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LAND PRODUCTIVITY AND THE EMPLOYMENT PROBLEM OF RURAL AREAS

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1. Introduction

The debate on the performance of the past development decade renewed, by pointing to growing "unemployment" and "underemployment" in LDC's, the interest in a topic which had been discussed widely and controversially under the phrase of "disguised unemployment" at the very beginning of the academic interest in the economics of underdevelopment.¹

Bold assumptions on a "constant institutional wage" in the agricultural sector and/or an "agricultural surplus" allowed the construction of sophisticated dual economy models of development of the FEI-RANIS or the JORGENSON type.

The present debate, however, differs in at least two points: (1) Whereas the dual economy approach centered on the utilization of "surplus labor" for economic development, there is now an awareness of the social problem created by masses of unemployed or underemployed. It is realized that there might well be a serious conflict between a short-run policy of employment creation and a policy of utilization of labor surplus for long-run economic growth. (2) Whereas the dual economy approach assumes a static, low productivity agricultural sector in the early stages of development the recent dramatic rises in land productivity in grain growing areas suggests that the agricultural sector might play a more active role during the whole development process.

¹The different employment terms are often used in an inconsistent way to denote, i.e., the working of less than "normal" time units, a wage below some minimum income level or above the value of marginal product, employment in an occupation inferior to one's training. While "unemployment" depends on the definition of labor force and labor force participation (see Table 1), in this paper the term "underemployment" will be confined to cases of the value of marginal product falling below some culturally established sectoral minimum income, that is, the term does not include exploitation, which would be the difference between the VMP and the wage actually paid. "Disguised unemployment" should be used only in an intersectoral context to denote an observed difference between marginal products of labor.

The author, in 1971 (1350 in the Afghan calendar) had the opportunity to collect data on the demographic and occupational structure of Paktia/Afghanistan, where a German technical aid project provides new inputs to wheat and maize growing farmers on a large scale.

The geographic isolation of this mountaineous province (located south-east of Kabul at the border to Pakistan) provides a somewhat simplified situation for a study of the interplay between agricultural productivity, employment of labor in various sectors of the rural economy, and the differentiation of the social structure. At the same time, basic similarities to other development regions in i.a., growth of population, sectoral distribution of the labor force, land tenure and the kinship and political structure allow for a tentative generalization of its case.

Before stating the leading question more precisely, let us sketch some of the basic features:

Welajat Paktia comprises 15,700 sqkm with a resident population of 630,000. Twice a year the province is traversed by about 150,000 nomads travelling between the Indus plain and the Hindukush. The geographical regions are clearly marked: the low basins (LB) in the east, the high basins (HB) in the west and south, and the mountain areas (MA) in the northern and central part. In the LB and the mountain valleys below 1750 m two harvests a year are possible against only two to three harvests every two years in other parts.

With few exceptions both residents and nomads are organized into segmentary tribes belonging to the Pashtu stock of people that live on both sides of the Afghan-Pakistan border. Paktia has been integrated into the Afghan nation state only during the last two generations. However, besides two border tribes that remained autonomous (and, for security reasons, could not be included in the surveys) also some of the central mountain tribes are subject only to a very loose form of state control. The tribal political structure of Paktia has been described as acephal and anarchic. While this holds true for the mountain tribes in the sense of thenonexistence of leadership roles and weak communal action at village level, on the subtribal and tribal level roles of arbitrator, war leader, representative

to other tribes are clearly defined although not always ascribed permanently. In the LB and HS national integration has, to a great extent, weakened the egalitarian mechanisms of Pashtu society and has, of late, made possible social differentiations based on an increasing concentration of land ownership and on privileged accession to representatives of the central government: the military, the judiciary, and different services.

About 89% of the holdings are owned and operated by peasant families. During the period 1343-49, however, there has almost been a doubling of share tenancy regulations, which by now apply to 11% of all holdings (20% in the LF).

The standard production and consumption unit in agriculture is the extended nuclear family, consisting, ideally, of a father, his wife (wives), and their unmarried children, but occasionally being extended by not more than one married son and his dependents, a distant relative and an unmarried agricultural worker on a share labor contract. The unit might vary widely between 2 and 20 members with an average of 8.9 members and a male working force of 1.9.

The annual rate of growth of population has, on the average, amounted to 2.5% during the last five years, the net outmigration to about 0.25%. Whereas the live birth rate remained fairly constant at 45.1 per 1,000 the crude death rate dropped to 20.0 per 1,000 during the past two five year periods, which means that, in the period to come, annual growth rates of about 2.9% are to be expected. A rise in population makes itself felt in the labor potential after about three five year periods, thus the potential labor force will still rise by about 8.2% during the current period, but will grow by 2.9% annually after 1955 depending on outmigration. At present, outmigration is growing by about 5% p.a. due less to the stagnant urban-industrial sector of Afghanistan but to the growing demand for labor in the Pakistan economy.

Table 1 classifies the population according to economic activity. The participation rate is considerably lowered by the fact that apart from animal husbandry and some sort of indoor work the gainful employment of women in Paktia is virtually unknown. Outright unemployment is rare in a working agrarian society because everybody has a claim to gainful employment against the family farm. However, like other developing regions with the expansion of the educational system Paktia has witnessed the phenomenon of school leavers failing in their search for nonagricultural jobs and refusing to accept any kind of agricultural employment instead.

Table 2 shows the sectoral distribution of the gainfully employed males in Paktia province. It closely resembles the model of an agrarian economy with low occupational differentiation and without an industrial sector. More than three-quarters of the gainfully employed males have their main "occupation" in agriculture.

Allowing for subsidiary employment, however, the share of those gainfully employed outside agriculture is seen to rise considerably. Apart from traditional rural crafts performed mostly in the peasant family, subsidiary employment in Paktia is accounted for mainly by the exploitation of the forests and the transport of wood to Pakistan (see Table 3, column 1).

The population to arable land ratio differs widely between regions; whereas the LB have a ratio of 12 heads to an equivalent of 1 ha of irrigated land and the HB have one of 11 to 1, the MA reach a 22 to 1 ratio. The basins produce about 80% of their subsistence in the main staple foods of wheat and maize. In contrast, the MA reached only 25% or less, i.e. they have to import three quarters of the grain needed for consumption. While the basins still have some limited though very labor and capital intensive possibilities of extending the area under irrigation, the MA don't. (in the following, arable land area will be regarded as fix)

Finally, their only exportables--wood and goats and sheeps products--are both badly affected by the exhaustion of the forest reserves (forests serve as the main pasture).

High rates of increase in population and labor potential, low out-migration, and a rather high and inhomogeneous population to arable land ratio in Paktia point to the social necessity of generating employment. The features of a still relatively homogeneous agrarian society with a land tenure system based on the family-owned and operated peasant farm, suggest that, in the absence of a rise in non-agricultural employment, there would not be outright unemployment but a considerable rise in the agricultural worker to arable land ratio. In the absence of a rise in land productivity this would lead to a serious decline in the marginal and the average product per agricultural worker.

The leading question for the relation between land productivity and the rural employment problem can now be stated more precisely by distinguishing between two aspects:

1. At different rates of increase in land productivity, what determines the employment of labor in rural nonagricultural sectors?

