CONTRACTS, LATE PAYMENTS AND FARM GROWTH:

EVIDENCE FROM BULGARIAN AGRICULTURE

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Abstract
The transition of a centrally planned to a more market economy provides a natural experiment on the role of institutions and exchange in economic growth. This paper uses a unique dataset based on a survey of 305 dairy producing and supplying households in Bulgaria to analyze the impact of late payments for delivered products and farm assistance programs. The results of the dynamic panel analysis indicate that late payments have a negative influence on farm growth, while contracting with interlinked farm assistance programs, had a positive effect on farm growth.

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1. INTRODUCTION

The transition of a centrally planned to a market economy provides a natural experiment on the role of institutions and exchange in economic growth. More specific, one can use it to gain new insights on the effect of contract break-downs (hold-ups) as well as contractual innovations on growth in supply chains. In this paper we attempt to measure both effects drawing on micro-evidence from Bulgaria.

First, in the 1980s and 1990s the liberalization and transition towards a more market oriented economy had an important impact on all market transactions in former socialist countries and developing countries. In the Central and Eastern European Countries, unclear property rights, weak legal institutions and the breakup of the previously vertically coordinated supply chains, largely increased the chance that the newly established processing firms did not comply to the contractual obligations and ex post renegotiated the contractual terms (Blanchard and Kremer, 1997). These "hold up" problems were frequently observed as late payments by the processing firm (Gow and Swinnen, 1998; 2001).

Late payments are a well known problem in the transition and developing countries. Survey work by Bigsten et al. (2000) indicates that late payments are frequently observed in the African manufacturing sector. Similar results are found in survey work on manufacturing farms in Ghana and Kenya by Fafchamps (2004). He finds that all surveyed farms experienced late payments and more than half of them even experienced non-payments. Van Biesenbroeck (2005) indicates that between 1992 and 1996, two third of the surveyed manufacturing farms in nine African countries report late or non-payments and generally they report multiple incidences, between 4 and 12 per year. In the transition region, Johnson et al. (1999) surveyed managers of privately owned manufacturing firms in Poland, Romania, Russia, the Slovak Republic and Ukraine and in 1997 44% of these firms report late payments. In the agricultural sector, Fafchamps and Minten (2001) find that about 31% of all surveyed traders experience late payments and about 7% experienced non-payment in the grain market in Madagascar.

It is expected that late payments slowdown investments and firm growth through both a direct and an indirect effect (Cungu et al., 2008). Directly, late payments not only put the firms'

working capital under pressure, but also worsen the firms' credit constraints[1], cash flow and profitability (Gow and Swinnen, 2001). In the short run it limits the access to input supplies for future production, which has a negative effect on both output and quality. In the long run late payments limit the investment capacity. Indirectly, firms that experienced a late payment this year, will expect a late payment next year and are reluctant to make asset-specific investments (Klein et al., 1978), which slows down restructuring of the sector.

There is much qualitative information on the occurrence of late payments and their impact on firm growth in the transition region. Gorton et al. (2000) find that in 1998 late payments by customers are the most important obstacle to firm growth of food processing companies in Slovenia and the Czech Republic. In Hungary, they find that late payments are the third most important factor out of 12 possible factors that delayed growth. In the same year, Cungu et al. (2008) report based on a farm survey in Hungary that 60% of all farm enterprises find late payments to be important or fairly important. However, while there is much ad hoc evidence on the occurrence of late payments and their impact on farm growth, there is only little empirical evidence, especially in the agricultural sector. Our study will contribute to decline this gap in the literature. Some evidence of the impact of late payments on investments can be found in Cungu et al. (2008). They find that late payments have a significant negative effect if farmers consider late payments to be "important". However, if farmers indicate that they find late payments only "fairly important", no significant effect on investment is found.

Second, when in the mid 1990s new investors entered the market, they were faced with the difficult task of establishing a sufficient supply base for quality production. The financially distressed farmers could not provide the demanded quantity and quality. Therefore dairy companies introduced a series of contract innovations, including assistance programs, such as input supply programs, credit and investment programs. Enforcement is typically done by interlinking the input and output market as payments for assistance programs are typically done by deductions of payments to the farmer at the time of delivery.

[1] In the agricultural sector, the malfunctioning of the rural credit market in the years after transition probably enhanced the impact of late payments on farm growth. Credit constraints were a major problem for growth and restructuring during transition (Swinnen and Gow, 2000) and were still considered an important problem at the time of EU accession in several of the Central and Eastern European Countries (Latruffe, 2005; Petrick, 2004; Bakucs et al., 2006). However, credit problems are not limited to developing and transition countries as studies show that also in the US and the EU, farmers' access to credit is constrained (Blancard et al. 2006; Färe et al. 1990).

These contracts are found to have important horizontal and vertical spillover effects (Dries and Swinnen, 2004). Horizontal spillover effects emerged because domestic companies only shortly after the introduction of the programs started to copy these programs. Vertical spillover effects emerged because the vertical integration strategies led to improved access to finance for all farmers, increased investments and improvements in the quantity and quality of the agricultural production.

Various studies have discussed the positive impact of the vertical integration strategies on agricultural output and productivity (Gow et al., 2000; Leat and Van Berkum, 2003; White and Gorton, 2006). In Poland, Dries and Swinnen (2004; 2009) have investigated the impact of assistance programs on farm growth, investment and quality changes in dairy sector. They found a positive impact of assistance programs, even in the case of small dairy farmers.

In this paper, we use a unique dataset based on a survey of 305 dairy producing and supplying households in the North and South Central Region of Bulgaria in 2003 to measure the influence of hold ups (late payments) and contract innovations (assistance programs) on farm growth in the dairy sector. The dynamic panel estimates suggests that late payments have a negative impact on farm growth, while receiving assistance programs have a positive effect of on farm growth.

Our findings on the impact of late payments and assistance programs are relevant beyond the Bulgarian dairy sector at the end of the 1990s and the beginning of the 2000s. First, previous studies have shown that also farmers in the EU and the USA have a variety of contracts and are credit constrained which indicates the importance of contracts and timely payments for them as well (Blancard et al. 2006; Färe et al. 1990). Second, although late payments are largely resolved in the Central and Eastern European countries that are currently member states of the European Union, they remain important in developing countries and transition countries that are less advanced in the transitional process (Cungu et al., 2008). In many of these countries late payments are expected to have a negative effect on farm growth and thus sector restructuring. Inversely, contract innovations and assistance programs are increasingly important for them (Gulati et al., 2007).

