Effects of imports on technical efficiency in Russian food industry

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June 16, 2016

Plan

1. Introduction
2. Goals
3. Literature
4. Data
5. SFA models used in research
6. Return to scale
7. Summary

Introduction

- Different mechanisms of impact of import share (hereinafter imports) in food industry to the technical efficiency of Russian firms
  1. The growth of imports in industry leads to decrease in the technical efficiency of firms due to the competition increasing
  2. The growth of imports in industry leads to increase in the technical efficiency of some firms, which rebuilt their production

Statement of the problem & Hypothesis

- Hypothesis:
  1. technical efficiency of firms is **decreasing** with increasing of imports
  2. technical efficiency of firms is **increasing** with increasing of imports
- SFA models used in research
- Return to scale

Literature

Articles (Miljkovic, Shaik, 2010; Miljkovic et al., 2013) are about influence of imports and exports in agriculture of USA to the technical efficiency

$$y_t = \alpha_t + \beta_1^t x_t + v_t - u_t \tag{1}$$

$$u_t = \alpha_2 + \beta_{2,1} Exports_t + \beta_{2,2} Imports_t + \epsilon_t \tag{2}$$

x_t — productivity factors, $Exports_t$, $Imports_t$ — export share and import share respectively

Data

1. Final sample — 2925 firms in Russian food industry, 2005–2011
2. Database — VanDijk: Ruslana.
3. Variables: turnover (ln tr), fixed assets (ln k), labour (ln l)

Model (Miljkovic, Shaik, 2010)

Model specification (Miljkovic, Shaik, 2010):

$$\ln tr_{it} = \alpha_1 + \beta_1 \ln k_{it} + \beta_2 \ln l_{it} + \\ + \beta_3 \ln k_{it} \ln l_{it} + \beta_4 (\ln k_{it})^2 + \beta_5 (\ln l_{it})^2 + v_{it} - u_{it}. \quad (3)$$

$$u_{it} = \alpha_2 + \beta_6 Import_{it} + \epsilon_{it} \quad (4)$$

$u_{it} \overset{\text{iid}}{\sim} N^+(\mu, \sigma_u^2)$, $v_{it} \overset{\text{iid}}{\sim} N(0, \sigma_v^2)$, $\epsilon \overset{\text{iid}}{\sim} N(0, \sigma_\epsilon^2)$, u, v independently distributed.

In models, where u_{it} distributed by halfnormal or exponential distribution and heteroscedasticity is expected, σ_u and σ_v replaced by $\sigma^2 = \exp(w_i \delta)$.

where w_i — heteroscedasticity factors.

Model (Miljkovic, Shaik, 2010)

Models to estimate:

- Without heteroscedasticity:
  - Model 1: using import in food industry, which is divided by subindustries (ln *import_gdp*)
  - Model 2: using average import in food industry (ln *import_avg_gdp*)
- With heteroscedasticity:
  - Model 3: using import in food industry, which is divided by subindustries as a heteroscedasticity factor (ln *import_gdp*)
  - Model 4: using average import in food industry as a heteroscedasticity factor (ln *import_avg_gdp*)

Estimation results of the model (Miljkovic, Shaik, 2010)

In 3rd and 4th models coefficients near $\ln \sigma_u^2$ evidence for presence of heteroscedasticity: increasing in imports lead increasing in inefficiency.

