21.739 7.346		60,055 901	7i.53t,	55.
						65.429 56	54.492	43.9

TABLE Dl continued

	F-REr*ION NO. 97 ?. 96 1	RATES FOR NO. 98	F-REGlON NO. 99	F-RtG10N NO- 10*)	^-REGION <MO» 101	F-HEGION NO» 102	
I			v65S	1.596	0.002	1.582	
S			8.797	X<*eO?9	5,206	8.200	
1			/?5.G7i	4U.1B3	23.745	38.61b	
6				8*5e /49	90.70*5	96.413	
1	117.216		114.501	1 j ■ 3, f, q 9		£49^780	
7	i 45 # ?«;<>'		t is ? 7 7 p	16V, ^77	IH7^ ?.'■?_	1 ii ~S ft T i.	
			£ 0 ? * (-'	190?169		j 99 j» j	
			233.470	?0.fee&2Q	210.821	211 "'49^	
1			218*764	■'194.116	?46.726	208,7a>"	
8		211. 936	211.538	i8^,363	?3i®bO2	2.08.72i	
			21? s.274	18b#0Q2	2.20 s 000	..195*103	
1			191.005	17b.305	217,216	i?5e139	
9	'P5. 371	P1S. 800	?99.30?	170.801	221.284	159,890	
			i95«,650	14b.?13	165.946		
?'	8		135*950	138.b3?	167*247	i23,060	
0	148.	141.	149,341	14b®803	164,166	i28,806	
s	'9	414	146,843	10b.7?1			
>	161.	17I.	124,337	114,b04	136,235	115.621	
'	10	S01	104®643	ioi no	119.431	92,114	
3	118.	96,6	81.75?	82#bOO	116^22?	71,571	
l'		54	89, ?19	7^.377	105.708	74,17b	
a		141.	97,595	70«80H	.96.070	. 70.-99O -	
		391	71.141	6J®8flS	109 ,6S60		
		54.6	74,0?4	5'?«835	68,376	39.293	
1	77*	88;	60 ,9b8	3/.50C	77*236	39.718	
6	897	33	5?,390	34,8?6	35,565	33.499	
		35	37,474	?9, 797	48,421	18.371	
		76,?	3?®624	3I.J0?	32.78 7	15e541	
		81	1 7..5*4	19.95^	24,149	12.550	
		61.0	23 ,,051	6B /c;7	15.251	H.25S	SUM ALSO INCL
		1?	6,21 i	b./31	16.667	7,01B	DDES THE AGE
		53.^	"I*3Q 1 TO/ j? j ™ & $ jcn	3U?'»294	3681,34tt	3022.232	GROUPS 46-50.
		41					
		19.4					
		333 3^:■.					
		863					

43	?	
4.15	9	
44	IS.H	
'		
45	15.371	
SUM*	313?.5<	

used to indicate observed value and i nuirber of fertility area,.

One may then estimate the vector 9. as the vector 6 .

*zl°

o1

which minimizes the expression]>__ w (f .(x_f8.)-f(x,9.)) .
x=15 X ol * x tf one chooses w_x==($W_{>:\_}$., + w_x^/$^{2f}_o$i (x'9o) ' 9oi wlli
be a

minimum chisquare estimate. This estimator is optimal in the sense that no other least squares or moment estimator will have better asymptotical properties (Hoem 1972) as long as f is chosen from a fairly wide and explicitly defined {by Hoem 1972}universe of functions within which one for instance will find all left-skewed probability densities.

There seems to be no particular theoretical reason to choose one f instead of another besides the fact chat the function ought to be continuous, left-skewed and one-topped for a less than x and x less than b, if x is age and a and b are the ages at puberty and menopause respectively, and the function ought to vanish outside the interval (a,b). The empirical investigations have concentrated on the Hadwiger function (Gilje 1969, Hoem and Berge 1974 and 1975,Berge and Hoem 1975, Berge 1974b, and Hoem and Holmheck 1975) with quite satisfying results. The use of the Hadwiger function as graduation function will therefore be continued, *T'nen* f has t-,o be replaced by h in the expressions above.