The paper is organized as follows. In Section 2, we discuss the data that were collected during a household survey. In section 3, we provide some qualitative evidence on late payments, assistance programs and farm growth in the dairy sector. Next, we present an econometric analysis of the impact of late payments and assistance programs on farm growth and finally, section 5 concludes.

2. DATA

There are no reliable data on the evolutions within the Bulgarian dairy sector in the first years after transition and the crisis years at the end of the 1990s. Therefore we collected ourselves data trough a random survey of dairy suppliers, mainly farm households.

The data were collected during a 2003 survey of dairy households in the North and the South Central region of Bulgaria. These two regions are particularly interesting for the analysis because they are the main dairy producing regions in Bulgaria. In 2001, the area represented 49% of all cows in the country and 44% of all Bulgarian milk-supplying households. Within the regions, the surveyed counties are Veliko Tarnovo, Pleven and Gabrovo in the North; and Plovdiv, Haskovo and Stara Zagora in the South. In these counties, 22 villages are chosen at random. The survey gathered detailed information on the demographics, non-farm activities, wealth, contract behaviour, milk quality and investments over the period 1994-2003. A total of 305 households who had at least some dairy production in this period were surveyed. This implies that, in addition to households that had some commercial dairy production in the period 1994-2003, both households that stopped and households that started commercial dairy production in that period, are included in the sample.

Several sections of the household survey were designed to collect comprehensive information about the contracts that farmers had with the dairy processing companies in the period 1994-2003. These sections collect yearly information on the evolution of the payment conditions, the type of contract, the farmers' negotiation power and the ownership of the dairy processing company with whom they contract. It is generally acknowledged that retrospective reporting may be less accurate than yearly reporting, because it is inherently more difficult to recall information about the past (Kennickell and Starr, 1997; Brennan et al., 1996; Neter and Waksburg, 1964). However, there are studies that have used long series of recall data[2]. We addressed concerns about recall bias through the design of the survey and careful training and monitoring of the enumerators to ensure that respondents gave the most accurate responses. In order to get an idea of the potential recall bias, we present in section 5 in addition to the

[2] De Brauw and Rozelle (2008) use recall data on a 15-year time period to investigate the how household investment is affected by migration in rural China. Fleisher and Wang (2005) study the changing returns to schooling in China based on recall data over 40 years. Boucher, Smith, Taylor, and Yúnez-Naude (2007) use a dynamic panel estimator to examine how U.S. policy initiatives such as NAFTA and immigration reform affected the supply of Mexican labour to U.S. farms based on data of the past twenty year.

estimation results of the full sample also the estimation results of a restricted sample in which we exclude the first five years. These estimations show that the results are robust, which is an indication that are data are relatively accurate.

In Bulgaria, the majority of the dairy farms are households that have only one or two cows and mostly produce for home consumption[3]. In 2003, such one or two-cow farms represent more than 90% of the total number of dairy farms, while in our sample these small farms represent 24% of the surveyed farms (Table 1). This is because the focus of our research is to understand how late payments and assistance programs offered by dairy processing companies affect suppliers and therefore we only interviewed farm households that had some commercial dairy activities, which in general have more cows. Nevertheless this selection, the majority of the interviewed farm households are very small compared to Western standards. In 1994, 97% of the surveyed farms had less than 10 cows and in 2003, still 93% of the farms had less than 10 cows.

[3] The random sample included one large legal entity, which we excluded from the econometric analysis.

3. QUALITATIVE EVIDENCE ON HOLD-UPS, CONTRACT INNOVATIONS AND FARM GROWTH

(a) Hold ups

Hold ups of farm households by late payments from processing companies are expected slowdown investments and farm growth because worsen the firms' credit constraints, cash flow and profitability (Gow and Swinnen, 2001). In the short run it limits the access to input supplies for future production while in the long run, late payments limit the investment capacity. There is much qualitative information on the occurrence of late payments and its impact on firm growth in the transition region (Gorton et al., 2000; Cungu et al., 2008).

Our survey results show that late payments have also been an important characteristic of the Bulgarian dairy market in the observed period (1994-2003). We asked farm households for three measures of late payments. First, we asked farmers whether they have experienced a delay in payment by the processing company in the past 12 months. In 1994 approximately one-third of all dairy supplying farm households reported payment delays and only after 1998 this number started to decrease to reach about 8.4% in 2003 (Figure 1). Second, we asked farmers which confronted with a payment delay to indicate what was the longest delay in that year. In 2003 half of the cases are payment delays of less than a week, and another 20% are delays between 7 and 30 days. The improvement is considerable compared to 1994 when more than 70% of payment delays lasted for more than a month (Figure 2). Third, we asked farmers how long they usually needed to wait before being paid and also in this case we find that there was a considerable amelioration of the payment conditions after 1998. In 1994, 40% of the farmers needed to wait more than 30 days before being paid, while in 2003 only 8% of the farmers needed to wait longer than 30 days before being paid (Figure 3).

(b) Contract innovations

In several transition countries, processing companies played an important role in the growth of the farms by providing contracts which included assistance programs as a quality improvement strategy (Dries et al., 2009). However, our results indicate that only a small number of the farmers receive assistance programs, although recently there was an increase in the participation rate. In 2003, 8% of the Bulgarian dairy households received assistance, shifting up from only 2% in 1995 (Figure 4). Most of them benefit from milk collection at the farm gate (Table 2).

(c) Farm Growth

In this section, we analyze how the restructuring of the dairy sector affected exit-entry decisions and growth of household farms.

Our survey data show that from the 236 farm households that were delivering to a dairy in 1994, only 7 farm households (or 3%) quit delivering to a dairy by 2003. All seven households stopped because of personal, non-economical reasons, such as ageing or health problems. Hence, 97% of the households continued delivering to a dairy despite the restructuring of the sector. Moreover, there was even an increase in the number of households involved in dairy production. About one quarter of all surveyed farms (24%) started their dairy processing activities before 1990 and half of them started in the first years after transition (1990-1994). Approximately 20% of all surveyed households started their activities in the second half of the 1990s. An increase in farming activities is a rather exceptional phenomenon in the European Union, where the agricultural population has been steadily decreasing for the last 20 years. One explanation could be that household farming was a mechanism to attain food and social security in the years after transition, as been observed by Swinnen et al. (2005) in Bulgaria and Romania.

