



NÁRODNÁ BANKA SLOVENSKA  
EUROSYSTEM

# Firm Competitiveness Determinants: Results of a Panel Data Analysis (very preliminary results)

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# Motivation/Starting Points

- Several studies indicate that leading Slovak companies are competitive (highly profitable), but we do not know much about why it is so
- Very limited number of quantitative studies on competitiveness factors of Slovak companies (almost solely as a part of cross-country studies)
- Available literature concentrates mainly on the influence of macro factors (cross-country differences) and not on (qualitative) company factors
- Availability of questionnaire survey results (with some potential & so far limited use) and individual yearly data
- No consensus on a common competitiveness measure (almost every study uses different dependent variable)
- Relatively large number of possible dependent and explanatory variables

=> We know it should be a dynamic process based on productivity, profitability, export performance and market share



# Model Specification

- Linear dynamic panel model with individual effects

$$y_{it} = \gamma y_{i,t-1} + x'_{it}\beta_1 + z'_i\beta_2 + \alpha_i + \varepsilon_{it}$$

Available performance/  
competitiveness  
variables  
(profitability, productivity  
export and market share  
data)

Basic quantitative  
variables  
(profit/loss, balance  
sheet, production and  
export data)

Basic and survey  
based qualitative  
(dummy) variables  
(sector, management,  
foreign influence + other  
company and  
environment data)

\* Dependent, lagged dependent and quantitative explanatory variables expressed in logs



# Data

- Financial data on the 90 top Slovak companies (that participated in our survey) from Trend Top 200 Database for years 1993 -2009 (with high number of observations for 2001 - 2009)
  - + basic qualitative company data from the same database
- Additional qualitative data from the Slovak Business Register
- Results (mainly qualitative data) from our aforementioned questionnaire survey
- Some data (total export, value added and turnover) about non-financial companies from the Statistical Office of the SR



# Dependent Variables

- **labour productivity (labprod)** = company gross revenue / number of employees
- **return on assets (roa)** = company gross profit / total company assets
- **export performance (exp)** = value of company export
- **market share (m\_share)** = company revenue / total revenue of non-financial companies in SK
- other variables: return on equity (roe), profit margin (ror), productivity based on value added (va\_emp), capital productivity (capital\_emp), export share (exp\_share), total revenue (rev), amortisation adjusted value added (va\_emp\_n) + roe, ror, roa based on after tax profit  
-> not significant lagged dependent variable



# Explanatory Variables - Quantitative

- Value added (va)
- Revenue (rev)
- Value of export (exp)
- Investments (inv)
- Long-term assets (capital)
- Fixed assets (assets\_f)
- Amortisation (amort)
- No. of employees (emp)
- Personal costs (cost\_prs)
- Loans (loan)
- Company age (est\_m)
- Export from SK (exp\_sk)
- GDP in SK (gdp\_sk)

Source: Trend

SO SR

+ derived variables:

- Market share (m\_share)
- Labour costs (ulc)
- Leverage (lever)
- Investment productivity (invprod)
- Capital intensity (capital\_int)
- Investment intensity (inv\_prf)
- Export performance (exp\_prf)
- Export share (exp\_share)

+ all dependent variables



# Explanatory Variables - Qualitative

## Basic company factors:

- ❖ Industry dummy (industry)
- ❖ Network industry (network)
- ❖ Accounting year (acc\_year)
- ❖ Foreign capital (fc09)

Source: Trend

- ❖ Name change (name\_ch)
- ❖ Foreign manager (boss\_f)
- ❖ Manager with domestic education (boss\_ing)

Business Register

## + Top15 Competitiveness factors:

- ❖ Efficiency of company leadership (upf01)
- ❖ Concentration on cost reduction (upf07)
- ❖ Professionalism of management (upf02)
- ❖ Quality of company management (upf05)
- ❖ Extent of utilization of comm. technology (upf20)
- ❖ Existence of developed supply industries (uof04)
- ❖ Buyer sophistication (uof05)
- ❖ Nature of competitive advantage (uof09)
- ❖ Availability of experienced managers (uof15)
- ❖ Availability of adeq. educated labor force (uof16)
- ❖ Exchange rate stability (umf06)
- ❖ Energy costs (umf22)
- ❖ EU membership (umf10)
- ❖ Perspective of euro adoption (umf11)
- ❖ Quality of transport infrastructure (umf21)

