1 INTRODUCTION

Economic performance of relatively large commercial farms is an important issue in rural development, as they are the main agricultural producers and land users. At the same time, in developing countries, rural population mainly consists of semi-subsistence rural households or smallholders that derive the largest share of their income from agricultural production and employment off the family plot. Agricultural production is thus organized into a dual system of symbiotic relationships between commercial farms and rural households. Agricultural policies for rural development are commonly oriented toward one of these two groups of agricultural actors (BINSWANGER, DEININGER, 1997). In many post-Soviet countries, including those in Central Asia, large-scale commercial farms dominate the use of arable land. As the commercial farms are the main producers of strategic export-oriented crops, e.g., cotton in Uzbekistan and Turkmenistan or wheat in Kazakhstan, the agricultural policies attempt to improve output and productivity of these farms (DEININGER, BYERLEE, 2012; POMFRET, 2012). In countries where agriculture consists predominantly of small family farms, e.g., South Asia and China, the agricultural policies are designed to support smallholders (BINSWANGER, DEININGER, 1997). Yet, despite their advantages in access to markets, infrastructure, and technology, large-scale commercial farms often do not operate their entire farmland on their own (LAFFONT, MATOUSSI, 1995), relying on hired labor from neighboring rural families. Such interdependency of land-abundant commercial farms and labor-abundant rural households forms a bimodal agricultural or farming system. In the bimodal agricultural system, the economy of rural households is closely connected to the economic performance of commercial farms and to the shifts in the external policy environment that determine commercial-farm perfor-

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mance. In Uzbekistan, for instance, commercial farms (farmers in Uzbek) interact with rural households (dehqans in Uzbek) through various forms of contractual agreements (DJANIBEKOV et al., 2013b). This case of farm-smallholder interlinkage and its possible contribution to rural economy is partly discussed by VELDWISCH and BOCK (2011). Yet, such interrelationship varies depending on the attributes of farmers and their workers (smallholders), production technologies, input and output prices, and agricultural policies (MURREL, 1983; ROUMASSET, 1995). The role that in-farm labor relationships in a bimodal agricultural system play in rural livelihoods has often been overlooked in the literature on post-Soviet countries.

Agricultural contracts are formed through mutual agreement between landlord and tenant (ROUMASSET, 1995). We abstract from the classical landlord-tenant definition and adjust it to match the transitional post-Soviet environment with its bimodal agricultural system. In our case, the landlord is a commercial farm that has accumulated abundant land through the process of farm consolidation, and the tenant is a land-scarce semi-subsistence rural household (DJANIBEKOV et al., 2012a). The land-abundant commercial farm suffers from shortage of labor and supervision skills, which are in abundance in rural households. In addition to land and labor, commercial farms and smallholders possess other inputs (in different proportions and quality), which they draw upon for deciding the form of contractual arrangements. Despite their importance in food security and poverty alleviation, smallholders have insufficient capital and land for agricultural production. In this respect, the economic performance of commercial farms is essential in providing rural employment and securing welfare (SLESNICK, 1996; IRZ, 2001). Consideration of the agrarian actors and institutional arrangements between them can allow for a broader and clearer understanding of the organization of agricultural production in transition countries.

We use the case of Khorezm region and the southern districts of Karakalpakstan (Beruniy, Ellikkala, and Turtkul) in Uzbekistan as an example representing the symbiotic bimodal agricultural system in irrigated areas of the post-Soviet Central Asia. The predominant crops in the study area are cotton and wheat, as well as other food crops such as rice and vegetables. Agriculture in Uzbekistan has a recent history of collective farming based on intensive input use, employment of trained farm managers, and engineers operating within a specially designed infrastructure of irrigation canals and roads. Agricultural reforms over the last years created two main actors – commercial farms and rural households, which are interdependent through agricultural contracts. The objective of our study is to investigate the present interrelationship via agricultural contracts between commercial farms and semi-subsistence smallholders and its effect on rural livelihoods.
To analyze rural interdependencies, a multi-topic survey of rural households was conducted to collect information on aspects of rural economy and agriculture that could influence decisions regarding contractual arrangements. The survey attempted to identify determinants of rural living standards with a focus on agricultural interrelationships of commercial farms and rural households. For achieving this aim, a rural household survey was carried out between June 2010 and March 2011, covering 400 rural households that had been randomly selected from all administrative districts in the study area. The details of the survey are presented in DJANIBEKOV et al. (2013a). In this chapter, we first describe the general setting for the bimodal agricultural system in Uzbekistan, as well as the present forms of contractual arrangements that are common in the study region. We also discuss the external factors that influence the formation of these contractual arrangements, deviations from the agreements, and the available enforcement mechanisms. We use principal component analysis and cluster analysis to classify rural households into distinct clusters and show how different groups of rural households depend on employment at commercial farms and on agricultural contracts.