Besides changes in the number of dairy farms, also the size distribution changed importantly (Figure 5). In 1994, 70% of all household farms had less than 3 cows. In 2003, the number of small household farms has reduced significantly to 59%, indicating that a large proportion of the farms has upgraded to a larger herd size. By 2003, more than 14% of the household farmers had a herd size of more than 5 cows, whereas in 1994 this was only 7%. More than 42% of all farmers have increased their farm size in the period 1994-2003, while only 23% of the farms have decreased their farm size.

In summary, the data suggest that most small dairy farms have survived the restructuring period very well. In general, they have not been cut out and increased their production by expanding their farm size. Moreover, we find even an increase in dairy activities as a quarter of the sample started their activities in the period 1994-2003. The few farm households that stopped their dairy activities in the period 1994-2003 mainly stopped because non-economic reasons (e.g. death or ageing of the household members).

4. ECONOMETRIC EVIDENCE

(a) Model specification

To econometrically quantify the effect of payment delays and assistance programs on farm growth, we estimate a model based on the firm growth literature. This literature generally defines the firm growth relationship as (Nelson and Winter, 1982; Evans, 1987; Weiss, 1999; Dries and Swinnen 2004):

$$S_{i,t} = \left[F(X_{i,t-1}, Y_i, S_{i,t-1})\right] \; S_{i,t-1} \;\; e_{i,t} \tag{1}$$

where $S_{i,t}$ and $S_{i,t-1}$ denote the size of the farm i in term of its number of cows at respectively time t and t-1; $X_{i,t-1}$ represents a vector of contract characteristics at t-1, including late payments and assistance programs; and $e_{i,t}$ is a lognormally distributed error term with a possibly non constant variance. After taking logarithms, equation (1) results in:

$$\ln(S_{i,t}) = \ln\left[F(X_{i,t-1}, S_{i,t-1})\right] + \ln(S_{i,t-1}) + \varepsilon_{i,t} \tag{2}$$

where $\varepsilon_{i,t}$ is normally distributed with zero mean and a possible non constant variance.

After allowing for second order expansion, equation (2) results in:

$$\ln(S_{i,t}) - \ln(S_{i,t-1}) = a_0 + a_1 PAYTIME_{\,i,t-1} + a_2 PROGRAM_{\,i,t-1} + a_3 \ln(S_{i,t-1}) + a_4 \ln(S_{i,t-1})^2 + \sum_{j=1}^{k} b_j \; X_{i,b,t-1} + \varepsilon_{i,t} \tag{3}$$

where $S_{i,t}$ and $S_{i,t-1}$ are defined as in equation (1); $PAYTIME_{i,t-1}$ measures the impact of late payments in t-1; $PROGRAM_{i,t-1}$ measures the impact of assistance programs that farmers received in t-1; $X_{i,b,t-1}$ represents a vector of contract characteristics at t-1, excluding late payments and assistance programs; and $\varepsilon_{i,t}$ is normally distributed with zero mean and a possible non constant variance.

In order to estimate this relation, we present three different estimation approaches.

Pooled OLS model

As a basic empirical approach, we estimate the following pooled OLS model:

$$\ln(S_{i,t}) - \ln(S_{i,t-1}) = a_0 + a_1 PAYTIME_{i,t-1} + a_2 PROGRAM_{i,t-1} + a_3 \ln(S_{i,t-1}) + a_4 \ln(S_{i,t-1})^2 + \sum_{j=1}^{k} b_j X_{i,b,t-1} + \sum_{j=1}^{l} c_j Y_{i,c} + \delta_t + \varepsilon_{i,t} \qquad (4)$$

where $S_{i,t}$, $S_{i,t-1}$, $PAYTIME_{i,t-1}$, $PROGRAM_{i,t-1}$ and $X_{i,b,t-1}$ are defined as in equation (3); vector $Y_{i,c}$ is a vector of l variables related to time invariant household characteristics; vector δ_t is a vector of time dummies and $\varepsilon_{i,t}$ is the error term.

However, there are several statistical issues in estimating this pooled OLS model.

First, estimating equation (4) with OLS techniques will only take in account the growth of firms that still exist at the end of the period that we consider. Such analysis based on a sample of surviving farms only, may be biased due to sample attrition. However, we have some indications that the sample attrition bias is rather limited. First, only few farm households stopped their dairy activities (3%) and they mainly stopped because non-economic reasons. Second, in order to tackle the potential bias that arises from excluding these few exiting farms, we include in sample in addition to the surviving farms also the exiting farms in their pre-exit period (Bigsten and Gebreeysesus, 2007).

Second, panel data can be viewed as a special case of clustered data. In our sample, the clusters are households and we have several observations over time within one household or cluster. Within one household it is possible that the observations are correlated in an unknown way so that also the errors are correlated over time for a given household. In order to deal with the within-household correlation, we use cluster standard errors in the estimations.

Third, this model implicitly implies that the farm household specific effects are homogeneous and all sources of heterogeneity among farms are assumed to be fully reflected in the observed variables. However, the presence of some other non observed farm household specific effects that are correlated with the variables of interest or the control variables, can bias the results of the regression. It is for example possible that dairy companies offer more productive farm households better payment conditions or more assistance programs and at the

same time the more productive farm households are more likely to grow. The presence of these non observed variables makes a consistent estimation of the effect of late payments and assistance programs on growth problematic in a pooled OLS estimation. Therefore we estimate in a second empirical approach a fixed effects model.

Fixed Effects model

In order to get consistent estimates, we make use of the panel dimension of the data and we estimate a fixed effects model to control for unobserved heterogeneity across firms. The fixed effects model that we estimate is similar to the one of Bigsten and Gebreeysesus (2007):

$$\ln(S_{i,t}) = \mu_i + a_1 PAYTIME_{i,t-1} + a_2 PROGRAM_{i,t-1} + (a_3 + 1)\ln(S_{i,t-1}) + a_4 \ln(S_{i,t-1})^2 + \sum_{j=1}^{k} b_j X_{i,b,t-1} + \delta_t + \varepsilon_{i,t} \qquad (5)$$

where vector μ_i captures unobserved and time constant farm specific effects, $S_{i,t}$, $S_{i,t-1}$, $PAYTIME_{i,t-1}$, $PROGRAM_{i,t-1}$, $X_{i,b,t-1}$ and vector δ_t are defined as in equation (4) and $\varepsilon_{i,t}$ is the error term.