Source: Lalinský (2008)





# Methodology

- OLS, FE and RE are biased because lagged dependent variable is correlated with error term  
=> we need IV/GMM estimator (xtabond2)
- 1) Identification of key models with lagged dependent variable and quantitative explanatory variables  
(1 for profitability, 1 for productivity, 1 for export performance and 1 for market share)
- 2) Extended regressions including all 15 competitiveness factors (top 5 company, sectoral and macro factors) – very limited results
- 3) Gradual extension of the 4 key models including both basic company and competitiveness factors

# Main Results

## A) Profitability

➤ Return on assets as a function of lagged dependent variable and company market share

➤ Significant effect of several competitiveness factors

➤ Dominance of macro factors (energy costs, EU membership & ER stability)

➤ Only one top 5 sectoral (developed consumer sectors) in combination with an additional factor

➤ Company communication tech. utilisation with price/cost reduction at the company level

|                  |  |       | Model 1          | Model 2          | Model 3          |
|------------------|--|-------|------------------|------------------|------------------|
|                  |  |       | return on assets | return on assets | return on assets |
|                  | return on assets (-1)                  | coef. | .21459308*       | .23622856*       | .2266776*        |
|                  |  | s.e.  | 0.0769           | 0.0710           | 0.0696           |
|                  | market share                           | coef. | 1.3358976***     | 1.3874475**      | 1.2939345***     |
|                  |  | s.e.  | 0.0056           | 0.0107           | 0.0096           |
| company factors  | com. tech. utilisation (high)          | coef. | .30280156**      |                  |                  |
|                  |  | s.e.  | 0.0162           |                  |                  |
|                  | price/cost reduction (med)             | coef. | -.1831653*       |                  |                  |
|                  |  | s.e.  | 0.0503           |                  |                  |
| sectoral factors | price/cost reduction (high)            | coef. | -.1304316        |                  |                  |
|                  |  | s.e.  | 0.2107           |                  |                  |
|                  | quality dom. suppliers (med)           | coef. |                  | .42632368**      |                  |
|                  |  | s.e.  |                  | 0.0138           |                  |
| macro factors    | quality dom. suppliers (high)          | coef. |                  | .02765561        |                  |
|                  |  | s.e.  |                  | 0.8995           |                  |
|                  | developed consumers (med)              | coef. |                  | -.36171919**     |                  |
|                  |  | s.e.  |                  | 0.0230           |                  |
| macro factors    | developed consumers (high)             | coef. |                  | -.25507973       |                  |
|                  |  | s.e.  |                  | 0.1551           |                  |
|                  | energy costs (med)                     | coef. |                  |                  | -.45254527***    |
|                  |  | s.e.  |                  |                  | 0.0002           |
|                  | energy costs (high)                    | coef. |                  |                  | -.39253917**     |
|                  |  | s.e.  |                  |                  | 0.0135           |
|                  | exch. rate stability (med)             | coef. |                  |                  | .06318917        |
|                  |  | s.e.  |                  |                  | 0.5331           |
| macro factors    | exch. rate stability (high)            | coef. |                  |                  | .35573383*       |
|                  |  | s.e.  |                  |                  | 0.0659           |
|                  | EU membership (med)                    | coef. |                  |                  | .38824496**      |
|                  |  | s.e.  |                  |                  | 0.0130           |
| macro factors    | EU membership (high)                   | coef. |                  |                  | .38802436***     |
|                  |  | s.e.  |                  |                  | 0.0076           |
|                  | Number of observations                 |       | 529              | 502              | 532              |
|                  | Number of groups                       |       | 75               | 72               | 75               |
| macro factors    | Number of instruments                  |       | 28               | 29               | 31               |
|                  | Arellano-Bond test for AR(1)           |       | -1.8804398       | -1.853095        | -1.9062458       |
|                  | Prob (Arellano-Bond test for AR(1))    |       | .06004816        | .06386874        | .05661832        |
|                  | Arellano-Bond test for AR(2)           |       | 1.2139271        | 1.2465694        | 1.2070482        |
|                  | Prob (Arellano-Bond test for AR(2))    |       | .22477555        | .21255545        | .22741359        |
|                  | Hansen test for over-id. restrictions  |       | 29.231656        | 27.742075        | 28.797805        |
|                  | Prob (Hansen test for over-id. restr.) |       | .17275171        | .22569253        | .18710722        |