2 BIMODAL AGRICULTURAL SYSTEM

Following the declaration of Uzbekistan’s independence in 1991, various reforms have been implemented in agriculture, the most significant of which was the process of farm restructuring (LERMAN, 2008b, 2008a; VELDWISCH, SPOOR, 2008; DJANIBEKOV et al., 2012a). Farm restructuring led to the creation of the bimodal agricultural system with two main types of agricultural producers – commercial farms and semi-subsistence smallholders (rural household plots), which can be distinguished according to their specialization, size, employment, and other factors (Table 1). Commercial farms are private agricultural enterprises managed under long-term land lease contracts from the state; they employ labor under contract agreements with the workers and trade in agricultural commodities subject to government procurement policies.

The share of land used by commercial farms in the study area increased from about 3% to 88% between 1997 and 2010. There are about 7,200 commercial farms in the study area that produce about one-third of the regional gross agricultural product and operate about 350,000 hectares of arable land (STATE STATISTICAL COMMITTEE, 2012). Rural households produce the rest of the regional gross agricultural product. The average size of a commercial private farm in Uzbekistan was about 60 hectares in 2010 (Figure 1); the average commercial farm in the study area was somewhat smaller, about 53 hectares (DJANIBEKOV et al., 2012a; STATE STATISTICAL COMMITTEE, 2012). The dominant type of commercial farm is the cotton-grain farm with average size of 100 hectares (MAWR, 2010). These farms produce all the cotton and the major share of wheat in the region.
Less than 1% of land is in state agricultural enterprises and the remainder is in rural household plots. Rural households are the smallest agricultural producers in Uzbekistan; they rely on family labor and produce vegetables, fruits, and animal products on own plots that are given in lifetime inheritable possession (DJANIBEKOV et al., 2012b). Rural households have an abundance of labor, lack of storage and transportation facilities, and insufficient buffer wealth, which forces them to sell their output soon after harvest, when the prices are lowest. Although over the past ten years, the total area of the rural household plots increased by about 7% and the total area of arable land currently cultivated by rural households is about 60,000 hectares (STATE STATISTICAL COMMITTEE, 2012), they still have insufficient land to meet own household consumption demand. Rural households operate an attached plot of 0.08 hectares on average and an additional remote plot of 0.12 hectares, making up a total arable area of 0.20 hectares per household. These household plots serve to complement family income and contribute to the family’s food security. Rural households are exempt from the state procurement policy.

Table 1: Characteristics of commercial farms and rural households in the study area

<table>
<thead>
<tr>
<th></th>
<th>Commercial farms</th>
<th>Rural households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production specialization</td>
<td>Cotton-grain, livestock, horticulture, and others</td>
<td>Vegetables, fruits, wheat, livestock (consume largest share of own products)</td>
</tr>
<tr>
<td>State policies</td>
<td>Cotton and winter wheat subject to state procurement</td>
<td>No state procurement</td>
</tr>
<tr>
<td>Form of land tenure</td>
<td>Long-term lease contract from the state (30-50 years)</td>
<td>Lifetime inheritable possession from the state</td>
</tr>
<tr>
<td>Form of labor</td>
<td>Family workers and hired labor</td>
<td>Family workers</td>
</tr>
<tr>
<td>Employment</td>
<td>At own farm</td>
<td>At commercial farm and in non-agricultural activities</td>
</tr>
</tbody>
</table>

Source: Based on DJANIBEKOV (2012b); VELDWISCH, BOCK (2011).
Figure 1: Number and average size of commercial farms in Uzbekistan 1997-2010

Source: STATE STATISTICAL COMMITTEE (2012).