2. At different levels of nonagricultural employment, what determines labor absorption into the agricultural sector and how, in turn, is land productivity affected by it?

The present paper centers on the first aspect but will, in a very simplified manner, spell out some of the consequences nonagricultural labor absorption might have for the agricultural sector. Chapter 2 characterizes the links between a rising agricultural income and rural nonagricultural employment in terms of a Z--and M--good approach. Chapter 3 will focus on two such links (occupationalization and land tenure) and establish them empirically for the 1343-49 period in Pakia. Chapter 4.1 will then estimate the growth in rural nonagricultural demand for labor during the periods 1350-54 and 1355-59 at different rates of growth of land productivity. Chapter 4.2 balances total labor supply and nonagricultural demand and spells out some consequences for the agricultural sector. Chapter 4.3 finally, draws some conclusions for an employment policy.

2. Agricultural Income and Rural Nonagricultural Employment

Multi-sector models often neglect a fact well-documented in social and economic history: nonagricultural goods and services are not only

produced in the "urban industrial" and the "urban trade-service" sector but also by peasant families and by specialized rural crafts--and tradesmen. HYMER and RESNICK set up a model of an "agrarian economy with nonagricultural activities", which, besides M(anufactured)--goods produced in the urban-industrial sector and F(ood)--goods produced in the agricultural sector accounts for nonagricultural goods and services produced by the peasant family, the so-called Z-goods. The extension has considerable value in challenging the conventional view of the peasant family allocating its labor between farm operations and leisure only as well as pointing to the gradual replacement of Z- by M-goods as a major feature of the development process. Of late, BAUTISTA rightly pointed out, that both Z- and M-goods should be divided into consumer and intermediate goods. Still, however, the model does not represent different degrees of specialization in the rural production of goods and services. We might roughly distinguish between three types:

- (a) the undifferentiated production for consumption in the own household or for productive use on the own farm like the sewing of clothes or the digging of wells.
- (b) the "family-specialization", i.e. the production of goods and services by families that acquired special skills in, f. ex., housebuilding or pottery, exchange their goods in a village market but still receive their main income from agricultural activities.
- (c) The "individual specialization" of, say, the blacksmith who might not even have a subsidiary agricultural income, and earns his living by selling his products or services on a village market or a central bazaar.

By not allowing for a market exchange of Z- against either M- or F-goods H + R restrict their analysis to type (a) only. Asking for the possible employment effect of nonagricultural activities, one should, however, look into types (b) and (c) as well.

M-goods can be split into urban-industrial UM-goods and rural nonagricultural RM-goods produced by (b) and (c) type activities. It then becomes possible, first, to generalize the H + R approach in order to account for a change in the demand for Z- and M-goods in response to a change in factors relevant in the Paktia case and, secondly, to ask in which way the employment effects of a changing demand for M- and Z-goods are determined by the conditions of RM- and UM- production.

2.1 Changes in the Demand for Z- and M-goods

In the Appendix we set up a model of a peasant family farm plus household which produces two ranges of goods: G-goods are either marketed (cash crops) or potentially marketable (food crops), while Z-goods are wholly consumed in the family. The range of Z-goods includes physical objects like home-produced pottery, furniture, clothing as well as more intangible "goods" like the participation in village meetings, recreation and religious activities. In the absence of wage labor the production of G-goods depends on the amount of family time allocated, the amount of purchased inputs like fertilizers and seeds of high yielding varieties and of other non-labor factors. Among the other factors social status (the sum of roles "played" by members of the family and the prestige ascribed to these roles) is regarded as prominent: attending a village meeting, for example, the owner of a large estate is likely to gain more satisfaction than the landless laborer does during the same time.

The model, first, states the conditions of utility maximization and is then used to derive the comparative-static solutions. for a change in land productivity. A rise in land productivity might be caused, i.e. by a decline in

the price of purchased inputs (due to a deliberate Government policy) or by a switch to a higher level of production technology (due to the extension activities of a technical aid project)¹. The solutions can be interpreted in terms of both the income and the substitution effect (see FERGUSON).

Thus equation 16, which gives the change in the demand for M-goods resulting from a change in the price of purchased inputs has the expenditure on fertilizers or seeds as a weighing factor determining the magnitude of whichever effect the bracket contains. The first term in the bracket shows the rise in the shadow price of Z-goods (equalling the money-income forgone by allocating time to Z- instead of G-production) due to an increase in the application of purchased inputs resulting in a substitution of M- against Z-goods: with income held constant a decrease/increase in input prices will raise/diminish the demand for M-goods. The second term gives an income or output effect while prices are held constant. As was to be expected the term tends to offset the substitution Z-goods. If the VMP of purchased inputs, which serves as a weighing factor, is high, it might swamp the substitution effect and reverse the direction of M-demand totally.

This interpretation of the income effect, however, presupposes the normalcy or the superiority of Z-goods. If Z-goods are regarded as distinctively inferior to M-goods and are technically substitutable in consumption, the income effect will turn around, thus further decreasing the demand for Z-goods. The question of inferiority can, clearly, be answered only on empirical grounds. Comparative sociological and historical research is likely to come up with distinctive cultural differences, which might shed new light on some old acquaintances like the labor-leisure model and the backward-bending

supply curve of labor in the colonial economy.²

The interpretation of the substitution effect should be more restrictive. The effect rests upon the assumption that the family has in fact a choice in allocating family time to either G- or Z-activities. This, for once, neglects the ample evidence on intrafamilial division of labor based on sex, age, or kinship status (see BOSERUP). For example, Paktia like other societies strongly adhering to Islamic values prevents women beyond the age of 13 to leave the family compound. The household-head has a choice of allocating women-time between Z-activities and a limited range of G-activities like animal husbandry only.

²One might hypothesize that, indeed, in the short run the inferior sub-range of Z-goods turns the income effect into the same direction as the substitution effect, thus leading to a decline in the home-production of non-food items, while in the long run there is likely to be a return to the "normal" direction. This could be based on the following argument: One can divide Z-activities into subranges according to the degree in which they are ruled by social norms. Activities central to the power structure and/or basic values of a society usually are strongly normatized. The education of children, the production of weapons, religious activities are cases in point. Other activities like the processing of food, the sewing of clothes, the repairing of tools are relatively "free." Social norms, however, only change over a fairly long stretch of time as vested interests defending old institutions loose influence against other vested interests which stand to gain from "social change". While the second subrange will respond quickly to an increase in income, the first subrange might change only intergenerationally. However, it seems safe to hypothesize that a society will normatively bind mainly those goods it regards as superior while leaving free mostly inferior goods.

One might, thus, expect an increase in Z-demand or a decrease in M-demand in response to an increase in income either at a very early stage of "colonial development" when the variety of M-goods offered is still very poor or not superior to Z-goods or at a late stage of "modern economic growth" when nonmarketable goods again are demanded by the working classes, thus changing the allocation of time between "work" and "leisure."