legend: \* p<.1; \*\* p<.05; \*\*\* p<.01

Note: : Dependent variables, lagged dependent variables and quantitative explanatory variables in logarithm. Dummy variables for competitiveness factors. Two-step difference GMM estimation using xtabond02 module for Stata. Asymptotic robust standard errors are reported. Lagged dependent and differenced explanatory variables used as instruments.



# Main Results

## B) Labour productivity

- Labour productivity as a function of lagged value of productivity and labour costs
- Statistically significant, but relatively small effect of foreign management & at least one company, sectoral and macro factor
- EU membership at the macro level
- Competitive advantage based on efficiency at the sectoral level
- Medium and high quality company management at the company level

|                  |  |       | Model 1              | Model 2              | Model 3              |
|------------------|--|-------|----------------------|----------------------|----------------------|
|                  |  |       | labour productivity  | labour productivity  | labour productivity  |
|                  | <b>labour productivity (-1)</b>        | coef. | <b>.31258446*</b>    | <b>.46188461***</b>  | <b>.33780202*</b>    |
|                  |  | s.e.  | 0.0670               | 0.0037               | 0.0670               |
|                  | <b>labour costs</b>                    | coef. | <b>-.88784009***</b> | <b>-.86816931***</b> | <b>-.86746521***</b> |
|                  |  | s.e.  | 0.0000               | 0.0000               | 0.0000               |
| basic char.      | <b>foreign management</b>              | coef. | <b>.02846555**</b>   | <b>.03283458*</b>    | <b>.03912645***</b>  |
|                  |  | s.e.  | 0.0191               | 0.0641               | 0.0088               |
| company factors  | <b>quality management (med)</b>        | coef. | <b>.03750564**</b>   |                      |                      |
|                  |  | s.e.  | 0.0201               |                      |                      |
|                  | <b>quality management (high)</b>       | coef. | <b>.03228002*</b>    |                      |                      |
|                  |  | s.e.  | 0.0733               |                      |                      |
| sectoral factors | <b>nature of comp. adv. (med)</b>      | coef. |                      | <b>.02838201*</b>    |                      |
|                  |  | s.e.  |                      | 0.0785               |                      |
|                  | <b>nature of comp. adv. (high)</b>     | coef. |                      | .02001763            |                      |
|                  |  | s.e.  |                      | 0.3475               |                      |
| macro factors    | <b>EU membership (med)</b>             | coef. |                      |                      | <b>.03897243***</b>  |
|                  |  | s.e.  |                      |                      | 0.0053               |
|                  | <b>EU membership (high)</b>            | coef. |                      |                      | .02377837            |
|                  |  | s.e.  |                      |                      | 0.2931               |
|                  | Number of observations                 |       | 290                  | 260                  | 273                  |
|                  | Number of groups                       |       | 76                   | 69                   | 72                   |
|                  | Number of instruments                  |       | 14                   | 14                   | 16                   |
|                  | Arellano-Bond test for AR(1)           |       | -1.175932            | -1.0771242           | -1.1473413           |
|                  | Prob (Arellano-Bond test for AR(1))    |       | .23962206            | .28142479            | .25124058            |
|                  | Arellano-Bond test for AR(2)           |       | .61876559            | .57062377            | .59211835            |
|                  | Prob (Arellano-Bond test for AR(2))    |       | .53607079            | .56825471            | .55377134            |
|                  | Hansen test for over-id. restrictions  |       | 17.530688            | 10.843331            | 17.454239            |
|                  | Prob (Hansen test for over-id. restr.) |       | .04102569            | .2866009             | .09513897            |

legend: \* p<.1; \*\* p<.05; \*\*\* p<.01

Note: : Dependent variables, lagged dependent variables and quantitative explanatory variables in logarithm. Dummy variables for competitiveness factors. Two-step difference GMM estimation using xtabond02 module for Stata. Asymptotic robust standard errors are reported. Lagged dependent and differenced explanatory variables used as instruments.