The choice of fertility parameters is a problem which must be considered in conjunction with the choice of graduation function. The earlier investigations ended up by choosing 0=(total fertility rate, modal age at birth, mean age at birth, and variance of the age distribution of childbirth). This is at least an approximate interpretation of the parameters actually used, which were the mode, mean and variance of the density defined by h(x,9)/

J h(x,6)dx and jh(x,6)dx was interpreted as the total
a a

fertility rate.

Hoem and Holmbeck (1975) point out that the earlier interpretations are far from accurate, especially for the **variance**, since the fertility ought to be zero for x larger than b, the age at menopause. Iff one is interested

in interpretable fertility parameters one cannot use x=50 directly the vector S estimated from V ~" (w • . + W)
x=15 x x (f_{oi}(x,e)-h(x,e)J^2/2($f_{o;}$,(x,e)). The estimate of 9 has to

be adjusted to allow for the final interval (a,b). If one
b

then says that R. = *S* ■< ·hi'x,8)dx the total fertility rate
K a **will** be R_Q, the mean age at birth will be Rj/Rq and the

variance of the age at chilciboaring will be R_2/^{R}n ~ ^/^V^

while the mode will be the same *as* before (Hoem and Holmbeck 1975).

The fertility paranecers(total fertility rate, modal age of childbirth, mean age of childbrith and variance

of childbirth) will then be estimated by means of minimum chisquare and a Hadwiger function **x—a ^T I ˣ^a**

1 2

and 8 =the total fertility rate=R,6 -the model age at childbirth=a+T/(1+i^H^4)$^{0'5}$ -1 I /(»H^2) ,9^J=the mean age at

childbirth=T+a* and © =the variance of the age at child-
12 2 birth=^T /H with the correction or x<b as indicated above.

The uncorrected 9 vector was computed by means of the program MINSYS described by Berge (1974a). To this program was added a part which computed the corrected parameter vector 9 . The integration of the Hadwiger function was done by a subprogram from CERNLIB called GAUSS using the standard Gauss algorithm.

The results from the Gauss program were checked by the . more precise (and also more time consuming) methods in the Romberg algorithm and the Clenshaw-Curtis algoritnt programmed in the GPINDP subroutine in the CERNLIB library. No difference in the results from the three methods suggested that the more economical Gauss algorithm might be used.

The results from these computations are presented in table D2.

TABLE D2 THE TOTAL FERTILITY RATE,THE MODAL AGE OP FERTILITY, THE MEAN ACE OF FERTILITY AND THE VARIANCE OF THE FERTILITY OVER AGE,ESTIMATED 3Y MEAN'S OF THE HADWIGER FUNCTION AND ADJUSTED TO *'I1lE* AGE INTERVAL 15 TO 50 FOR THE 102 FERTILITY REGIONS DEFINED IN APPENDIX B