However, the introduction of a lagged dependent variable as an explanatory variable causes problems in the fixed effects estimation. The estimation by a fixed effects model yields biased and inconsistent estimates since in the within estimation the regressor $\left(\ln(S_{i,t-1}) - \overline{\ln(S_{i,.})}\right)$ is correlated with the error $\left(\varepsilon_{i,t} - \overline{\varepsilon_{i,.}}\right)$, because $\ln(S_{i,t-1})$ is correlated with $\varepsilon_{i,t-1}$ and hence with $\overline{\varepsilon_{i,.}}$. The bias in the fixed effects dynamic specification only diminishes when the number of time periods approaches infinity, which is clearly not the case in our data.

System GMM

In order to address the bias in the fixed effects dynamic specification, we use an instrumental variable estimation model which corrects for the endogeneity. Arrelano and Bond (1991) proposed a generalized method of moment method (GMM) that yields consistent and efficient estimation results. They developed a GMM method that uses lagged levels of the

explanatory and the dependent variable as instruments for the first differenced equation. Arellano and Bover (1995) and Blundell and Bond (1998) suggested to use, in addition to the first-differenced moment conditions, also the moment conditions in levels using lagged first-differences of the explanatory and the dependent variables as instruments for the equations in levels. This approach, which is called system GMM has a number of advantages. First, in the presence of high serial correlation, the performance of system GMM is considerably better than the GMM method proposed by Arrellano and Bond (1991). Second, by including the moment conditions in levels, we can also include time-invariant variables in our estimation (Gardebroek et al., 2009). Therefore we use the system GMM model to estimate equation (5).

(b) Description of the variables

Table 3 gives an overview of all variables in the econometrical analysis. All variables are obtained from the household survey, described in section 3.1, and are based on retrospective questions on the period 1994-2003. The dependent variable in the pooled OLS estimation (or equation (2)) is GROWTH. GROWTH is defined as the difference between the natural logarithm if the number of cows owned in *t* and the natural logarithm of the number of cows owned in *t-1*. The dependent variable in the fixed effects and the system-GMM estimation (or equation (5)) is FARMSIZE. FARMSIZE is the natural logarithm of the number of cows owned in *t*.

The first set of explanatory variables measure the impact of contract characteristics, including late payments and assistance programs.

PAYTIME is the natural logarithm of the time until payment (in days) reported by the farmer in period *t-1*. The expected sign of the variable PAYTIME is negative, as late payments are thought to limit the investment capacity of the farm household. This effect is probably enforced by the fact that the household farms were credit constrained due to the malfunctioning of rural credit markets during transition.

PROGRAM measures the number of assistance programs that the farm receives from the dairy in period *t-1* and takes a value between 0 and 9. The possible programs are agricultural extension services, veterinary credit, forward credit for dairy specific investments, forward credit for general agricultural investments, forward credit for buying cows, forward credit for buying inputs, milk collection at the farm, bank loan guarantees and forward credit to buy forage, fuel,

medicine for the animals, etc. Assistance programs are expected to have a positive influence on farm growth.

To test whether security of milk delivery has an impact on growth we include two variables related to the contract base. CONTRACT is a dummy variable that takes a value of 1 if the farmer has a written or oral contract with the milk company in t-1 and a value of 0 otherwise. We include an additional dummy variable WRCON that takes a value of 1 if the farmer has a written contract with the dairy company in t-1 and a value of 0 otherwise. WRCON estimates whether there is a supplementary impact of having a written contract. We expect that having an oral agreement with the dairy company will have a positive impact on farm growth and that there is an additional positive effect of having a written contract.

Finally, FDI is a dummy that takes a value of 1 if the dairy company is foreign owned in period *t-1* and a value of 0 otherwise. Farms contracting with foreign dairy processors may be more likely to invest compared to farms contracting with domestic dairy processors because foreign processors, for example, may have better access to technology and a better reputation than domestic processors. Hence, we expect a positive effect of FDI on farm growth.

There could be potential correlation between several of these contract variables. This correlation could cause problems related to multicollinearity. Therefore we present in Table 4 the correlation coefficients between the different variables. These results show that we might expect some problems related to the correlation between the contract type variables, CONTRACT and WRCON, and the variables of interest, PAYTIME and PROGRAM. To test for the possible impact of multicollinearity problems in the estimation we run different restricted models in which we exclude CONTRACT, WRCON and FDI.

The next group explanatory variables are the variables related to farm size. SIZE is the natural the natural logarithm of the number of cows owned by the household in period *t-1*. This variable will allow us to test Gibrat's law, which states that farm growth is independent of the initial farm size. To capture non-linear effects of farm size, we include a variable SIZESQ, the squared value of SIZE.

Finally, we include variables related to household characteristics, namely AGE, EDU, HHSIZE, COOPMEMB, NEWFARM and SOUTH. AGE measures the natural logarithm of the age of the household head in years. EDU is the natural logarithm of the number of years of

education of the household head. HHSIZE represents the number of household members. COOPMEMB is a dummy variable that takes the value of 1 if at least one of the dairy household members is a member of a co-operative and 0 otherwise. NEWFARM is a dummy variable that takes a value of 1 if the farm started their activities after 1994 and 0 otherwise. To control for regional differences in investment behaviour we include a regional dummy variable SOUTH, which takes a value of 1 if the farm is situated in the south of Bulgaria and 0 otherwise.

(c) Regression results

Tables 5-7 present regression results of the different model specifications (Pooled OLS, Fixed Effects and SYS-GMM). For each model specification, we report the estimation results for 2 restricted versions of the basic model and the model itself (Table 5-7). In the SYS GMM model specification (Table 7) we assumed that all variables related to the contract (X_{it-1}), including PAYTIME and PROGRAM , are predetermined[4]. The GMM estimator is found to be consistent as the instruments are valid and the error term is not serially correlated[5].

The estimated coefficients of the two key variables are consistently significant across the three models. First, the results indicate that late payments (PAYTIME) have a significant and negative impact on farm growth.

Second, assistance programs (PROGRAM) that dairy companies provide for their supplying firms are found to have a highly significant and positive impact on farm growth. Hence, farm households that receive programs grow more than farm households that do not receive any programs. This confirms earlier results by Dries and Swinnen (2004).

