Contracts, Late Payments and Growth: Evidence from Bulgarian Agriculture

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(joint work with Johan F.M. Swinnen)

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Outline

- Research question
- Motivation
- Data
- Descriptive statistics
- Model specification & Results
- Conclusion
Research Question

What is the impact of institutions and exchange in economic growth?

More specifically, how is economic growth in the Bulgarian dairy sector influenced by

1. contract break-downs (late payments) and
2. contractual innovations (farm assistance programs)?
Motivation

- Natural experiment: TRANSITION experience
  - Privatization (break up of supply chains)
  - Poor legal institutions & inadequate contract legislation
  - Price and trade liberalization
  - Macroeconomic instability

  \[\Rightarrow\] Contract enforcement problems (e.g. late payments) (1)

  \[\downarrow\] Credit constrained farmers

  \[\downarrow\] Quantity and Quality of the production

  \[\downarrow\] Emergence of innovative contract mechanisms
  (e.g. farm assistance programs) (2)
Why the Bulgarian dairy sector?

• Importance of agriculture in Bulgaria
  • 17% of population employed in agriculture

• Importance of dairy in rural areas
  • 30% of all farms are dairy farms

• Interaction with the accession process
  • Changes in legislation and production practices to fulfill EU requirements

• Need for restructuring
  • Large decline in production, number of cows and productivity after transition
  • Mainly very small scale households producing dairy
Data

• Two data sources
  – In depth interviews with 11 dairy processing companies
  – Survey of 305 of their potential suppliers, mainly farm households
Dairy processor survey

- **Region:**
  - Central region
  - Sofia
  - North Eastern region

<table>
<thead>
<tr>
<th>Data</th>
<th>Danone</th>
<th>Serdika90</th>
<th>Mlekimex</th>
<th>Fama</th>
<th>Iotovi</th>
<th>Markelli</th>
<th>Meggle</th>
<th>Merone</th>
<th>PRL</th>
<th>Mandra</th>
<th>Milky World</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processed milk (mio ltr./year)</td>
<td>36</td>
<td>24</td>
<td>20</td>
<td>19</td>
<td>11</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Newly Established</td>
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<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
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<td>No</td>
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</tr>
<tr>
<td>FDI</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
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</tr>
<tr>
<td>If yes, since when</td>
<td>1993</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2000</td>
<td>-</td>
<td>-</td>
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<tr>
<td>If yes, home country</td>
<td>France</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Germany</td>
<td>-</td>
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</tbody>
</table>

Data
Household Survey
Household Survey

- **Sample:**
  - **2 regions:** NCR and SCR with 44% of dairy suppliers and 49% of dairy cows in Bulgaria
  - **6 counties:** Pleven, Veliko Tarnovo, Gabrovo, Plovdiv, Haskovo, Stara Zagora
  - **22 villages** (random selected)
  - **305 households** that had at least some commercial dairy activities in the period 1994-2003

- **Data:**
  - Information on the demographics, non-farm activities, contract behaviour, milk quality and investments over the period 1994-2003
  - Yearly information on the evolution of the payment conditions, the type of contract, the farmers’ negotiation power and dairy processing company to whom they deliver
## Household Survey