2.2 The Demand for M -goods and Rural Nonagricultural Employment

The total rise in the demand for M -goods will result in an increase or decrease of nonagricultural employment depending largely on conditions of RM - and UM -production. Assuming a capital-intensive UM - and a labor-intensive RM -production a rise in the demand for M -goods might allow for increasing returns to scale in UM -production. Further assuming constant utilities of RM - and UM -goods, the drop in relative prices of UM -goods would lead to their substitution in the consumption against RM -goods. The consequent drop in rural nonagricultural employment might not be compensated by a rise in the labor absorption of the urban-industrial sector.

The case of Jinja and the surrounding district of Busoga in Uganda can be interpreted this way.

In Jinja, an industrial program was launched at the time of the coffee boom in the early 1950's. A village study in 1952 (FALLERS 1956) reported a share of nonagricultural workers in the male labor force of about 20%, 12% consisting of type c activities (teacher, policeman, automobile mechanic), whereas the rest consisted solely of family specialists in pottery, hoe-making, cloth-making, etc. By 1966 a village study in the same area (CERKEN 1972) reported only 9% of b type activities, whereas 3% were transformed into c type activities (mainly commerce and cotton and coffee processing), which then comprised about 10% of the male labor force. Meanwhile, farmers had witnessed a spectacular rise in their cash income following the replacement of low earning cotton by high earning coffee. The rising light consumer goods industry of the East African Common Market provided most of the goods produced by family specialists like textiles, household wares, agricultural tools. UM -goods replaced RM -goods with the exception of public services, trade, processing of export crops and the production of sacred goods and some services. The family specialists in their majority gave up in favor of full-time farming, a minority found employment in the urban-industrial sector. In only a few cases had family specialization matured into the individual specialization of, say, a full-time carpenter. The effect on total nonagricultural employment had been negative because the urban sector provided only a fraction of those jobs formerly held by family specialists.

One can, however, easily specify conditions which would account for a positive overall employment effect, i.e.: a low technical substitutability between RM- and UM-goods, effective barriers to the marketing of UM-goods in isolated rural areas, a traditionally high specialization of RM-production, a land tenure system resulting in different supply prices of labor to the urban and the rural nonagricultural sectors. The data available for Paktia allow us to look more closely into the occupational organization and into the land tenure system. The data on nonagricultural activities are compiled in Table 3 and relate to the years 1350 (1971) and 1343 (1964) respectively. The figures are broken down into four economic sectors and 26 occupational groups, they exclude Z-production but include RM-production by both b and c type activities.

3. Rural Non-agricultural Employment 1343-1350

Column 11 of Table 3 shows that there has been a remarkable though very uneven rise in nonagricultural employment during the seven year period prior to the survey: an overall average annual growth of 3.9% compares to a 2.2% rise in the total labor force. The seven year period roughly covers the time the technical aid project has been working. However, considering that the first years were spent mainly on trials for seed and fertilizer selection without an immediate impact on agricultural productivity, and further accounting for two dry seasons the average annual rise in agricultural production during this time is probably lower than the growth of labor force. Nevertheless, there has been a rise in income and, probably, in demand for M-goods that is accounted for by: the distribution of wheat and other food items under the World Food Programme, a sudden rush in the exploitation of the forest reserves in

reaction to rising wood prices in Pakistan and (unsuccessful) attempts of the Afghan Government to prevent the final exhaustion of the reserves, a rapid expansion of relatively high earning positions in public service due mainly to the build-up of the technical aid project but also to some other government activities, notably in road construction. The source of income is certain to deteriorate decisively during the next period and also the growth of public service will slow down as no further expansion of the aid project is to be expected. Looking for an explanation of the past differentials in employment growth in terms of occupational organization of land tenure, we can, however, with some precautions regard the sources of income as a kind of functional substitute for the rise in agricultural productivity expected to take place in the coming periods.¹ When trying to establish a relation between employment growth and the other variables, we must, however, leave occupational groups belonging to the public service and the forest industry (including animal transport) out of consideration.

3.1 Occupational Organization and Employment Growth

The sociological definition of occupation is ideal-typical, framed after the position of an official in the rational bureaucratic system. Leaving aside the question as to what extent the realization of this ideal construction would indeed guarantee a maximum of rationality, we restrict ourselves to three variables of the construction which we believe to be of relevance for the absorption of labor: exclusiveness, labor income, and compartmentalization of role-sets.

¹Equation 20 of the Appendix gives the solution for a change in non-farm income. It shows that for agricultural families there will only be an income effect.

Exclusiveness

By exclusiveness of an occupation we refer to the degree to which its individual position holders engage in this and only this economic activity. Under conditions of a backward rural economy the variable can conveniently be operationalized by the presence/absence of an agricultural labor income (not rental income) as has been done in column 2 of table 3, where the percentage of those position holders who do not receive an agricultural labor income is reported.

The class of occupational groups containing 75% or more exclusive workers consists of (a) all public service occupations (sector I), (b) all occupations in the motorized transport branch of sector II (commerce and transport), and some specific occupations of sector III (crafts and trades): barbers hold a special ethnic position in all Pasutu societies; bakers are the only traditional group which, for technical reasons, shows a high degree of labor division combined with wage labor; mechanics are a modern occupation strongly related to motorized transport.

A distinctively low percentage is to be found in sector IV occupations, i.e. those occupations relying on local raw materials like wood and buria-palms, and in the animal transport branch of sector II that is strongly related to forestry.

Labor Income

The occupational organization depends on whether the workers income is sufficient to support his nuclear family or not. As in a subsistence economy it makes little sense to try to determine the monetary value of the income needed, the respondents were asked to compare the income situation with that of a local farmer who is able to support his nuclear family without pursuing a subsidiary occupation.

Column 3 gives the percentage of each occupational group of those workers whose income was classified as belonging to the "higher than farmer" brackets. The class of groups containing 75% or more assembles all those who scored high also on occupational specialization with the single exception of the ethnically separate barbers. Additionally, we find the whole commerce branch of sector II as well as the mullahs, i.e. groups we intuitively would expect to join the other groups in the "high occupational specialization class", who, however, have more latitude to decide on the place of residence of their family and, therefore, are more likely to earn a subsidiary income from farming their inherited land.

Again, a very low percentage is indicated for occupations dependent on local raw materials. Additionally, this holds true for groups strongly related to agriculture like shepherds, water-distributors, and millers.

Compartmentalization

Column 4 shows the percentage of commuters in the respective groups. Commuting can be considered as an indicator for a time-space separation of the "working sphere" from the "private sphere" unknown to an agrarian society. The separation of both spheres leads to the compartmentalization of an individual's role-sets attached to them, thus fostering a tendency to confine the scope of kinship and neighborhood solidarity norms to the private sphere and to, gradually, replace them in labor relations by rules of bureaucratic, technical or market rationality. Occupational groups with 75% and more commuters can be classified by cause into those bound to an administrative center (sector I), to the bazaar (mechanics and bakers) or to a permanent geographical mobility (transport workers and wholesalers). With the single exception of the camel-drivers these occupations score high as well on exclusiveness and on labor income. The high empirical correlation between the three variables can be made plausible by referring to land utilization as an intervening variable: the time-space separation effectively limits the chances to farm one's inherited land. There being only few possibilities to subsidiary employment outside agriculture this results in commuters having a high degree of exclusiveness. Keeping in mind that farming as an occupation is open to nearly all members of a Pakita tribe the exclusive employment in a nonagricultural occupation is only to be accepted when its labor income is at least sufficient to support the nuclear family.