Variable	Model 1	Model 2	Model 3	Model 4
lnk	–0,177***	–0,177***	–0,279***	–0,179***
	(0,024)	(0,024)	(0,046)	(0,024)
lnl	1,694***	1,694***	1,917***	1,698***
	(0,047)	(0,047)	(0,086)	(0,047)
lnk×lnl	–0,071***	–0,071***	–0,088***	–0,070***
	(0,005)	(0,005)	(0,009)	(0,005)
$(\ln k)^2$	0,107***	0,107***	0,125***	0,107***
	(0,003)	(0,003)	(0,006)	(0,003)
$(\ln l)^2$	–0,037***	–0,037***	–0,033*	–0,038***
	(0,010)	(0,010)	(0,018)	(0,010)
lnimport_gpd	0,011*	–	–	–
	(0,006)			
lnimport_avg_gpd	–	0,181***	–	–
		(0,024)		
$\ln \sigma_u^2(\ln import_avg_gdp)$	–	–	–	0,413***
				(0,052)
$\ln \sigma_u^2(\ln import_gdp)$	–	–	0,025*	
			(0,011)	
σ_v^2	–1,152	–1,152	0,550	0,563
	(0,024)	(0,024)	(0,011)	(0,007)
σ_u^2	0,584	0,584	–	–
	(0,018)	(0,018)		
σ^2	2,110	2,110	–	–
	(0,029)	(0,029)		
λ	2,382	2,382	–	–
	(0,017)	(0,017)		

Table 1: Model estimation

Footnotes. *, **, *** represents significance in 10, 5 and 1% level. In brackets - standard deviation.

Models True RE, True FE, TI, TVD

Model True fixed effect:

$$\ln tr_{it} = \alpha_i + f(\ln k_{it}, \ln l_{it}, \ln k_{it} \ln l_{it}, (\ln k_{it})^2, (\ln l_{it})^2; \beta) + \\ + v_{it} - u_{it} \tag{5}$$

Model True random effect:

$$\ln tr_{it} = \alpha_i + f(\ln k_{it}, \ln l_{it}, \ln k_{it} \ln l_{it}, (\ln k_{it})^2, (\ln l_{it})^2; \beta) + \\ + w_{it} + v_{it} - u_{it} \tag{6}$$

$w_{it} \sim$ — random individual firm-specific effect
Models TI & TVD:

$$\ln tr_{it} = \beta_0 + f(\ln k_{it}, \ln l_{it}, \ln k_{it} \ln l_{it}, (\ln k_{it})^2, (\ln l_{it})^2; \beta) + \\ + v_{it} - u_{it}, \tag{7}$$

where in TI model (unlike TVD) inefficiency (u) doesn't depend on time t.

Estimation of models True RE & True FE

Similar, coefficients near $\ln \sigma_u^2$ evidence for presence of heteroscedasticity: increasing in imports lead increasing in inefficiency.

Variable	True RE	True FE
lnk	0.034	0.005
	(0.029)	(0.032)
lnl	0.180***	0.288***
	(0.050)	(0.056)
lnk×lnl	0.033***	0.050***
	(0.005)	(0.006)
$(\ln k)^2$	–0.005	–0.022**
	(0.004)	(0.004)
$(\ln l)^2$	0.022*	–0.045***
	(0.010)	(0.011)
$\ln \sigma_u^2 (\ln import_avg_gdp)$	1.140***	1.114***
	(0.096)	(0.101)
σ_v^2	0.381	0.384
σ_u^2	0.788	1.115
σ^2	0.572	0.791

Table 2: Model estimation

Return to scale

$$\ln tr_i = \alpha_{11} + \beta_{11} \ln k_i + \beta_{21} \ln l_i + v_i - u_i \quad (8)$$

$$RTS = \beta_{11} + \beta_{21} \quad (9)$$

Model	2005	2006	2007	2008	2009	2010	2011
				Cross-sectional data			
Model (Miljkovic, Shaik, 2010)	1.044	1.069	1.067	1.105	1.124	1.149	1.161
Model (Miljkovic, Shaik, 2010) with heteroskedasticity, factor – lnimport_gdp	1.095	1.117	1.104	1.132	1.143	1.183	1.194
				Panel data			
True-random	0.841	0.841	0.841	0.841	0.841	0.841	0.841
True-fixed	0.581	0.581	0.581	0.581	0.581	0.581	0.581
Time-variant	1.096	1.096	1.096	1.096	1.096	1.096	1.096
Time-invariant	0.818	0.818	0.818	0.818	0.818	0.818	0.818

Table 3: Return to scale in different models

Summary

- Model estimation (Miljkovic, Shaik, 2010) supports for hypothesis — inefficiency increasing with increasing in imports
- Return to scale may account for increasing in market concentration and increasing competition inside industry