<table>
<thead>
<tr>
<th>Number of cows per farm</th>
<th>Survey 1994</th>
<th></th>
<th></th>
<th></th>
<th>Survey 2003</th>
<th></th>
<th></th>
<th></th>
<th>Bulgaria, total, 2001</th>
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<tbody>
<tr>
<td></td>
<td># farms</td>
<td>Share farms</td>
<td>Share</td>
<td># farms</td>
<td>Share farms</td>
<td>Share</td>
<td># farms</td>
<td>Share farms</td>
<td>Share cows</td>
<td># farms</td>
<td>Share farms</td>
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<td>1</td>
<td>89</td>
<td>37.7</td>
<td>15.2</td>
<td>87</td>
<td>29.2</td>
<td>8.1</td>
<td>149323</td>
<td>70.7</td>
<td>45.0</td>
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<td>2</td>
<td>75</td>
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<td>25.7</td>
<td>89</td>
<td>30.0</td>
<td>16.5</td>
<td>42498</td>
<td>20.1</td>
<td>25.6</td>
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<tr>
<td>3-5</td>
<td>56</td>
<td>23.7</td>
<td>35.5</td>
<td>77</td>
<td>25.9</td>
<td>25.7</td>
<td>15552</td>
<td>7.4</td>
<td>16.5</td>
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<td>6-9</td>
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<td>3.8</td>
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<td>25</td>
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<td>2725</td>
<td>1.3</td>
<td>6.2</td>
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<tr>
<td>≥10</td>
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<td>3.0</td>
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<td>34.1</td>
<td>1071</td>
<td>0.5</td>
<td>6.7</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>236</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>297</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>211169</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
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Data
Late payments

1. Have you experienced a payment delay or non-payment in this year?
Late payments

2. On average, how long did it take until you received your payment?
# Farm assistance programs

<table>
<thead>
<tr>
<th>Processed milk (mio ltr./year)</th>
<th>Danone</th>
<th>Serdika90</th>
<th>Mlekimex</th>
<th>Fama</th>
<th>Iotovi</th>
<th>Markelli</th>
<th>Meggle</th>
<th>Merone</th>
<th>PRL</th>
<th>Obnova</th>
<th>Milky World</th>
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<tbody>
<tr>
<td>36</td>
<td>24</td>
<td>20</td>
<td>19</td>
<td>11</td>
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<td>6</td>
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<table>
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<tr>
<th>Newly Established</th>
<th>No</th>
<th>No</th>
<th>No</th>
<th>Yes</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>Yes</th>
<th>No</th>
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<tr>
<td>FDI</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
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<td>No</td>
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</table>

<table>
<thead>
<tr>
<th>Does the company offers the following program and since when?</th>
<th>Danone</th>
<th>Serdika90</th>
<th>Mlekimex</th>
<th>Fama</th>
<th>Iotovi</th>
<th>Markelli</th>
<th>Meggle</th>
<th>Merone</th>
<th>PRL</th>
<th>Obnova</th>
<th>Milky World</th>
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</thead>
<tbody>
<tr>
<td>Veterinary service</td>
<td>Yes (1995)</td>
<td>No</td>
<td>Yes (1997)</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
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</table>
Farm assistance programs

- Number of farms receiving farm assistance programs:

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</thead>
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<tr>
<td>Agricultural extension service</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Veterinary assistance</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Forward credit for dairy specific investments</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Forward credit for general agr. investments</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Forward credit for buying cows</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Forward credit for buying inputs</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Milk collection at the farm</td>
<td>5</td>
<td>7</td>
<td>13</td>
<td>22</td>
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<tr>
<td>Bank loan guarantees</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Forward credit to buy forage, animal medicine, etc.</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>5</td>
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</tbody>
</table>
Farm growth

• Survival of farms:
  • 75% of all farm households started their dairy activities before 1994 and are still active in 2003
  • 22% of all farm households started their dairy activities after 1994 and are still active in 2003
  • 3% of all farm households stopped their dairy activities in the period 1994-2003 (mainly because non-economic reasons)
Farm growth

- Size distribution:
Model specification

• **Firm growth relationship** (Nelson and Winter 1982; Evans 1987; Weiss 1999; Dries and Swinnen 2004):

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

• \( S_{i,t} = \) Size of farm \( i \) in number of cows in year \( t \)
• \( S_{i,t-1} = \) Size of farm \( i \) in number of cows in year \( t-1 \)
• \( X_{i,t-1} = \) vector of contract characteristics in year \( t-1 \)
  (including late payments and assistance programs)
• \( e_{i,t-1} = \) Error term
Model specification