We are thus justified in merging the three dimensions to a single variable "occupationalization" by simply ranking occupational groups by their average score. This allows us to establish Spearman's rank correlation coefficient r_s between growth in employment and occupational organization. The coefficient measures as $r_s = + 0.88$, thus suggesting a strong relation between the two variables. At the upper end occupations belonging to motorized transport, the related mechanical service, commerce, and bakeries all but one belong to the first seven groups on both scales. The coincidence is intuitively plausible: a high degree of occupationalization implies a rather specialized production and, thus, allows Ki-goods and services to compete successfully with UM-goods.

Furthermore, R1-goods of this type can be regarded superior to other R1-goods (motorized vs. animal transport) and to Z-goods (bakery-vs. home processed food) and can be expected to substitute them in a situation of rising agricultural income. [In a sociological sense, these groups can be regarded as a kind of social subsystem in which norms of communicative behavior are replaced by rules/^{of} zweckrational action. In a different context one might ask, if this social subsystem is likely to play a distinctive role in the long-term process of economic development.]

At the lower end of both scales buria-weaving is the typical case of a poorly specialized trade whose products (mats, beds, carpets) cannot compete against mass-produced industrial goods and will be substituted by them unless there is a decisive change in utilities by, f. ex., a tourist demand for folk-products. The poorly occupationalized millers will, in the future, probably even be reduced in absolute numbers because growing grain harvests facilitate the replacement of labor intensive water mills by labor saving diesel mills. Although this could be described as a rise in labor productivity inside a trade, it is more realistic to perceive of it as the rise of a new occupational group with a higher degree of occupational organization substituting for the service of an old trade. A similar expectation can be held regarding the housebuilding trades. Modern masons using different materials (bricks instead of mud) and techniques will replace the traditional family-specialized masons.

The total effect of rising agricultural income on nonagricultural employment largely depends on the performance of crafts and trades in the middle echelon of occupationalization. Here, we find a large group of occupations whose products are clearly substitutable by U1-goods:

tanners, carpenters, tailors, blacksmiths, butchers. No safe prediction can be made. If these groups will mature into the individual specialization of, say, the baker or the mechanic, or will be reduced to some repair function for UM-goods or vanish altogether will not the least depend on the presence or absence of a deliberate policy on crafts and trades promotion. We might, however, see if the application of the land tenure variable allows for a more differentiated view of these mostly traditional occupations. In discussing occupational organization we did not touch on the scope of the market as it is determined by settlement patterns. Indeed, a positive relation between village size and occupationalization in Paktia can be derived from a comparison between regions. In the densely populated basins with a village type settlement pattern the upper class of occupations (incl. public service) comprises about 20.0% of the nonagricultural workers against only 11.4% in the sparsely populated mountain areas with mostly scattered individual settlements. While the settlement pattern certainly is an important variable in explaining cross-regional differences, in a case study we are justified to keep it constant.

3.2 Land Tenure

Contrawise to a common assumption a worker in Paktia as well as in many other developing regions with a land tenure system based on the owner operated family farm will, on leaving the farm not give up any claim to a rental and/or labor income against his family. The claim enters an individual's comparison of utilities between staying on the farm or leaving it for a non-agricultural job and thus affects the supply price of labor to the non-agricultural sector. This, in turn, will affect the absorption of labor.

Column 5 to 9 of table 3 compile the information on the actual relation of nonagricultural workers to agricultural land. In all occupational groups apart from barbers the overwhelming majority owns land. Less than 75% are to be found in groups known to the rural society since uncounted generations (mullahs, blacksmiths, shepherds, millers) whereas in the new occupations (civil service, motorized transport) the portion of landowners is among the highest. Exclusiveness and high labor income outside agriculture in no way induce the workers to give up their right of ownership, nor does there seem to be a social mechanism working in this direction. One should not be surprised by such pertinacity in a dominantly peasant culture, in which land ownership is a major element in a man's social personality, at least as long as a high nonagricultural income cannot be secured permanently. One might rather suspect that a decreasing family specific land-man ratio has causal relevance in forcing families to transform their 2-production into R1-production i.e. changing from a type activities to be type family specialization. Generally, the right of ownership in Paktia constitutes a claim to an income. What this amounts to depends on the distribution of the rights of usufruct. Table 3 discriminates between owner-operation (with family or hired labor) and non-owner-operation (by members of the owners' family or nonfamily tenants). A permanent non-utilization of usable land is unknown in Paktia. The decision between owner and nonowner-operation depends on the distance between the locations of land owned and nonagricultural occupation performed. In the case the distance effectively bars all owner-operation, ideally a claim to half of the physical product of the main crops remains, unless the rights to usufruct are given to a family member and the claim is thus reduced to a

quarter. The norms of family solidarity require the preferential treatment of a family member whenever it lives in the same village. Thus, column 9 shows a very small share of nonfamily tenants only. The owner can, however, realize a claim to a second quarter when he or a member of his nuclear family manage to work on the farm on weekends and on holidays.

As outlined here, the rules are a simplification of what actually happens, they may, however, clarify the social mechanism. Usually, the comparison of utilities between agricultural and nonagricultural employment will differ substantially according to location, resulting, c.p., in different supply prices of labor. Excluding nonfamily tenancy we might roughly generalize: (a) labor migrating to the urban-industrial centre will remain with a rental claim to a quarter of the product, which is, however, difficult to realize in full, (b) highly occupationalized ("modern") rural labor is excluded from owner-operation as well but can effectively control its rental share. It might often be able to increase its share by holding close contact with the farm, (c) all other rural labor has a distinctively better chance to claim labor and rental income from agriculture.

If our hypothesis holds, that the claim to an agricultural income enters the comparison of utilities, there should be an observable positive relation between the growth of employment and the percentage of workers in an occupation claiming an agricultural income. Although our data do not allow for an empirical proof of differences between the urban and the rural nonagricultural occupations we can test the hypothesis with regard to differences between rural nonagricultural occupations only. Keeping in mind that occupationalization has not been defined independently from

agricultural income (exclusiveness was operationalized by the absence of agricultural labor income) we will relate to rental income (represented by column 5, landownership) only and will, furthermore, keep occupationalization constant by calculating separate rank correlation coefficients each for the class of the modern, highly occupationalized group and for the class comprising all other occupations.

In the upper class the coefficient amounts to $r_s = + 0.20$ only a result not altogether unexpected. Nonagricultural labor income among the highly occupationalized groups suffices to support the nuclear family of the worker. The absence of an agricultural rental income, therefore, is not likely to rise the supply price of labor above the existing labor income of these groups.

In the lower class, however, there is a coefficient of $r_s = + 0.77$, suggesting that, indeed, employment growth is positively related to a claim for agricultural rental income. This amounts to saying, that the agricultural sector subsidizes the traditional, poorly occupationalized rural non-agricultural groups. As subsidies are a constant fraction of agricultural income they will rise with agricultural productivity. In a situation of rising demands for M-goods this might, for a time, offset possible economies of scale in the UH-production by lowering wages (profits in a family trade) in the poorly specialized M-production.