3 AGRICULTURAL POLICIES

After gaining independence, Uzbekistan launched a program of agricultural reforms aimed mainly at improving agricultural production on commercial farms. These agricultural reforms focused on generating additional revenues for the state through exports of cotton from commercial farms. The cotton procurement policy in Uzbekistan prescribes allocation of a certain area of farmland in commercial farms to cotton and requires production of a specified quantity of cotton on this land. The entire target quantity of cotton is purchased by the state at prices lower than the potential border prices. In 2010, cotton occupied about 50% of sown area in commercial farms. The fulfillment of cotton targets is enforced by the threat that the state may cancel the land lease of a cotton-growing farm if the production target is not met. To minimize the risks of low cotton yields, the state coordinates farmers’ field operations and prioritizes input supply for cotton growers (VELDWISCH, SPOOR, 2008).

In the next stage of reform, the commercial farms were restructured with the objective of increasing agricultural production. The first steps of commercial farm restructuring, 1992-2002, created thousands of small farms and did not promote the idea of a commercial farm as a single production unit cultivating a contiguous land area. As farm fragmentation increased, the availability of farm-service infrastructure began to fall short of the demands of the multitude of newly
established small farms. The original design of the rural infrastructure (roads, irrigation canals, drainage systems) had been intended to serve a relatively small number of large-scale farms; the infrastructure could not meet the needs of the large number of small commercial farms, which accordingly suffered from insecure access to key resources endangering the sustainability of agricultural production. The existing infrastructure was costly to maintain, and yet its adaptation to fit the new smaller water users was technically and financially infeasible.

A farm consolidation program was thus launched in 2008 with the declared aim of "optimization" of commercial farm sizes by merging smaller commercial farms into larger units. However, the potential benefits of farm consolidation, in the sense of creating a single farm unit with contiguous fields and a better fit to the existing infrastructure, rarely materialized. The farm consolidation program implemented in response to these difficulties did not solve the problem, as in most cases farm size augmentation did not entail proper consolidation into a single contiguous parcel, supposedly fitting the old Soviet irrigation infrastructure designed to serve large farms: there are still many relatively small commercial farms, the fields in these farms are widely scattered, and the goals of improved water distribution have not been addressed.

Given the policy of production targets, the commercial farmers’ land lease rights (from 30 to 50 years) are limited to non-transferable usufruct rights. The users are prohibited to sell, mortgage or exchange the land leased from the state (Lerman, 2008a; Djanibekov et al., 2012a). The state is the exclusive landowner and it can expropriate land from farmers if this is deemed necessary, as often occurred in the process of farm consolidation. This makes private farming in Uzbekistan only quasi-private (Lerman, 2008a). On the other hand, rural households are given land in lifetime inheritable possession and are not subject to the land consolidation policy (nor are they subject to the state’s cotton procurement policy). The process of farm consolidation has sent wrong signals to the new commercial farmers, because the state turned around and took away the land that had been granted to private farms only a short time before. It seems clear that not so much inadequate property rights as an unstable and unpredictable tenure arrangements discourages investment and efficiency gains. Commercial farms cannot change their land use from cotton production to other crops that may better suit the preferences of their members and produce higher returns.

4 INTERLINKAGES BETWEEN COMMERCIAL FARMS AND RURAL HOUSEHOLDS

The implementation of various agricultural reforms in Uzbekistan since its independence resulted in the formation of an interdependent bimodal agricultural system that comprises commercial farms and rural households. In our example, a commercial farm is represented by a cotton-grain growing farm that relies
heavily on labor from rural households. Figure 2 presents the organization of a bimodal farming system highlighting the key elements that affect the formation of agricultural contracts between commercial farms and rural households. These elements have to be taken into account when studying the organization of agriculture in Uzbekistan.

**Figure 2: Organization of a bimodal agricultural system**

Commercial cotton-grain growers are subject to state orders in the production of the two strategic crops. As part of the state order system, these farmers have better access to technology and market information, which includes information on available and new crop varieties, expectation of water availability, and market prices; they also receive better information about agricultural policies. The superiority of commercial farms over rural households in access to this information is reflected in their greater wealth, status, networking options, and interactions with traders and financial institutions. Commercial farms have managerial capacity to make production decisions on the choice of crops, proper land and water management, selection and negotiation of timely availability of inputs, as well as procurement of machinery services.