The contract variables (CONTRACT and WRCON) have no significant impact on farm growth. Firms that have an oral or written agreement with the dairy company are not found to grow more than firms without any contract. These results suggest that it is not so much the

[4] In the case of predetermined variables Zit, we cannot include the whole vector of differences of observed Z_{it} into the instrument matrix. We can just include the levels of Z_{it} for those time periods that are assumed to be unrelated to $\Delta\varepsilon_{it}$. Note that a variable is X_{it} is predetermined if $E(X_{is}\varepsilon_{it}) = 0$ for $s \leq t$ and $E(X_{is}\varepsilon_{it}) \neq 0$ for $s > t$.

[5] There exist two tests to verify these assumptions. The first test is the Sargan test of overidentification, which indicates the validity of instruments with t-1 lags is not rejected at a reasonable confidence level. The validity of instruments with t-1 and earlier lags did not pas the Sargan test at a 5% confidence level. Therefore we will only report the SYS-GMM model with t-1 lags as a set of instruments. The second test examines the hypothesis that the error term $\varepsilon_{i,t}$ is not serially correlated. We test whether the differenced error term is second-order serially correlated and find no strong evidence of second order correlation.

contract as such but rather what is in the contract (assistance programs) which affect growth. Also FDI did not significantly affect farm growth, ceteris paribus. This result implies that firms delivering to foreign dairy companies are equally likely to invest and to increase their farm size than households delivering to domestic dairy companies.

From the Pooled OLS and the fixed effects results we can conclude that farm size has a significant effect on farm growth and that small firms grow faster than large firms. The results of the GMM model no longer support these findings and we have no strong evidence to reject Gibrat's law, which states that farm growth is independent of initial farm size.

(d) Robustness tests

In order to check the robustness of the results we have performed several robustness checks. First, as already mentioned it is possible that there is correlation between the contract variables, which could cause problems related to multicollinearity. To test for the possible impact of multicollinearity problems in the estimation we run different restricted models in which we exclude CONTRACT, WRCON and FDI (see Table 5-7). The estimated effects are robust to these different model specifications.

Second, despite the fact that we have put much effort to make sure that our recall data are as accurate as possible, it is generally acknowledged that retrospective reporting is less accurate than yearly reporting. Therefore, we illustrate the robustness of our results based on a restrictive sample in which we exclude the first five years and only base estimates on the last five years. It is expected that farm households will report these recent data more accurate, because they have less difficulties in remembering them. The results of the fixed effects and SYS-GMM estimation on the restricted model are presented in Table 8 and are consistent with the estimates that we find in case of the full sample. This consistency suggests a firm robustness of the results, which is an indication for the accuracy of our recall data.

5. CONCLUSION

There is only little empirical evidence of the effect of delayed payments and contracting on farm growth. This paper uses a unique dataset based on a survey of 305 dairy producing and supplying households in the North and South Central Region of Bulgaria in 2003 to provide econometrical evidence of the influence of late payments and contracting on farm growth in the dairy sector over the period 1994-2003.

Our study indicates that contract breaches, especially late payments, had a negative impact on the farm growth. Directly, late payments put pressure on the farm household budget and worsen farm's credit constraints, cash flow and profitability. In the short run, this limits the access to inputs, which has a negative effect on produced quantity and quality. In the long run, it limits the investment capacity of farmers. Indirectly, farm households that experienced a late payment this year, will also expect a late payment next year and will be reluctant to make asset specific investments, which slows down the restructuring of the sector.

In addition to this, the results suggest that contract innovations, in particular assistance programs that firms receive from dairy companies have a large effect on farm growth. Currently, the number of farm households receiving this type of assistance is relatively low (8% of the farm households), but since the 2000s there has been an increase in the number of farm households receiving support which is expected to continue. The positive impact of assistance programs on farm growth indicates that there are positive spill over effects of investments, which induced contracting and vertical coordination in the Bulgarian dairy industry.

Our findings on the impact of payment problems and assistance programs are relevant beyond the Bulgarian dairy sector at the end of the 1990s and the beginning of the 2000s. First, previous studies have shown that also farmers in the EU and USA have contracts and are credit constrained and thus also for these farmers timely payments and assistance by the processing industry are important. Second, in the Central and Eastern European countries that are currently member states of the European Union, most transitional problems are largely resolved. However, late payments remain important in developing countries and transition countries that are less advanced in the transitional process. Therefore the introduction of timely payments and assistance programs could be expected to have a positive impact on farm performance in these countries.

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Table 1: Share of farms in the survey and in Bulgaria by size classes

Number of cows per farm	Survey 1994			Survey 2003			Bulgaria, total, 2001		
	# farms	Share farms	Share cows	# farms	Share farms	Share cows	# farms	Share farms	Share cows
1	89	37,7	15,2	87	29,2	8,0	149323	70.7	45.0
2	75	31,8	25,7	89	29,9	16,4	42498	20.1	25.6
3-5	56	23,7	35,5	78	26,2	25,9	15552	7,4	16,5
6-9	9	3,8	10,3	25	8,4	15,6	2725	1.3	6.2
>10	7	3.0	13,4	19	6,4	34.0	1071	0.5	6.7
Total	236	100	100	298	100	100	211169	100	100

Source: Authors' calculations based on the dairy household survey sample and NSI (2001) for Bulgaria (total).

Table 2: Farms in the survey with contract-based assistance programs (Number of farms)

Year	1994	1997	2000	2003
Agricultural extension service	3	5	5	6
Veterinary assistance	0	0	0	1
Forward credit for dairy specific investments	1	1	1	2
Forward credit for general agr. investments	1	1	1	1
Forward credit for buying cows	1	2	2	4
Forward credit for buying inputs	1	1	2	4
Milk collection at the farm	5	7	13	22
Bank loan guarantees	1	1	1	1
Forward credit to buy forage, animal medicine, etc.	2	2	3	5

Source: Authors' calculations based on the dairy household survey sample.