• After taking logarithms:

\[
\ln(S_{i,t}) - \ln(S_{i,t-1}) = a_0 + a_1 \text{DELAY}_{i,t-1} + a_2 \text{PROGRAM}_{i,t-1} + a_3 \ln(S_{i,t-1}) + \sum_{j=1}^{k} b_j X_{i,b,t-1} + \varepsilon_{i,t}
\]

• \(S_{i,t}\) and \(S_{i,t-1}\) = defined as on the previous slide
• \(\text{DELAY}_{i,t-1}\) = impact of late payments in \(t-1\)
• \(\text{PROGRAM}_{i,t-1}\) = impact of farm assistance programs received in \(t-1\)
• \(X_{i,b,t-1}\) = vector of contract characteristics in year \(t-1\) (excluding late payments and assistance programs)
• \(\varepsilon_{i,t-1}\) = Error term
<table>
<thead>
<tr>
<th>Variable name</th>
<th>Description</th>
<th>Mean</th>
<th>Std. dev</th>
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</thead>
<tbody>
<tr>
<td><strong>Outcome variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GROWTH</td>
<td>Difference of natural logarithm of herd size in period t and in period t-1</td>
<td>0.03</td>
<td>0.24</td>
</tr>
<tr>
<td>FARMSIZE</td>
<td>Natural logarithm of the herd size in period t</td>
<td>0.80</td>
<td>0.68</td>
</tr>
<tr>
<td><strong>Contract variables</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>DELAY</td>
<td>Dummy for experiencing a late payment in t-1</td>
<td>0.27</td>
<td>0.44</td>
</tr>
<tr>
<td>PAYTIME</td>
<td>Natural logarithm of the time until payment of the farm in t-1 (in days +1)</td>
<td>2.85</td>
<td>0.53</td>
</tr>
<tr>
<td>PROGRAM</td>
<td>Number of assistance programs received by the farm in t-1</td>
<td>0.08</td>
<td>0.55</td>
</tr>
<tr>
<td>CONTRACT</td>
<td>Dummy for having a oral or written contract in t-1</td>
<td>0.64</td>
<td>0.48</td>
</tr>
<tr>
<td>WRCONTRACT</td>
<td>Dummy for having a written contract in t-1</td>
<td>0.05</td>
<td>0.21</td>
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<tr>
<td>FDI</td>
<td>Dummy for foreign ownership of the dairy company to which the farm delivers in t-1</td>
<td>0.14</td>
<td>0.35</td>
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<td><strong>Household variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(time invariant)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>AGE</td>
<td>Natural logarithm of the age (in number of years) of the household head</td>
<td>4.03</td>
<td>0.23</td>
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<tr>
<td>EDU</td>
<td>Natural logarithm of the education (in number of years) of the household head</td>
<td>9.58</td>
<td>2.64</td>
</tr>
<tr>
<td>HHSIZE</td>
<td>Number of household members</td>
<td>3.46</td>
<td>1.72</td>
</tr>
<tr>
<td>COOPMEMB</td>
<td>Dummy for membership by a household member of a cooperative</td>
<td>0.45</td>
<td>0.49</td>
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<td>NEWFARM</td>
<td>Dummy for farms that started in the period 1994-2003</td>
<td>0.22</td>
<td>0.42</td>
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<tr>
<td>SOUTH</td>
<td>Dummy for the region of the farm</td>
<td>0.46</td>
<td>0.50</td>
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<td><strong>Lagged Size variable</strong></td>
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<tr>
<td>SIZE</td>
<td>Natural logarithm of the herd size in period t-1</td>
<td>0.79</td>
<td>0.66</td>
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</tbody>
</table>