Due to their higher opportunity income from non-agricultural sectors, commercial farm owners are often physically distant from the agricultural and rural scene. Commercial farmers also may have higher costs of day-to-day monitoring
of activities on their land. Commercial farmers thus hire nearby rural households to manage their agricultural production. In the contractual arrangements, a commercial farmer may be considered as an absentee landlord, whereas the rural households bring their human capital in the form of crop cultivation skills and the ability to mobilize extra hands from among their family members during labor intensive seasons (Djanibekov et al., 2013b; Veldwisch, Spoor, 2008). Rural households do not have machinery operating skills, mechanical equipment, or irrigation (pump) services to contribute to the production process; they mainly specialize in the provision of labor services to the commercial farm.

4.1 Forms of agricultural contracts

Commercial farmers cannot directly observe the agricultural productivity characteristics of their workers, who bring different skills to the farm. Commercial farmers accordingly offer their workers a menu of contracts, and rural households in turn select from this menu contractual forms that fit best their characteristics and needs (Djanibekov et al., 2013a). Depending on the commercial farm’s land size and availability of cash, as well as the characteristics of the rural households, contractual arrangements between these two actors are distinguished as fixed wage, fixed rent, and flexible.

Under the fixed-wage contract, commercial farmers employ rural households and keep the entire harvest, paying in cash or in kind (the main crop or various crop byproducts) for labor services provided by the rural households. The commercial farmer bears all production costs and risks, personally supervising the labor force. Fixed-wage contracts are typically arranged for a specific task and are mainly practiced in cotton cultivation.

The next widely practiced form of contractual arrangement is the fixed-rent contract. According to Roumasset (1995), when material determinants are such that production is prone to labor shirking, the fixed-rent contract is preferable for both actors. Although renting out of land is prohibited by Uzbekistan’s land law, the commercial farm informally rents out part of its land to a rural household in return for a certain cash payment received prior to the sowing season. The rural household bears all production costs and risks, providing both management and supervision, and keeps the entire harvest. In the study area, this contractual arrangement is preferred by commercial farmers who live far from their farm, as for these absentee farmers the monitoring and supervision of contractual agreements is a costly task. The land is typically rented for one crop season for about $450-$900 per hectare depending on soil quality and access to irrigation water. The fixed-rent contract is usually applied for the cultivation of cash crops such as vegetables or rice (Djanibekov et al., 2013b).
The next type of contractual arrangement between commercial farmers and rural households is the flexible contract, i.e., sharecropping. According to STIGLITZ (1974), sharecropping can produce higher returns to the farmer than wage contracts. In our case, the commercial farmer bears most of the production costs while the rural household provides labor; the actors share the harvest according to their contribution to the production costs. Sharecropping provides commercial farmers and rural households an opportunity for specialization in skills and resources according to their relative advantage. In this sense, sharecropping emerges as the decision of the actors to pool their skills and resources and thus achieve an output that they would not be able to achieve individually. This arrangement is commonly used in the cultivation of wheat and crops with high market value, such as rice and vegetables. In such contract both farmers and rural households share the production costs, where farmers mainly cover the fertilizer and machinery costs, and ensure the delivery of irrigation during the season, whereas rural households conduct management activities, and the harvest is divided based on the efforts of both actors. Commercial farms and rural households often use simple fractions of crop output for distribution (e.g., buckets of harvested grain in the case of wheat production) to minimize measurement costs.

CHEUNG (1969) argues that sharecropping may emerge as the dominant contractual arrangement in the presence of both agricultural risks and transaction costs. The structure of agricultural contracts in our study differs in certain respects from the contracts in other countries as described in the literature. In Uzbekistan, all three types of contracts – fixed wage, fixed rent, and flexible – have one feature in common: the remuneration for land and labor comes both in cash and in kind. The sharecropping contract resembles fixed-rent contracts when it is agreed that the rural household bears all production costs and leaves a share of the output to the commercial farmer, calculated taking into account the rent value of the land provided by the commercial farmer less production costs and the value of labor services provided by the rural household. The sharecropping contract resembles fixed-wage contracts when it is agreed that the commercial farmer bears all the production costs and then allocates a share of the output in kind to the rural household taking into account his production costs and the value of land rented to the household. In our study region we actually observed that commercial farmers use a part of their cropland as payment to rural households for labor in each of the three forms of contracts.