There are, however, obvious limits to such an effect: As agricultural productivity keeps growing diverting family labor to farming becomes profitable for those non-agricultural workers who still own some land. Occupationalization, thereby, is reduced further, which will eventually result in an inferiority

of RM-goods produced by these workers against either UM-goods or RM-goods produced by those who upgrade into individual specialization and enter the class of modern rural occupations (like, f. ex., brick masons and operators of diesel mills). For those, who neither own enough land nor succeed in occupationalization, falling nonagricultural wages or profits will lead to their giving up the trade and either looking for agricultural wage employment or migrating to the urban sector.

4. The Labor Market at Different Levels of Output Growth

4.1 The Prospective Demand for Labor in Rural Nonagricultural Sectors

So far we have argued that output (and employment) in sectors II (commerce and transport) and III (crafts and trades) is determined by the demand for their RM-goods generated in sectors I (public service), IV (nonagricultural primary production), and V (agriculture). The share of RM-goods in the total demand for M-goods, in turn, is determined by, i.a., the level of occupationalization in the RM-producing sectors II and III and by the effect the land tenure system has on supply prices of labor. If we assume the share of RM-goods to be constant for a certain time-span (two five-year periods) we can proceed to estimate the prospective demand for rural nonagricultural labor at alternative rates of growth of agricultural output by applying the reduced form of a projection model proposed by THORBECKE AND STOUTJESDIJK.

T + S estimate the future growth of output according to observed elasticities between sectoral and total output and arrive at employment growth by introducing assumptions on changes in labor productivity.¹ The

¹The relation between growth rates of output, employment and labor productivity is given by $r_o = (1 + r_e) (1 + r_l) - 1$.

procedure has been changed here by substituting elasticities between output of the two "dependent" sectors (II, III) and the aggregate output of the "independent" sectors (I + IV + V) for elasticities between sectoral and total output. As income elasticities of RI-goods presumably differ widely, the model is probably justified only when applied to very small sectors and will gain in predictive value with a subdivision of sectors.

The estimation is done in Table 4 for three alternative rates of average annual growth of agricultural output: 1.5%, 2.5%, and 3.5% respectively. These compare to a 1.9% rate presumably achieved during the past five-year period and a target 3.2% rate proposed by a Soviet planning mission for the five-year plan in preparation.

The following observed relationships and assumptions enter Table 4:

1. Employment in sector I is determined autonomously by the Government. During the past period the build-up of the technical aid project resulted in an unusually high sectoral employment growth assumedly accompanied by a .5% annual increase in labor productivity. As no further expansion is planned and other services can be assumed to grow at the past rate the sectoral rates of output and employment can be expected to slow down to 5.0% p.a.
2. Sector IV has been characterized by the scrambling for the forest reserves. In the past, sectoral labor productivity rose by about 1.0% annually due to the intensification of wood-cutting and wood-milling in terms of hours per man. With the now visible exhaustion of reserves output and labor productivity will go down considerably as wood cutting progressively runs into marginal locations. No change is expected for shepherds and buria-weavers. Employment and output will grow at their present slow rate, there is no change in labor productivity. The decrease in wood production mainly affects the MA, but some effect is also to be expected in both HB and LB.
3. The aggregate rate of growth of output for sectors I + IV + V was arrived at by

$$r_{O_{I+IV+V}} = \frac{L_I r_{O_I} + L_{IV} r_{O_{IV}} + L_V r_{O_V}}{L_I + L_{IV} + L_V}$$

where L refers to the total number of workers gainfully employed in a sector.

4. Sector II is characterized by a high but falling portion of animal transport. The expansion of motorized transport heavily affects the average rate of growth of labor productivity. For the past this rate has intuitively been set at 2.0% p.a., and is assumed to rise to 2.5% in case of the 3.5% land productivity growth alternative.
5. Sector III comprises most of the nonmodern rural occupations. It is expected to keep its past low increase in labor productivity (intuitively set at 0.5%), unless a rapid rise in agricultural income leads to the kind of differentiation between workers of these trades that has been described in chapter 3.2 of this paper.

The elasticities can now be calculated at 2.7 for the commerce and transport sector and 1.4 for the crafts and trades sector. Assuming these values to remain constant during the next two five-year periods table 4 then calculates the demand for labor in the rural nonagricultural sectors.

4.2 Agricultural Labor Supply, Labor Absorption, and Migration

Table 4 can be used to specify, which pressures are likely to arise on the agricultural sector and how they might be met. Assuming that the rural nonagricultural sectors will satisfy their demand for additional labor we expect the agricultural sector and migration to meet the balance with the total additional labor supply. We, first, regard migration to be determined independently and assume net outmigration to continue to grow at the past rate of about 5.0% p.a. Column 1 in table 5 then gives the total additional labor supply in the Province.¹ Column 2 balances it with the additional demand for rural nonagricultural labor as estimated in table 4. Thus giving the additional supply to the agricultural sector. Columns 3 to 5 spell out, which consequences this supply would have if farm holders react in two distinct patterns of behavior.

¹The supply is calculated from the state and growth of labor potential as given in Chap. 1. The participation rate has been slightly lowered to 88.2% to account for increasing school enrollment.

Pattern 1 assumes the complete absorption of the labor supply. The new workers being, as a rule, either sons or brother's sons in most cases the holder can do nothing but honor their claim to employment. Column 3 gives the changes in output per agricultural worker this implies. There are considerable regional variations in the consequences a rise in agricultural output will have on employment. Whereas in the HB in the first period even the worst assumption of a 1.5% rise in agricultural output will suffice to avoid any drop in output per man and, in the second period, still less than 2.5% is required, in the MA even the most optimistic and probably unrealistic assumption of a 3.5% rise in agricultural output would not prevent a dramatic fall in output per agricultural worker. As the social institutions cannot be expected to hold in such an extreme situation and as outmigration in many cases is not a viable alternative (esp. for married men without school education), there arises a high pressure on intrasectoral and intraprovincial migration. Given the rather weak norms of communal action and conflict solution and the long experience in tribal warfare the resulting movement is likely to be violent.

Patter 2a and 2b proceed on the assumption that farm managers under any condition succeed in keeping output per agricultural worker constant or rising it by 1.0% annually. Column 4 and 5 show the number of workers unemployed (+) or missing (-). The figures show at once, in which areas there is likely to be a shortage of agricultural labor that will hinder the attempted growth in agricultural output. Labor saving innovations and/or a slow down in outmigration are possible reactions. We are, however, more

interested under which conditions open unemployment would arise. The farm-holder has, in fact, three (limited) possibilities for approaching patterns 2a or 2b: He might, firstly, replace nonfamily wage laborers, who have no share contract. The margin of adjustment is, however, small because this applies to only 4% of all men in agriculture (nonkin agricultural workers usually have a labor share contract and are regarded as protected although low-status members of the extended family). The farmer can, secondly, try to reduce the labor input of family members with a nonagricultural occupation but is likely to meet stiff resistance by those poorly occupationalized workers who depend on a subsidiary agricultural labor income to support their nuclear family. Thirdly, he can evict tenants. On a large scale, this possibility arises in the LB only, where a process of rapid social differentiation has been going on since the integration of Paktia into the feudal Afghan nation state. If this happens, there would result a decisive change in the composition of migrants. Whereas now mainly young unmarried schoolleavers, who keep close contact to their rural families, leave the Province, then whole families of uneducated, higher aged agricultural workers would migrate to the urban center or to Pakistan.