Model specification & Results
Pooled OLS

\[
\ln(S_{i,t}) - \ln(S_{i,t-1}) = a_0 + a_1 \text{DELAY}_{i,t-1} + a_2 \text{PROGRAM}_{i,t-1} + a_3 \ln(S_{i,t-1}) + \\
\sum_{j=1}^{k} b_j X_{i,b,t-1} + \sum_{j=1}^{l} c_j Y_{i,c} + \delta_t + \varepsilon_{i,t}
\]

- \(S_{i,t}, S_{i,t-1}, \text{DELAY}_{i,t-1}, \text{PROGRAM}_{i,t-1}, X_{i,b,t-1}\) = like already defined
- \(Y_{i,c}\) = vector with household variables
- \(\delta_t\) = time dummies
- \(\varepsilon_{i,t-1}\) = Error term
Problems with Pooled OLS

- Unobserved heterogeneity: Presence of non-observed farm household specific effects that are correlated with the variables of interest or the control variables $\Rightarrow$ Biased estimates

For example: it is 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
Fixed effects

• Include household fixed effects $\mu_i$ to control for unobserved heterogeneity and rewrite the model:

$$
\ln(S_{i,t}) = \mu_i + a_1 \text{DELAY}_{i,t-1} + a_2 \text{PROGRAM}_{i,t-1} + (a_3 + I) \ln(S_{i,t-1}) + \sum_{j=1}^{k} b_j X_{i,b,t-1} + \delta_t + \varepsilon_{i,t}
$$
Problems with Fixed effects

- In the within estimation the regressor \( \left( \ln(S_{i,t-1}) - \bar{\ln}(S_{i,\cdot}) \right) \) is correlated with the error \( \left( \epsilon_{i,t} - \bar{\epsilon}_{i,\cdot} \right) \), because \( \ln(S_{i,t-1}) \) is correlated with \( \epsilon_{i,t-1} \) and hence with \( \epsilon_{i,\cdot} \)

\( \implies \) Bias in the fixed effects dynamic specification
System GMM

- Method used by Blundell and Bond (1998):
  Estimates a system of equations:
  - First differenced equation where they use lagged levels of the explanatory and the dependent variable as instruments (cfr. Arrellano-Bond GMM)
  - Equation in levels where they use lagged first-differences of the explanatory and the dependent variables as instruments
## Overview

### Model specification & Results

<table>
<thead>
<tr>
<th>Dependent variable: FARMSIZE</th>
<th>OLS model</th>
<th>Fixed effects</th>
<th>SYS GMM</th>
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<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>t-value</td>
<td>Coefficient</td>
</tr>
<tr>
<td>Contract variables</td>
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<td></td>
<td></td>
</tr>
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<td>DELAY</td>
<td>-0.042</td>
<td>(-3.23)***</td>
<td>-0.076</td>
</tr>
<tr>
<td>PROGRAM</td>
<td>0.038</td>
<td>(2.19)**</td>
<td>0.094</td>
</tr>
<tr>
<td>CONTRACT</td>
<td>0.004</td>
<td>(0.35)</td>
<td>0.099</td>
</tr>
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<td>WRCONTRACT</td>
<td>0.087</td>
<td>(1.67)*</td>
<td>-0.046</td>
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<td>FDI</td>
<td>-0.033</td>
<td>(-1.68)*</td>
<td>-0.045</td>
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<td>SIZE</td>
<td>0.935</td>
<td>(95.18)***</td>
<td>0.731</td>
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<td>Time dummies</td>
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<tr>
<td>Constant</td>
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<td>(0.85)</td>
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<tr>
<td>m₁</td>
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<tr>
<td>m₂</td>
<td>-</td>
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</table>
Robustness tests

• Estimation with a different measure for late payments, namely PAYTIME (=average time until payment)
  ➞ Robust estimations

• Recall bias due to inaccurate reporting
  ➞ Restricted sample (last 5 years)
  ➞ Robust estimations
Robustness tests
(variable PAYTIME)