These types of contracts may not always reflect the actual behavior of the actors (LAFFONT, MATOUSSI, 1995). For example, in case of fixed-wage contracts, the commercial farmer may exploit the workers and provide insufficient remuneration for their labor after the harvest. Such behavior can be prevented when the
commercial farmer and the rural household are located near each other, and the
farmer cares about his reputation in the local community. The farmer’s repute-
tion acts as an enforcement of the original agreement. In fixed-rent contracts,
rural households that do not have lifetime land tenure may over-apply chemical
fertilizers and pesticides to increase short-term crop yields at the expense of
future soil productivity. To prevent this, the commercial farmer guided by long-
run considerations of maintaining soil productivity monitors labor activities or
hires managers to monitor on his behalf. In addition, similarly to fixed-wage
contracts, it is in the interest of the rural household to maintain a good rela-
tionship and use the rented land in a sustainable way. In sharecropping, both
commercial farmer and rural household can deviate from the initial contractual
agreement. Since the farmer is not constantly present in the field, rural house-
holds may tend to apply less than the quantity of inputs provided under the
sharecropping contract and divert part of the inputs to the own plot, thus profi-
ting at the expense of the commercial farmer.

Another issue is the underreporting of expected or actual quantity and quality of
harvest by the rural household to the commercial farmer. The commercial farmer
may also deviate from the agreement by supplying his sharecropping partner
(i.e., rural household) with lower crop shares or crops of worse quality. As the
commercial farm size grows through consolidation, the so-called patron-client
relationship between farmer and rural households will become more established,
penalizing the incidents of moral hazards by among tenants. In such patron-
client relations, a patron (the commercial farmer) uses his power and resources
to provide benefits to loyal rural households that he employs (VELDWISCH, BOCK,
2011). The loss of patron’s trust and confidence will be costly for the smallholder:
he will lose all access to credit markets and, perhaps more importantly, also lose
his reputation as a reliable worker. At the same time, as the commercial farm
becomes larger, the farmer will have to spend more resources to supervise hired
work, which can be avoided only if there is trust between the actors. Hence,
contract fulfillment plays an important role in the economy of both commercial
farms and rural households.

4.2 Dependency of rural livelihoods on agricultural contracts

Most rural households produce insufficient quantity of wheat to cover their
annual consumption needs, despite wheat being the second major crop in the
study area (VELDWISCH, BOCK, 2011). Only rice, vegetables, and milk products are
produced in sufficient quantity to generate a marketable surplus. The demand
for wheat and other "deficit" products is satisfied from alternative sources, e.g.,
from employment on a commercial farm, from production on rented farmland,
and from buying in the market (Figure 3). Rural households that satisfy their own
needs from production on the household plot still obtain some food products,
such as rice and vegetables, through employment on a commercial farm or production on rented farmland, thus accumulating a marketable surplus. Rural households also receive cotton stalks as payment in kind from commercial farms; cotton stalks are used as a source of energy for cooking and heating, mitigating the frequent interruptions in central gas supply in rural areas.

Classifying rural households will provide clues about the main factors that characterize the different types and reduce the aggregation bias when studying their dependency on commercial farms. Principal component analysis (PCA) and cluster analysis (CA) have been applied to identify representative rural households from the survey of 400 rural households and to analyze their reliance on agricultural and non-agricultural activities. For further information about estimation procedures for PCA and CA, see HAIR et al., (1998) and VILLAMOR (2012).

PCA is performed to condense information from a large number of original variables describing rural households into a smaller number of new composite components with minimum information loss². Our survey data produced five principal components (Table 2). These were characterized according to their distribution.