4.3 Some Conclusions for an Employment Policy in the Agricultural Sector

The paper isolated two points at which an employment policy might start: (a) promotion of the specialization of rural nonagricultural occupations to secure a high share of M-goods in the hopefully rising demand for M-goods, (b) promotion of land productivity. I shall, finally, touch on some of the employment problems arising from point (b).

Pattern 1 in Table 5 gave an indication which rates of growth of agricultural output must be achieved if

1. the nonagricultural sectors should be allowed to grow in output and labor productivity as shown in the model,
2. there should be no visible unemployment, i.e., the agricultural sector should fully absorb whatever residual labor supply arises,
3. the average physical product per agricultural worker should at least be kept constant and should not be allowed to fall.

More precisely, the rates are

	1350-54	1355-59
High basins	1.5	2.4
Mountain areas	2.0	4.4
Low basins	2.4	3.2
Paktia	1.9	3.3

To achieve the set of minimum goals, an employment policy has to combine a policy to possibly, surpass the specified rates of growth of agricultural output and to secure the flexible absorption of labor into the agricultural sector. The goals are non-conflicting only under certain conditions.

A rise in agricultural production might be achieved by employing more labor, but might as well lead to the displacement of certain classes of agricultural labor. The explanatory variable is to be found in the relation between land tenure and the introduction of technological innovations, i.e., between--on the one hand--the apportionment of rights to own and rights to utilize land, labor, and capital to social units, and--on the other hand--the introduction of land augmenting (most labor-using) innovations like high yielding varieties and nitrogen fertilizers and of capital-intensive (mostly labor-saving) innovations like tractors and mechanized harvesting equipment.

In a rather rough and intuitive simplification we might generalize: (what will be worked out in the proposed second paper) Under conditions of land tenure system based on the interests of nuclear families and given a certain endowment of the agricultural sector with land, labor absorption and a maximum rise of output can be harmonized the easier, the more equal rights to own and rights to utilize land are distributed among families working in the agricultural sector. The following mechanisms become effective:

1. The highest farm-size class shows an average land productivity considerably below the average, whereas in the lowest class labor productivity is below average. There is only small, if any, variation in total factor productivity according to farm size. (A shortage of family labor is only partially compensated by the hiring of wage labor. Considerations of social status, moreover, prevent the part-time work of small independent farmers on large-scale farms.)
2. The introduction of high yielding varieties of wheat and maize and of nitrogen fertilizers generates an additional demand for labor of about 30% at harvest time, i.e., at a time of a peak in seasonal labor demand. Labor previously subjected to seasonal underemployment (not chronic underemployment) only cannot be used for this purpose. In the lower and middle size farm classes the demand can be met by the present and the rising future supply of family labor-- in the upper classes, however, the possible rise in production can either not be realized due to a shortage of labor or it has to await the simultaneous introduction of labor-saving innovations.
3. In the past, a shortage of family labor in households owning extensive amounts of land usually led to the granting of part of the utilization rights to tenants. The simultaneous introduction of land augmenting and

the mostly indivisible labor-saving innovations is, however, often profitable only, when the size of the owner-operated farm is enlarged by the land given to tenants. Therefore, a rise in output might lead to an eviction of tenant families without an additional demand for nonfamily wage labor arising on the enlarged farm.

4. An unequal distribution of rights of ownership traditionally results in a system of share tenancy. This, however, strongly impedes the introduction of land augmenting innovations and, as a result, an increase in production and employment. If tenants have to bear the full costs of new inputs but will receive a fraction of the additional output only, they are only poorly motivated to purchase those inputs.

A policy of employment promotion should, therefore, pursue an increase in land productivity in the context of a structural policy. Depending on the existing factor endowment and the actual distribution of rights to land, labor, and capital a policy of "pre-emptive structural change" will, i.e., include a redistribution of landownership rights, a reformulation of utilization rights, a ceiling on farm size, the organization of markets and credit, the settlement of newly claimed land, the statutory regulation of wage labor contracts.

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Table 1

Population by Economic Activity, Paktia 1350 (1971)

Sex	Region	Population	Males 15-59 y., Females 15-54 y. in % of Population (Labor Potential)	Gainfully Employed in % of Labor Potential (Participation Rate)	Non-Participants in % of Labor Potential		
					Students	Unemployed	Other Non-Participants
m	LB	88,700	51.1	86.8	6.3	3.9	3.0
	MA	97,700	48.8	89.3	3.8	3.4	3.5
	HB	109,300	54.0	90.1	4.6	3.6	1.7
	PAKTIA	295,700	51.7	88.9	4.8	3.6	2.7
f	LB	90,000	50.5	22.2	-	-	77.8
	MA	99,200	46.3	32.2	-	-	67.8
	HB	111,000	52.9	28.4	-	-	71.6
	PAKTIA	300,200	50.0	27.7	0.06	-	72.3

Table 2

Gainfully Employed Males by Sector and Region,
Paktia 1350 (1971) in %

Region	Sector (Main Activity Only)					Nonagricultural Sectors (I-IV)	
	I	II	III	IV	V	Main Activity Only	Main + Subsidiary Activity
	Public Service	Commerce & Transport	Crafts & Trades	NonAgricultural Primary Production	Agriculture		
LB	3.5	4.9	7.1	3.0	81.5	18.5	40.0
MA	1.3	5.7	5.1	8.9	79.0	21.0	41.3
HB	2.7	7.6	12.8	3.6	73.0	26.7	30.6
PAKTIA	2.5	6.2	8.6	5.1	77.6	22.4	36.7

Table 3 : Structure of Nonagricultural Economic Activity, Paktia 1350 (1971)