<table>
<thead>
<tr>
<th>Contract variables</th>
<th>OLS model</th>
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<th>SYS GMM</th>
</tr>
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<tbody>
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<td></td>
<td>Coefficient</td>
<td>t-value</td>
<td>Coefficient</td>
</tr>
<tr>
<td>PAYTIME</td>
<td>-0.028</td>
<td>(-2.46)**</td>
<td>-0.027</td>
</tr>
<tr>
<td>PROGRAM</td>
<td>0.041</td>
<td>(2.38)**</td>
<td>0.124</td>
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<tr>
<td>CONTRACT</td>
<td>0.003</td>
<td>(0.20)</td>
<td>0.069</td>
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<td>WRCONTRACT</td>
<td>0.083</td>
<td>(1.58)</td>
<td>-0.033</td>
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<td>-0.023</td>
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<td>SIZE</td>
<td>0.933</td>
<td>(91.29)***</td>
<td>0.733</td>
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Model specification & Results
Robustness tests  
(restricted sample)

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Model specification & Results
Conclusion

• Late payments:
  – Negative effect on farm growth

• Farm assistance programmes:
  – Positive effect on farm growth

• Findings relevant beyond the dairy industry in Bulgaria:
  – Most developing countries and less economic advanced transition countries: still disruptions in the supply chain and contracting problems + ineffective contract enforcement
Thank you for your attention

Questions?
## Robustness tests
### (OLS model)

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Model specification & Results
## Robustness tests
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Model specification & Results
### Robustness tests
*(SYS GMM model)*

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Model specification & Results
Late payments

2. If you experienced a payment delay, what was the longest payment delay in that year?
Dairy supply chain

Individual farmer → Milk collection point → Dairy processing company → Motivation
“Virtually every commercial transaction has within itself an element of trust, certainly any transaction conducted over a period of time. It can plausibly be argued that much of the economic backwardness in the world can be explained by a lack of mutual confidence”

Arrow (1974)
Late payments

• Contract enforcement
  • Legal contract enforcement (court action)
  • Private contract enforcement (reputation loss)

• Transition period:
  • Poor working legal institutions & inadequate contract legislation
  • Recent privatization → No reputation building yet & Creation of geographical monopolies and monopsonies

  ↔ Ineffective contract enforcement

  ↔ Emergence of “Hold-ups”
    (e.g. late payments by processing firms)
Late payments

• Impact of late payments on firm growth (Cungu et al. 2008):
  • Directly: it puts the firms’ working capital under pressure, worsen the firms’ credit constraints, cash flow and profitability (especially in comb. with high inflation)
    ➔ Short run: less input use
    ➔ Long run: less investment capacity
  • Indirectly: firms that experienced a late payment will expect a late payment or non payment in the next year and adapt their behavior
    ➔ Slows down firm growth
Late payments

• Large literature on the occurrence of late payments in developing and transition countries:
  • In the manufacturing sector: Bigsten et al. 2000; Fafchamps 2004; Van Biesenbroeck 2005; Johnson et al. 1999
  • In the agricultural sector: Fafchamps and Minten 2001; Gorton et al. 2000; Cungu et al. 2008

• Mostly ad hoc evidence and only little empirical evidence:
  • Cungu et al. 2008: They find that late payments have a significant negative effect on investments when farms consider late payments to be “important”
Farm assistance programs

• Introduced by foreign investors to improve quantity and quality of the production

• Examples are credit provision, input supply, milk collection on farm and investment support

• Enforcement typically by deductions from the payment to the farmer at the time of delivery ("interlinked contracts")
Farm assistance programs

• Horizontal & vertical spillover effects:
  (Dries and Swinnen 2004)
  • Horizontal spillover effects because domestic companies rapidly after the introduction of these programs started to copy the programs
  • Vertical spillover effects because improved access to finance & information for all farmers
    \[\Rightarrow\] Positive impact on productivity & quality
  (Gow and Swinnen 2000; White and Gorton 2004; Leat and Van Berkum 2003; Dries and Swinnen 2004, 2009)