Table 3: Description of the variables

Variable name	Description	Mean	Std. dev
Outcome variables			
GROWTH	Difference of natural logarithm of herd size in period t and in period t-1	0.03	0.24
FARMSIZE	Natural logarithm of the herd size in period t (in number of cows)	0.80	0.68
Contract variables			
PAYTIME	Natural logarithm of the time until payment of the farm in t-1(in days)	2.85	0.53
PROGRAM	Number of assistance programs received by the farm in t-1	0.08	0.55
CONTRACT	Dummy for having a oral or written contract in t-1	0.64	0.48
WRCON	Dummy for having a written contract in t-1	0.05	0.21
FDI	Dummy for foreign investorship of the dairy company to which the farm delivers in t-1	0.14	0.35
Household variables			
AGE	Natural logarithm of the age of the household head	4.03	0.23
EDU	Natural logarithm of the number of years of education of the household head	9.58	2.64
HHSIZE	Number of household member	3.46	1.72
COOPMEMB	Dummy for membership by a household member of a cooperative	0.45	0.49
NEWFARM	Dummy for firms that started in the period 1993-2004	0.22	0.42
SOUTH	Dummy for the region of the firm	0.46	0.50
Size variables			
SIZE	Natural logarithm of the herd size in period t-1 (in number of cows)	0.79	0.66
SIZEQ	Squared value of the natural logarithm of the herd size in period t-1 (in number of cows)	1.06	1.54

Source: Authors' calculations based on the dairy household survey sample.

Table 4: Correlation matrix of the independent variables related to the contract

	PAYTIME	PROGRAM	CONTRACT	WRCONTRACT	FDI
PAYTIME	1.000				
PROGRAM	-0.056	1.000			
CONTRACT	0.222	0.111	1.000		
WRCONTRACT	-0.122	0.443	0.170	1.000	
FDI	-0.048	0.111	-0.013	0.222	1.000

Source: Authors' calculations based on the dairy household survey sample.

Table 5: Regression results Pooled OLS model (full sample

	Model A		Model B		Model C	
Dependent variable: GROWTH	**Coefficient**	**t-value**	**Coefficient**	**t-value**	**Coefficient**	**t-value**
Contract variables						
PAYTIME	-0.028	(-2.29)**	-0.027	(-2.27)**	-0.027	(-2.28)**
PROGRAM	0.042	(2.59)***	0.035	(2.16)**	0.035	(2.23)**
CONTRACT	-	-	-0.001	(-0.04)	-0.001	(-0.10)
WRCONTRACT	-	-	0.052	(1.26)	0.058	(1.35)
FDI	-	-	-	-	-0.013	(-0.66)
Size variables						
SIZE	-0.159	(-9.20)***	-0.157	(-8.62)***	-0.155	(-8.42)***
SIZESQ	0.046	(7.61)***	0.044	(6.16)***	0.043	(5.88)***
Household variables	Yes		Yes		Yes	
Time dummies	Yes		Yes		Yes	
Constant	0.263	(1.50)	0.272	(1.54)	0.271	(1.54)
R^2	0.08		0.08		0.08	
Observations	2324		2324		2324	

*significant on 10%, **significant on 5% and *** significant on 1%

Note. Standard errors are clustered.

Source: Authors' calculations based on the dairy household survey sample.

Table 6: Regression results Fixed and Random effects model (full sample)

	Model A		Model B		Model C		Model D	
Dependent variable: FARMSIZE	**Coefficient**	**t-value**	**Coefficient**	**t-value**	**Coefficient**	**t-value**	**Coefficient**	**t-value**
Contract variables								
PAYTIME	-0.029	(-1.73)*	-0.029	(-1.71)*	-0.029	(-1.71)*	-0.034	(-2.67)***
PROGRAM	0.122	(3.52)***	0.123	(3.76)***	0.120	(3.85)***	0.050	(2.45)***
CONTRACT	-	-	0.078	(1.46)-	0.075	(1.38)	0.003	(0.21)
WRCONTRACT	-	-	-0.060	(-1.28)-	-0.043	(-0.87)	0.041	(0.99)
FDI	-	-	-	-	-0.029	(-1.02)	-0.022	(-1.02)
Size variables								
SIZE	0.677	(20.23)***	0.675	(19.94)***	0.679	(19.84)***	0.811	(36.36)***
SIZESQ	0.030	(2.02)**	0.031	(2.03)**	0.029	(1.89)***	0.042	(4.67)***
Household variables	No		No		No		Yes	
Time dummies	Yes		Yes		Yes		Yes	
Constant	0.298	(5.37)***	0.250	(4.03)***	0.251	(4.06)***	0.410	(2.14)**
R^2	0.87		0.86		0.86		0.88	
Observations	2369		2369		2369		2324	
Hausman test							211.61 (0.00)	

*significant on 10%, **significant on 5% and *** significant on 1%

Note. Standard errors are clustered. The Hausman test is reported and the p values of this test is reported in brackets.

Source: Authors' calculations based on the dairy household survey sample.

Table 7: Regression results: SYS-GMM model (full sample)

	Model A		Model B		Model C	
Dependent variable: FARMSIZE	**Coefficient**	**z-value**	**Coefficient**	**z-value**	**Coefficient**	**z-value**
Contract variables						
PAYTIME	-0.035	(-1.62)*	-0.048	(-2.23)**	-0.045	(-2.01)**
PROGRAM	0.190	(4.93)***	0.182	(3.72)***	0.194	(3.38)***
CONTRACT	-	-	0.051	(0.51)	-0.020	(-0.21)
WRCONTRACT	-	-	-0.033	(-0.41)	-0.006	(-0.09)
FDI	-	-	-	-	0.013	(0.22)
Size variables						
SIZE	0.998	(16.59)***	1.022	(17.33)***	1.001	(14.58)***
SIZESQ	-0.041	(-1.68)*	-0.043	(-1.89)*	-0.038	(-1.51)
Household variables	Yes		Yes		Yes	
Time dummies	Yes		Yes		Yes	
Constant	-1.42	(-0.88)	-1.28	(-1.03)	-2.15	(-1.65)*
R^2						
Observations	2324		2324		2324	
Sargan test	39.50 (0.88)		70.07 (0.64)		87.37 (0.56)	
m_1	-9.23 (0.00)		-9.31 (0.00)		-8.998 (0.00)	
m_2	1.03 (0.30)		1.04 (0.30)		0.99 (0.33)	

*significant on 10%, **significant on 5% and *** significant on 1%

Note. The standard errors are robust finite samples corrected on two-step estimates derived from Windmeijer (2000). The Sargan-Hansen test and the serial correlation test are reported as respectively Sargan, m_1 and m_2 and the latter two represent respectively the AR(1) and AR(2) tests under the null of no serial correlation. The p values of these different tests are reported in brackets.

Source: Authors' calculations based on the dairy household survey sample.