Sector	Occupational Group	Workers	Occupational Organization in % of Workers			Land Tenure					Employment Growth in % and p.a. between 1343 and 1350
			Excl. W	W. with "high" Income	Commuters	Land Owners in % of Workers	Land Utilization in % of Land Owners Nonowner				
							Owner-operation with		Operation by		
		1	2	3	4	5	Family Labor 6	Wage Labor 7	Family Members 8	Nonfamily Tenants 9	10
I Public Service	Civil Servant	1,544	86	92	96	96	5	10	81	4	6,8
	Teacher	835	84	88	66	90	-	13	79	8	5,4
	Project Worker	717	80	97	100	99	7	9	74	-	26,8
	Total/Average	3,096	84	92	88	95	4	11	79	6	11,0
II Commerce & Transport	Transport Contractor	196	97	100	82	89	1	2	97	-	12,3
	Driver/Cleaner	1,507	82	88	82	83	5	11	82	2	8,7
	Wholesaler	1,226	69	91	84	90	22	8	64	6	9,1
	Cattle Trader	450	68	79	52	77	33	5	50	12	7,1
	Retail Trader	1,663	63	93	46	90	35	6	56	3	7,1
	Camel Driver	5,385	32	48	96	90	69	6	24	1	3,7
	Total/Average	10,427	51	68	82	88	46	7	45	2	5,9
III Crafts & Trades	Barber	1,072	90	24	24	9	70	7	20	3	1,0
	Mechanic	274	78	86	92	76	8	21	66	5	15,8
	Baker	97	75	81	81	68	34	21	45	-	5,1
	Tanner	458	70	42	71	85	24	11	59	6	3,2
	Mullah	2,071	66	88	7	55	45	13	39	3	1,4
	Carpenter	1,461	56	72	47	92	41	5	50	4	5,0
	Tailor	1,977	46	72	26	91	49	5	41	5	5,2
	Miller	882	46	16	4	67	77	-	23	-	0,1
	Bricklayer	171	45	33	42	83	50	6	44	-	4,7
	Mason	2,568	44	24	55	85	53	8	44	2	4,0
	Blacksmith	632	40	54	24	62	59	2	35	4	2,0
	Butcher	200	32	67	30	90	46	7	38	4	5,2
	Water-distributor	379	17	3	7	81	61	-	36	2	0,4
Other	2,224	51	48	38	74	60	4	35	1	3,6	
Total/Average	14,466	54	51	34	72	51	7	39	3	3,7	
IV Non-agricul- tural Primary Production	Shepherd	3,909	63	17	42	63	45	5	49	1	1,1
	Woodmiller	2,200	39	29	59	74	36	31	30	3	5,0
	Woodcutter	10,410	26	17	12	95	73	1	22	4	2,7
	Burra-weaver	5,400	1	11	-	97	89	-	11	-	1,9
Total/Average	21,919	28	17	19	88	68	4	25	3	2,2	
I - IV	Total/Average	49,908	44	42	41	84	54	6	37	3	3,9

Table 4
 Projection of Demand for Labor in Rural Nonagricultural Sectors of Pakia 1350-54 (P1) and
 1355-59 (P2) by Regions and Alternative Rates of Growth of Agricultural
 Output

Sector	Annual Rate of Growth of Agricultural Output in %	AVERAGE ANNUAL GROWTH IN %															Workers in 1349 and Additional Workers in 1350-54 and 1355-59								
		OUTPUT						LABOR PRODUCTIVITY			EMPLOYMENT						HB		MA		LB				
		HB		MA		LB		HB	MA	LB	HB		MA		LB		1349	P1	P2	1349	P1	P2	1349	P1	P2
		P1	P2	P1	P2	P1	P2				P1	P2	P1	P2	P1	P2									
I Public Service	1.5,2.5,3.5	5.0	5.0	5.0	5.0	5.0	5.0	0.0	0.0	0.0	5.0	5.0	5.0	5.0	5.0	5.0	1.20	300	400	600	200	200	1,300	400	500
II Commerce & Transport	1.5	3.5	3.5	2.4	0.5	2.7	2.7	2.0	2.0	2.0	1.5	1.5	0.4	1.5	0.7	0.7	3,600	300	300	3,900	100	-300	2,900	100	100
	2.5	5.7	5.7	4.1	1.9	4.6	4.6	2.0	2.0	2.0	3.6	3.6	2.1	-0.1	2.6	2.6	700	800	700	400	-	400	500	500	
	3.5	8.1	8.1	5.7	3.5	6.5	6.5	8.5	2.5	2.5	5.5	5.5	3.1	1.0	3.9	3.9	1,100	1,100	1,100	-600	200	600	700	700	
III Crafts & Trade	1.5	1.8	1.8	1.3	0.3	1.4	1.4	0.5	0.5	0.5	1.3	1.3	0.8	-0.2	0.9	0.9	9,000	600	600	4,100	200	-	3,600	200	200
	2.5	2.9	2.9	2.1	1.0	2.4	2.4	0.5	0.5	0.5	2.4	2.4	1.6	0.5	1.9	1.9	1,100	1,300	1,300	300	100	400	400	400	
	3.5	4.2	4.2	2.9	1.8	3.4	3.4	1.0	1.0	1.0	3.2	3.2	1.9	1.3	2.4	2.4	1,500	1,800	1,800	400	300	500	500	500	
IV Nonagr. Primary Production	1.5,2.5,3.5	-2.5	-2.5	-0.8	-2.9	-0.8	-0.8	-1.2	-1.3	-0.7	-1.3	-1.3	0.5	-1.6	-0.1	-0.1	2,500	-200	-200	9,000	200	-700	8,200	-400	-400
I-IV Nonagr. Sectors	1.5																16,300	1,000	1,100	17,600	700	-800	16,000	300	400
	2.5																1,900	2,300	2,300	1,100	-400	800	1,000	1,000	
	3.5																2,700	3,100	3,100	1,400	-	1,100	1,300	1,300	

Table 5

Labor Absorption in the Agricultural Sector of Paktia by Region, Period, and Alternative Rates of Growth of Agricultural Output

Region and Period	Annual Rate of Growth of Agr. Output	Total Add. Labor Supply	Add. Labor Supply to Agr. Sector	Patterns of Reaction ¹		
				1	2a	2b
				Change in Labor Productivity in %	Surplus/Shortage of Labor	Surplus / Shortage of Labor
		1	2	3	4	5
HB 1350-54	1.5		2,200	-	-	1,500
	2.5	3,200	1,300	8.1	-2,400	- 800
	3.5		500	16.7	-4,800	-3,200
MA 1350-54	1.5		2,300	-3.7	800	1,800
	2.5	3,000	1,900	3.1	- 700	400
	3.5		1,600	9.8	-2,100	- 900
LB 1350-54	1.5		3,000	-5.9	1,400	2,500
	2.5	3,300	2,500	1.0	- 200	900
	3.5		2,200	7.0	-1,700	- 500
PAKTIA 1350-54	1.5		7,500	-3.0	2,200	5,800
	2.5	9,500	5,700	4.4	-3,300	500
	3.5		4,300	11.1	-8,600	-4,600
HB 1355-59	1.5		4,900	-7.2	2,600	4,100
	2.5	6,000	3,700	0.5	- 200	1,500
	3.5		2,900	7.9	-2,500	- 800
MA 1355-59	1.5		6,200	-14.1	4,500	5,600
	2.5	5,400	5,800	-11.1	3,000	4,200
	3.5		5,400	-5.4	1,400	2,700
LB 1355-59	1.5		5,300	-11.9	3,500	4,700
	2.5	5,700	4,700	-5.9	1,600	2,900
	3.5		4,400	-0.3	100	1,400
PAKTIA 1355-59	1.5		16,400	-11.4	10,600	14,400
	2.5	17,100	14,200	-5.0	4,400	8,600
	3.5		12,700	1.2	-1,000	3,300

1) Pattern 1: Complete absorption of agricultural labor supply. Pattern 2a: Constant labor productivity. Pattern 2b: 1% average annual increase in labor productivity.