NO. OF FERTILITY AREA	TFR	MODE	MEAN	VARIANCE
1	2.414	2 i.29	2 .64	3 .63 -
2	2.561	2	2 ,92	3 .95
3	2• 399	2 .°79	2 19	3 96
a,	2.181	2 17	2 ,00	3 .63
5	2.453	2 09	2 .49	3 15
6	2.465	2 .69	2 .66	3 .68
7	2.479	2 .41	27 .06	3 .17
8	2.677	2 .35 •	27 .20 '	3 .13
9	2.563	2 .08	26 .83	3 .30
10	2.748	2 96	26 .55	3 .82
11	2.732	2 65	26 .82	3 .07
12	2 .547	2 85	26 .62	3 87
13	1 .850	2 .25	27 .14	2 .28 ■
14	2 .074	2 31	27 .86	2 .22
15	2 .405	2 .54	27 ■ 54	2 .47
16	2 .524	2 .42	26 .36	3 .67
17	" 2 .205	2 .53	26 .82	3 .99
18	2 .502	2 61	26 .42	3 .27 -
19	2 .615	2 .11	26 .35	3 .90
20	2 467	2 .94	26 .99	3 • 30
21	2 .186	2 56	26 92	3 = 55
22	2 .536	2 .42	26 92 „	3 .68
23	2 .456	2 .88	26 58	3 .12
24	2 .507	2 .27	26 44	3 .44
IVJ	2 .368	2 .41	26 .60	3 .57
26	2 .636	2 .25	27 51	42 .89
27	2 .431	2 74	26 70	3 11
28	2 .422	2 71	26 77	3 .32
29	2, .739	23 07	26 58	3 75
30	2 .516	23 .16	27 08	40 .67
31	2, .278	23 .65	27 29	40 97
32	2, .266	2 78	27 74	3 32
33	2, .622	2 .66	27 24	3 95
34	2, .172	24 .11	27 23	34 69
35	2, .287	23 .33	26 88	37 59
36	2, .593	23 .21	26 69	37 47
37	2, = 303	23 64	26 89	34 70
38	2 .,491	22 98	26 22	34 76
39	2 .,744	24 .11	27 53	36 42

TABLE D2 continued

NO OP FERTILITY AREA	TPR
40	2.971
41	2.878
42	2.494
43	2.617
44	2.374
45	2.962
46	2.843
47	2.744
48	2.691
49	3.137
50	3.114
51	2.904
52	3.546
53	2.817
54	2.537
55	3.382
56 .	3.503
57	3.530
58	2.698
59	3.598
60	3.347
61	3-229
62	2.605
63	2.893
64	2.293
65	2.975
66	3.453
67	2.997
68	3.039
69	2.841
70	3.409
71	. 3.309
72	3.691
73	2.837
74	3.225
75	3.122
76	2.551
77	2.656
78	3.344
79	3.307
80	2.782
81	2.826
82	2.551

MODE	ME	VARIANCE
23.^9	2 47	**40** 0
23.70	2 36	39
24.00	2 65	38 6
24.07	2 29	37 0
23.15	2 49	^4 4
24.05	2 42	37 .6
23.76	2 92	36 .8
24.36	2 54	38 .0
24.58	2 45	35 7
24.39	2 52	37 4
23.98	2 77	40 9
23.63	2 62	40 4
23.95	2 00	. 45 •
23.95	2 44	38 9
24.83	2 48	35 .4
23.43	2 13	39 .2
24.66	2 .30	■ 40 .8
22.83	2 .04	42 7
23.94	2 36	39 4
23.54	2 98	45 1
24.30	2 89	39 4
23.63	2 58	41 5
24.84	27 55	33 6
24.06	27 03	35 9
25.10	27 **38**	32- 0
24.45	27 .64	38 .0
24.15	28 23	42 1
	26 88	35 .7
	28 73	48 0
	28 12	39 8
	28 29	42 7
	28 98	43 7
	27 88	46 7
	27 39	38 0
	28 05	43 3
	27 92	41 9
	27 44	37 4
	27 51	46 5
	27 30	40 80
	27 **15**	40 .49
	27 26	37 49
	27 19	40 71
	26 66	33* 13

2.49	24.06	27.33	39.61
2.28	22.56	26.77	39.22
2.30	23.35	26.91	37.25
3.62	23.25	27.51	43.09
2.60	23.24	27.07	40.37
3.06	23.80	27.95	44.71
3.71	22.98	27.37	43.56
2.86	22.32	26.45	41.35
2.90	23.72	27.10	38.28
3.25	23.25	27.33	42.50
2.25	23.13	27.42	44.68
2.37	22.91	26.88	39.01
3.09	23.40	27.06	38.69
2.60	23.31	27.26	42.41
3.22	23.27	27.94	46.59
3.56	22.91	27.71	48.07
3.36	23.44	28.00	48.51
3.12	23.18	27.29	45.61
3.76	23.39	27.97	48.12
2.92	22.59	26.65	41.35

M

O a: w
H

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