² Principal component analysis uses only variables with a Kaiser-Meyer-Olkin measure of sampling adequacy higher than 0.5 (the unacceptable threshold). This selection avoids the situation the variables are correlated and their properties are overvalued in the clustering process. In the principal component analysis based on our survey, the Kaiser-Meyer-Olkin measure showed a satisfactory sampling adequacy of 0.617. Afterwards the principal components for categorizing rural households were constructed using the rotated component matrix. The derived principal components interpret the original variables with loadings.
leading constituent variables (bold loadings in Table 2) as "Non-agricultural activity", "Commercial farmland", "Cash and crops from employment on a commercial farm", "Food commodity purchase expenditure", and "Own plot and livestock". The five principal components explained 74% of the total variance of 12 independent variables with highest loadings representing household characteristics (number of household members, employment on a commercial farm, employment in non-agricultural activities, land area, livestock headcount, as well as variables characterizing household expenditure and income structure).

The non-agricultural activities as the principal component 1 account for 19.1% of the total variance of the original dataset (Table 2). The non-agricultural activities of rural households are mainly employment (loading 0.83) and income in the non-agricultural sector (loading 0.87), such as government, as well as remittances from migrants working in Russia and Kazakhstan, and social payments, such as pensions. Other expenditures (transportation, health care, education, construction, and purchases not related to agricultural production) are also important in explaining dependencies on non-agricultural activities (loading 0.87). Rural households are also highly dependent on commercial farmland, mainly through agricultural contracts – land received as payment in kind, share-cropping, and land rent. Commercial farmland as the principal component 2 is composed of variables such as the number of rural household members employed on a commercial farm, the area of land in contracts, income from farmland, and expenditure on agricultural production. This component accounts for 17.5% of the total variance of the original dataset. Principal component 3 includes payments in cash and in crops in return for employment on the commercial farm from among factors describing rural household characteristics (it accounts for 14.1% of total variance explained). Since rural households produce insufficient wheat and other food products on their own plot, the household size and food purchases characterize principal component 4 as "Food commodity purchase expenditure" accounting for 12.9% of total variance explained of the original dataset. Livestock numbers (loading 0.79) and income from selling crops and animal products produced on the own household plot (loading 0.73) also contribute to rural livelihoods as principal component 5.
Table 2: Principal components of rural households characterized by dependence on various activities

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Principal components</th>
<th>Explained variance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) Non-agricultural activity (2) Commercial farmland (3) Cash and crops from employment at farm (4) Food commodity purchase expenditure (5) Own plot and livestock</td>
<td>19.1% 17.5% 14.1% 12.9% 10.4%</td>
</tr>
<tr>
<td>Number of rural household members</td>
<td>0.44 0.02 0.16 0.72 0.16</td>
<td></td>
</tr>
<tr>
<td>Number of rural household members working on a commercial farm</td>
<td>-0.21 0.60 0.70 0.39 0.11</td>
<td></td>
</tr>
<tr>
<td>Number of household members engaged in non-agricultural activities</td>
<td>0.83 -0.06 -0.11 0.14 0.08</td>
<td></td>
</tr>
<tr>
<td>Area of land rented, received as payment in kind, or used in sharecropping with commercial farm</td>
<td>-0.10 0.90 -0.10 0.14 0.09</td>
<td></td>
</tr>
<tr>
<td>Livestock headcount</td>
<td>0.24 0.04 0.14 -0.20 0.79</td>
<td></td>
</tr>
<tr>
<td>Food commodity purchase expenditure</td>
<td>0.37 0.03 0.10 0.78 -0.07</td>
<td></td>
</tr>
<tr>
<td>Agricultural production expenditure</td>
<td>0.18 0.66 0.48 -0.22 0.13</td>
<td></td>
</tr>
<tr>
<td>Other expenditures</td>
<td>0.58 -0.02 0.01 0.18 0.04</td>
<td></td>
</tr>
<tr>
<td>Income from marketing livestock and crops from own plot</td>
<td>-0.21 0.09 -0.07 0.32 0.73</td>
<td></td>
</tr>
<tr>
<td>Income from crops and cash payments from farm employment</td>
<td>-0.06 0.02 0.90 0.03 -0.02</td>
<td></td>
</tr>
<tr>
<td>Income from land rented, received as payment in kind, or obtained as sharecropping from commercial farm</td>
<td>-0.07 0.91 -0.03 -0.02 -0.01</td>
<td></td>
</tr>
<tr>
<td>Income from non-agricultural activities</td>
<td>0.87 -0.03 -0.10 0.12 -0.10</td>
<td></td>
</tr>
</tbody>
</table>

Note: Bold numbers are high loadings identifying the most important of the original variables that are included in the principal components using the rotated component matrix by Varimax with Kaiser Normalization. Bold numbers are the variables selected for household categorization.
Cluster analysis (CA) was performed using the 12 variables with highest loadings (Table 2). Using the five principal components produced by PCA, three clusters (or groups 1, 2, 3) were identified (Table 3).