APPENDIX

The peasant family (farm + household) produces two goods: G-goods are marketed or potentially marketable (food crops), Z-goods are wholly consumed in the family. The production functions are

$$(1) \quad G = \tau f (T_g, I, B)$$

$$(2) \quad Z = \theta g (T_z, S)$$

τ and θ denote levels of technology, T_g and T_z the time allocated to either G-or Z-production, I stands for purchased inputs (fertilizers), B for an aggregate of all other inputs and S for social status. B, S, θ, τ , for the time being are regarded as constant. The family does not employ wage labor but allocates its total available time (time lived by all family members in a culturally defined age-bracket less time for physical reproduction) on either G- or Z-production, thus

$$(3) \quad T = T_g + T_z$$

The time constraint and the constancy assumptions allow us to rewrite (1) as

$$(1a) \quad G = \phi(I, Z)$$

with $\phi_I > 0, \phi_Z < 0, \phi_{ZI} < 0, \phi_{II} < 0, \phi_{ZZ} > 0$

The utility function is

$$(4) \quad U = U(\bar{G}, M, Z)$$

with $U_{\bar{G}}, U_M, U_Z > 0; U_{\bar{G}\bar{G}}, U_{MM}, U_{ZZ} < 0; U_{\bar{G}M}, U_{M\bar{G}}, U_{ZM}, U_{MZ} > 0$

where \bar{G} denotes the amount of marketable produce consumed in the family and

M the amount of purchased consumer goods. The exchange function

$$(5) P_m M = P_g (\phi - \bar{G}) + P_e E - K$$

says that the expenditure on M equals the money income from the sale of the marketed surplus plus some other income (sale of forestry rights) minus some constant K. We follow conventional production theory in assuming that the family decides at the beginning of a period on how much of its money income it will spend on productive services. K is constant for the period under observation but will vary between periods. The family has access to low-interest Government loans for "productive purposes" (purchase of fertilizers) with the amount L depending on some quota system q. This may be summarized in

$$(6) K + L = P_i I + iL,$$

where i denotes the rate of interest.

Forming the Lagrangean expression

$$(7) U(\bar{G}, M, Z) + \lambda (P_m M - P_g (\phi(I, Z) - \bar{G}) - P_e E + K) \\ + \mu (P_i I + iL(q) - K - L(q))$$

and differentiating with respect to the choice variables yields the first-order conditions

$$(8) U_{\bar{G}} + \lambda P_g = 0$$

$$(9) U_M + \lambda P_m = 0$$

$$(10) \quad U_Z - \lambda P_g \phi_{ZZ} = 0$$

$$(11) \quad - \lambda P_g \phi_{ZI} + \mu P_i = 0$$

$$(12) \quad P_m M - P_g (\phi(I, Z) - \bar{G}) - P_e E + K = 0$$

$$(13) \quad P_i I + iL(q) - K - L(q) = 0$$

where subscripts denote partial derivations. Equations (8), (9), (10) state the well-known conditions of the ratio of marginal utilities equaling their price ratio as can be seen by deriving the expressions

$$\frac{U_{\bar{G}}}{U_M} = \frac{P_g}{P_m}, \quad \frac{U_M}{U_Z} = -\frac{P_m}{P_g \phi_Z}, \quad \frac{U_{\bar{G}}}{U_Z} = -\frac{P_g}{P_g \phi_Z}$$

Note that $P_g \phi_Z$, which gives the money income forgone by allocating time to Z- instead of G-production, serves as a shadow price for Z-goods. Equation (11) says that the ratio between price and marginal product of a purchased productive service should equal the ratio of their respective marginal utilities of money, i.e., without a constraint on input expenditure price and marginal produce would be equal.

To simplify the following solutions let us assume that all G-products are sold on the market. Then, totally differentiating (9)-(13) and transposing into matrix notation yields the following system

$$(14) \begin{vmatrix} U_{MM} & U_{MZ} & 0 & P_m & 0 \\ U_{ZM} & U_{ZZ} & -\lambda P_g \phi_{ZI} & -P_g \phi_Z & 0 \\ 0 & -\lambda P_g \phi_{ZZ} & -\lambda P_g \phi_{ZI} & -P_g \phi_I & P_i \\ P_m & -P_g \phi_Z & -P_g \phi_I & 0 & 0 \\ 0 & 0 & P_i & 0 & 0 \end{vmatrix} \begin{vmatrix} dM \\ dZ \\ dI \\ d\lambda \\ du \end{vmatrix} = \begin{vmatrix} -\lambda dP_m \\ \lambda \phi dP_g \\ \lambda \phi_I dP_g - u dP_i \\ -M dP_m + \phi dP_g + E dP_e \\ -I dP_i - i L_q dq + L_q dq \end{vmatrix}$$

In the context of the Paktia paper we are mainly interested in which direction M and Z will change in reaction to changes in the price of purchased inputs (fertilizers, HYV seeds, tractor services), the price of marketable farm produce (wheat), the availability of low-interest Government loans. Following this, some of the simplifying assumptions shall be dropped to allow for changes in the marketed surplus and in the level of technology.

To specify the influence of a change in input prices on Z-demand we solve (14) for

$$(15) \quad Z_{P_i} = \frac{I P_i [U_M P_m P_g \phi_{ZI} + P_g \phi_I (U_{MM} P_g \phi_Z + P_m U_{ZM})]}{D},$$

where D denotes the negative determinant of (14).¹

In writing the equational system as we did in (14) we buried the effect of the diminishing returns to factor in the determinant. Solving separately, (15) can be augmented on the right side by a term

¹For an interpretation see page 8.

$$(15a) \dots\dots\dots \frac{-U_M P_g \phi_{ZZ} P_m P_i^2}{D} \dots \frac{dZ}{dP_i} .$$

This term tends to offset the first two terms, its direction depending on the dZ/dP sign. Hymer and Resnick christened this as the curvature effect because it is related to the concavity of the production possibility curve between Z and G or the consumption possibility curve between Z and M.

Following, we derive without discussion some other solutions. As the solution for

$$(16) M_{P_i} = \frac{I P_i [-U_{Z P_m P_g \phi_{ZI}} + P_g \phi_I (U_{ZZ} P_m + U_{ZM} P_g \phi_Z)]}{D}$$

mirrors the solutions for dZ/dP_i neatly, we shall solve for dZ/dX only.

$$(17) Z_{P_m} = \frac{U_M P_i^2 P_g \phi_Z}{D} - \frac{M P_i (U_{MM} P_i P_g \phi_Z + U_{ZM} P_m P_i)}{D}$$

$$(18) Z_{P_g} = \frac{-U_M P_i^2 P_m \phi_Z}{D} - \frac{P_i^2 (U_{MM} P_g \phi_Z + P_m U_{ZM})}{D}$$

$$(19) Z_q = \frac{-(L_q - iL_q) [U_M P_m P_g \phi_{ZI} + P_g \phi_I (U_{MM} P_g \phi_Z + P_m U_{ZM})]}{D}$$

$$(20) Z_{P_e} = \frac{-E (U_{MM} P_g \phi_Z + P_m U_{ZM})}{D}$$

$$(21) Z_\tau = \frac{-U_M P_g \phi_Z P_m P_i^2}{D} - \frac{-P_g \phi (U_{MM} P_g \tau \phi_Z + P_m U_{ZM})}{D}$$

Giving up the assumption of $\bar{G} = 0$ and solving for \bar{G}_{P_g} , we have

$$(22) \bar{G}_{P_g} = \frac{-\lambda C_{11}}{D} + \frac{\lambda \phi_Z C_{31}}{D} + \frac{(\phi - \bar{G}) C_{51}}{D}$$