Table 8: Regression results: Fixed effects and SYS-GMM model (restricted sample)

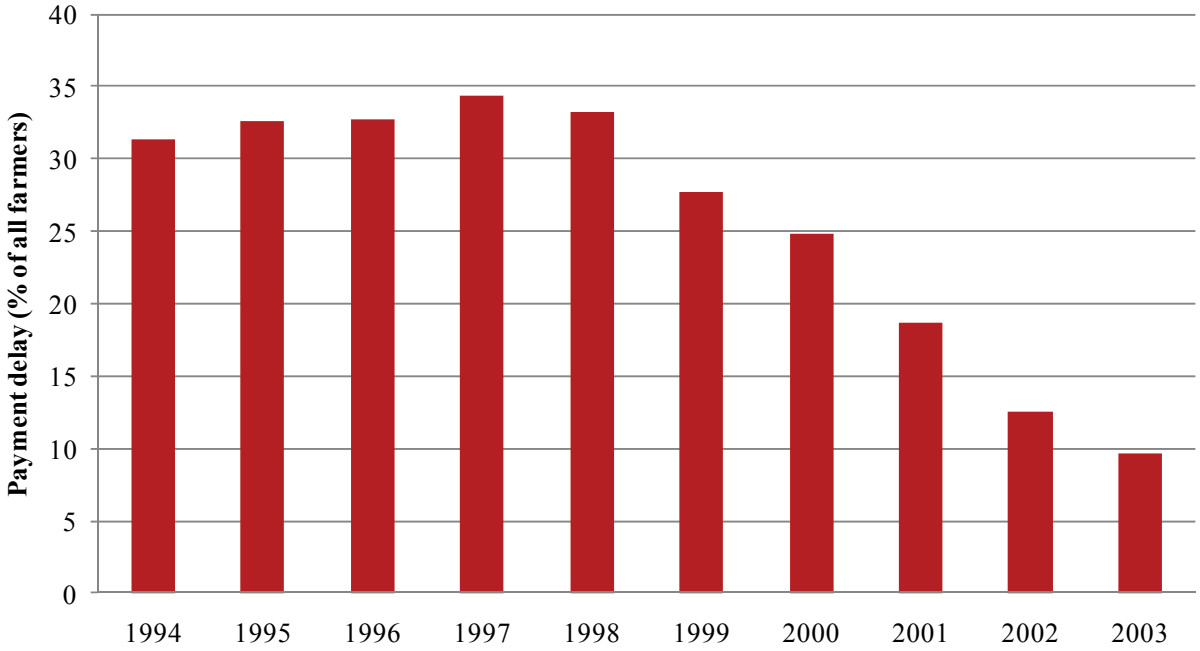
	Fixed effects		Fixed effects		Fixed effects		SYS-GMM		SYS-GMM model		SYS-GMM model	
Dependent variable: FARMSIZE	**Coefficient**	**t-value**	**Coefficient**	**t-value**	**Coefficient**	**z-value**	**Coefficient**	**z-value**	**Coefficient**	**z-value**	**Coefficient**	**z-value**
Contract variables												
PAYTIME	-0.050	(-2.65)***	-0.049	(-2.57)**	-0.050	(-2.60)***	-0.051	(-2.29)**	-0.049	(-2.08)**	-0.040	(-1.65)*
PROGRAM	0.146	(4.27)***	0.148	(4.26)***	0.143	(4.29)***	0.264	(2.94)***	0.253	(3.39)***	0.268	(3.88)***
CONTRACT			0.046	(0.71)	0.043	(0.65)	-	-	0.035	(0.88)	0.026	(0.24)
WRCONTRAC			-0.068	(0.22)	-0.045	(-0.80)	-	-	-0.039	(-0.98)	-0.033	(-0.66)
F̄DI											-0.002	(-0.06)
Size variables												
SIZE	0.413	(8.16)***	0.410	(8.08)***	0.414	(8.14)***	0.99	(16.71)***	1.01	(15.35)***	1.01	(13.55)***
SIZESQ	0.056	(3.04)***	0.057	(3.09)***	0.054	(0.054)***	-0.018	(-0.67)	-0.021	(-0.77)	-0.020	(-0.68)
Household variables	No		No		No		Yes		Yes		No	
Time dummies	Yes		Yes		Yes		Yes		Yes		Yes	
Constant	0.540	(9.57)***	0.516	(8.17)***	0.530	(8.27)***	0.212	(3.30)***				
R^2	0.84		0.84		0.84		-		-		-	
Observations	1405		1405		1405		1405		1405		1405	
Sargan test	-						32.60 (0.68)		50.58 (0.57)		62.40 (0.46)	
m_1	-						-8.23 (0.00)		-8.09 (0.00)		-7.91 (0.00)	
m_2	-		-				-0.20 (0.84)		-0.17 (0.86)		-0.18 (0.85)	

*significant on 10%, **significant on 5% and *** significant on 1%

Note. The standard errors are robust finite samples corrected on two-step estimates derived from Windmeijer (2000). The Sargan-Hansen test and the serial correlation test are reported as respectively Sargan, m_1 and m_2 and the latter two represent respectively the AR(1) and AR(2) tests under the null of no serial correlation. The p values of these different tests are reported in brackets.

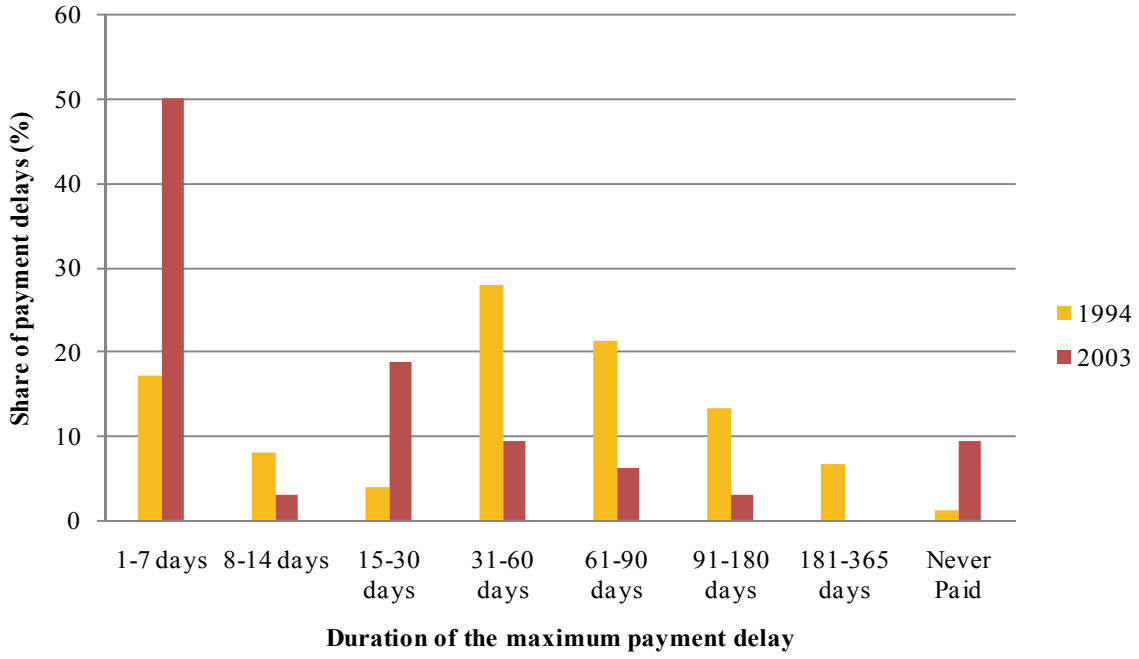
Source: Authors' calculations based on the dairy household survey sample.