Table 3: Characteristics of rural household groups, in average values

<table>
<thead>
<tr>
<th>Variable</th>
<th>Rural household group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1 Number of rural household members</td>
<td>6</td>
</tr>
<tr>
<td>2 Number of rural household members working on a commercial farm</td>
<td>3</td>
</tr>
<tr>
<td>3 Number of rural household members engaged in non-agricultural activities</td>
<td>2</td>
</tr>
<tr>
<td>4 Area of land rented, received as payment in kind, or used in sharecropping with commercial farm, ha</td>
<td>0.4</td>
</tr>
<tr>
<td>5 Livestock headcount</td>
<td>3.6</td>
</tr>
<tr>
<td>6 Share of food commodity purchase expenditure, %</td>
<td>34</td>
</tr>
<tr>
<td>7 Share of agricultural production expenditure, %</td>
<td>29</td>
</tr>
<tr>
<td>8 Share of other expenditures, %</td>
<td>37</td>
</tr>
<tr>
<td>9 Share of income from marketing livestock and crops from own plot, %</td>
<td>27</td>
</tr>
<tr>
<td>10 Share of income from crops and cash payments from farm employment, %</td>
<td>14</td>
</tr>
<tr>
<td>11 Share of income from land rented, received as payment in kind, or obtained as sharecropping from commercial farm, %</td>
<td>21</td>
</tr>
<tr>
<td>12 Share of income from non-agricultural activities, %</td>
<td>39</td>
</tr>
</tbody>
</table>

Of the total 400 rural households surveyed, 200 are in group 1, 112 in group 2, and 88 in group 3. Table 3 summarizes the main characteristics of the three groups. The largest group, i.e., group 1, has the smallest household size (6 people) and the lowest share of other expenditures (construction, transportation, purchasing clothes, and others). Group 2 consists of rural households whose main income and expenditure sources are related to non-agricultural activities. Group 3 has the smallest number of households from our survey, but the largest average household size. The distinguishing characteristic of these relatively large households is that the main source of income stems from agricultural activities: their income share from non-agricultural activities is the lowest (variable 12 in Table 3). Overall, we observe from Table 3 that employment of rural household members on a commercial farm (variable 2), and

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1 The K-mean method was applied to minimize the heterogeneity of each cluster by moving cases between clusters. This approach classifies the observations into several clusters, with each observation assigned to the cluster with the nearest mean value.
especially agricultural contracts (variables 9 and 10) play an important role in the livelihoods of rural households.

Different payment arrangements are agreed between rural households and commercial farms depending on household characteristics. Table 4 presents the different contractual forms practiced by rural households of different groups. The most frequently observed arrangement for all rural groups is payment in kind in the form of crops and crop byproducts. This is consistent with other studies, which report that a substantial amount of redistribution in rural areas occurs in kind – an arrangement vital for the subsistence of the rural population (GAHVARI, 1994). In our study, the largest number of respondents with fixed-wage payments is in rural household group 3, which largely relies on income from agricultural activity (see Table 3). This may be so because for rural households where food security and access to land are an issue, agricultural work may be more attractive than non-agricultural work if agricultural wages are paid in commodities (DJANIBEKOV et al., 2013b).

Table 4: Annual pattern of agricultural contracts in rural households (number of observations)

<table>
<thead>
<tr>
<th></th>
<th>Fixed wage</th>
<th>Fixed rent</th>
<th>Flexible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rural</td>
<td>Rural</td>
<td>Rural</td>
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<td></td>
<td>household</td>
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<td>group</td>
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<td>1 2 3</td>
<td>1 2 3</td>
<td>1 2 3</td>
</tr>
<tr>
<td>Contractual</td>
<td>100 75 121</td>
<td>71 55 60</td>
<td>80 55 103</td>
</tr>
<tr>
<td>arrangements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average area of</td>
<td>0.1 0.1</td>
<td>0.7 0.3</td>
<td>0.3 0.2</td>
</tr>
<tr>
<td>land contract, ha</td>
<td></td>
<td>0.7 0.7</td>
<td>0.3 0.3</td>
</tr>
<tr>
<td>Payment mode</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main crop products</td>
<td>100 60 115</td>
<td>n.a. n.a.</td>
<td>80 55 103</td>
</tr>
<tr>
<td>Crop byproducts</td>
<td>95 68 74</td>
<td>n.a. n.a.</td>
<td>80 55 103</td>
</tr>
<tr>
<td>Cash</td>
<td>54 33 58</td>
<td>71 55 60</td>
<td>38 28 50</td>
</tr>
<tr>
<td>Land</td>
<td>55 36 60</td>
<td>n.a. n.a.</td>
<td>n.a. n.a</td>
</tr>
</tbody>
</table>

Note: n.a. – Not applicable payment mode in given contract type. In the fixed rent contractual arrangement, the rural households rent land from farmers and hence payment of cash is from rural households to farmers.

In the study area, flexible arrangements (sharecropping) are mainly in the form of main crop harvest and its byproducts, and sometimes with payments in cash. Similar to fixed-wage contracts, sharecropping is mainly observed in rural household group 3, due to high dependency of these rural household members on employment on a commercial farm. Sharecropping, can be attractive for both commercial farmers and rural households: these contracts
allow them to share production risks and help households who lack sufficient capital for crop production (CHEUNG, 1969). The fixed-rent contract also plays an important role in the economy of rural households, which is mainly observed in group 1. The fixed-rent contract is also relevant when rural households suffer from scarcity of land whereas commercial farmers have insufficient capital (MURREL, 1983). The rural households that are less dependent on agricultural activities and whose main income sources is from non-agricultural activities, i.e., group 2 households, have the lowest observed number of agricultural arrangements with the commercial farmer. The rural household can have several contractual forms at the same time, e.g., receive a bucket of wheat as payment in kind and land as sharecropping, and rent land.

5 Conclusions

Our case study of the Khorezm region and the southern districts of Karakalpakstan in Uzbekistan revealed existing interdependencies between commercial farms which are the agricultural producers possessing most of the arable land and rural households or smallholders in Central Asia. The Uzbek setting is specific in several respects: first, the state exercises persistent involvement in agricultural decision-making through commercial farm restructuring and imposition of production targets; second, the inherited system of irrigation networks does not meet the needs of the new farming structure and the uncertain irrigation water supply creates additional risks for producers. The lack of stability in farm restructuring, incomplete autonomy of the farmers due to the imposition of cotton production plans, as well as the uncertainty of land tenure and water supply may have adverse effects on rural welfare through the organization of contractual arrangements between commercial farms and rural households. Hence, to be able to fully capture the effects of production changes in commercial farms on rural livelihoods it is important to understand the dependency of rural people on contracts with commercial farms.

By classifying the rural households into three clusters, we were able to identify the rural population groups that are the most dependent on agricultural or non-agricultural activities, more specifically on employment at a commercial farm and on the type of agricultural contracts. All the three groups relied to some degree on employment at commercial farms and all had various contractual arrangements with commercial farmers. Different contract types may be practiced in one smallholder family, e.g., a smallholder can have both a fixed-wage and a sharecropping contract, having agreed with a commercial farmer on both a fixed payment in wheat and a share of yield from the managed land. It was interesting to observe in our case is that the more dependent rural household group, i.e., group 3, has a larger number of observations in fixed-wage and flexible contracts than the other groups (see Table 4). This is due to
the fact that payment in crop products (under fixed-wage contracts) substantially contributes to the household’s food security, while the households do not have enough cash to rent land and thus rely on sharecropping. In contrast, smallholders that are more dependent on non-agricultural activities (i.e., group 2) such as entrepreneurship, employment abroad, and social payments, accordingly have the least number of agricultural payments in all three types of contracts, i.e., fixed wage, fixed rent and flexible.

Our results show that payments from commercial farms play an important role in rural livelihoods. Hence, developing policies oriented towards commercial farm production and restructuring should be based on a broader understanding of the interdependency between commercial farms and rural households, as these policies are likely to have spillover effects on rural livelihoods.

REFERENCES