Figure 1: Evolution of the number of farms that experience payment delays, 1994-2003*



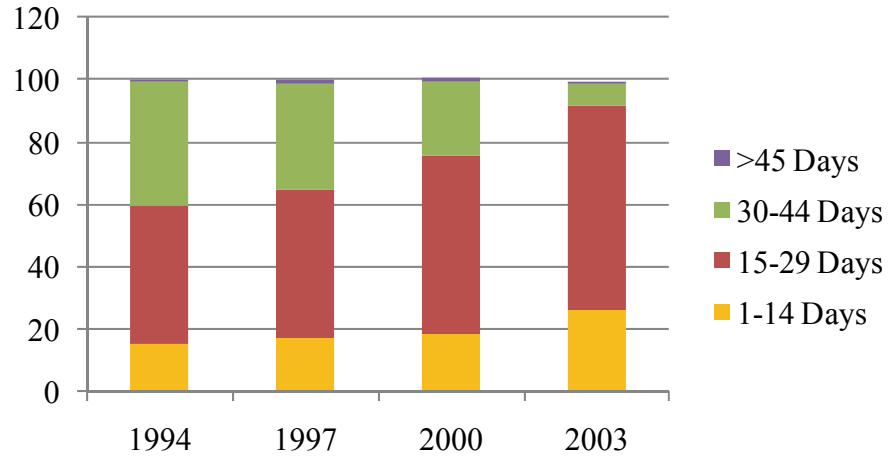
* Farmers that are never paid are excluded from the estimation
Source: Authors' calculations based on the dairy household survey sample.

Figure 2: Share of payment delays by the duration of the maximum delay



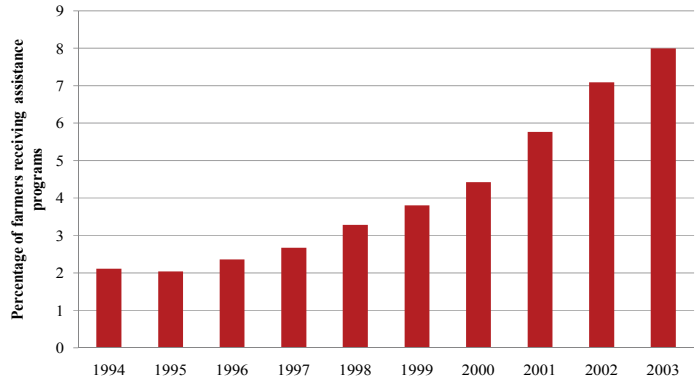
Source: Authors' calculations based on the dairy household survey sample.

Figure 3: Average length of the payment time (% of all farmers), 1994-2003



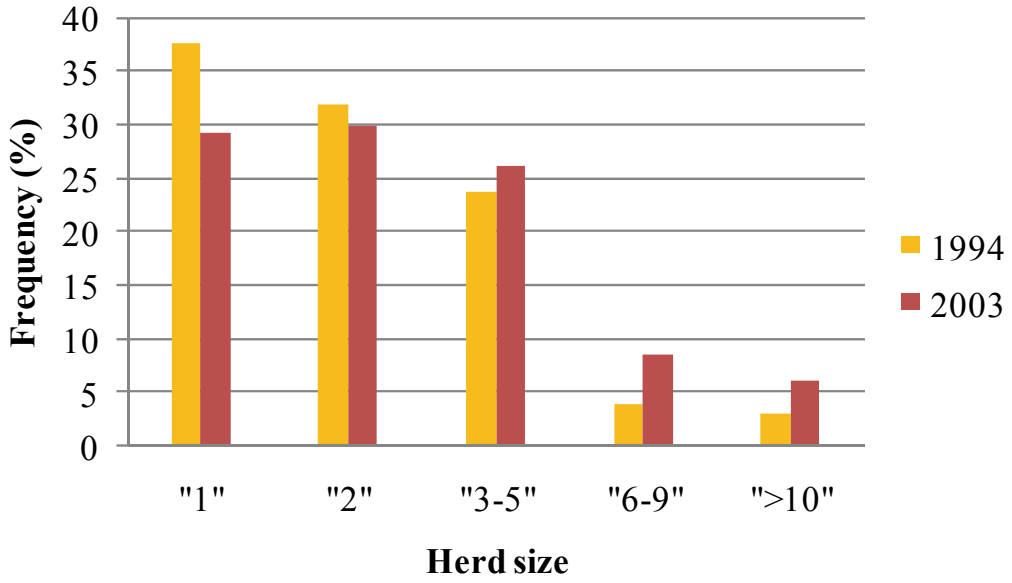
Source: Authors' calculations based on the dairy household survey sample.

Figure 4: Evolution of assistance programs, 1994-2003*



* Percentage of farmers in the survey that receive at least one assistance programs from the dairy. The possible programs are agricultural extension services, veterinary credit, forward credit for dairy specific investments, forward credit for general agricultural investments, forward credit for buying cows, forward credit for buying inputs, milk collection at the farm, bank loan guarantees and forward credit to buy forage, fuel, medicine for the animals, etc.
Source: Authors' calculations based on the dairy household survey sample.

Figure 5: Size distribution of the dairy farms, 1994-2003



Source: Authors' calculations based on the dairy household survey sample.