# Main Results

## C) Export performance

- export as a function of lagged value of export and labour costs
- Statistically significant, but relatively small effect of foreign management & at least one company, sectoral and macro factor
- Euro adoption at the macro level
- Developed consumer sectors at the sectoral level
- Highly efficient leadership at the company level (only with additional macro factor)

|  |                                      | Model 1<br>value of<br>export | Model 2<br>value of<br>export | Model 3<br>value of<br>export | Model 4<br>value of<br>export |
|--|--------------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
|  | <b>value of export (-1)</b>          | coef. <b>.76827472***</b>     | <b>.36527309**</b>            | <b>.29846731*</b>             | <b>.40796615**</b>            |
|  |                                      | s.e. 0.0000                   | 0.0263                        | 0.0598                        | 0.0207                        |
|  | <b>labour costs</b>                  | coef. <b>-1.1328577***</b>    | <b>-1.3468663***</b>          | <b>-1.0271134***</b>          | <b>-1.3049847***</b>          |
|  |                                      | s.e. 0.0000                   | 0.0000                        | 0.0000                        | 0.0000                        |
| basic                                  | <b>foreign management</b>            | coef. <b>.05907848**</b>      |                               |                               |                               |
|  |                                      | s.e. 0.0119                   |                               |                               |                               |
| company factors                        | efficient leadership (med)           | coef.                         | .04671683                     |                               |                               |
|  |                                      | s.e.                          | 0.1959                        |                               |                               |
|  | <b>efficient leadership (high)</b>   | coef.                         | <b>.06571195*</b>             |                               |                               |
|  |                                      | s.e.                          | 0.0803                        |                               |                               |
| sectoral factors                       | <b>developed consumers (med)</b>     | coef.                         |                               | <b>.07749444*</b>             |                               |
|  |                                      | s.e.                          |                               | 0.0946                        |                               |
|  | developed consumers (high)           | coef.                         |                               | .01612667                     |                               |
|  |                                      | s.e.                          |                               | 0.6318                        |                               |
| macro factors                          | <b>euro adoption (med)</b>           | coef.                         |                               |                               | <b>.0968835***</b>            |
|  |                                      | s.e.                          |                               |                               | 0.0098                        |
|  | euro adoption (high)                 | coef.                         |                               |                               | .04974751                     |
|  |                                      | s.e.                          |                               |                               | 0.2606                        |
|  | <b>telecom. infrastructure (med)</b> | coef.                         | <b>.03477191**</b>            |                               |                               |
|  |                                      | s.e.                          | 0.0325                        |                               |                               |
|  | telecom. infrastructure (high)       | coef.                         | -.00047581                    |                               |                               |
|  |                                      | s.e.                          | 0.9933                        |                               |                               |
| Number of observations                 |                                      | 201                           | 201                           | 186                           | 201                           |
| Number of groups                       |                                      | 51                            | 51                            | 48                            | 51                            |
| Number of instruments                  |                                      | 12                            | 15                            | 13                            | 13                            |
| Arellano-Bond test for AR(1)           |                                      | -1.6715445                    | -1.574652                     | -1.2507832                    | -1.6011308                    |
| Prob (Arellano-Bond test for AR(1))    |                                      | .09461419                     | .11533679                     | .21101359                     | .10934794                     |
| Arellano-Bond test for AR(2)           |                                      | .53904164                     | .48369607                     | .9194568                      | .50188676                     |
| Prob (Arellano-Bond test for AR(2))    |                                      | .58985812                     | .62860158                     | .35785669                     | .61574718                     |
| Hansen test for over-id. restrictions  |                                      | 10.147894                     | 13.191653                     | 17.189027                     | 14.502445                     |
| Prob (Hansen test for over-id. restr.) |                                      | .33864565                     | .1541242                      | .04583682                     | .10554126                     |

legend: \* p<.1; \*\* p<.05; \*\*\* p<.01

Note: : Dependent variables, lagged dependent variables and quantitative explanatory variables in logarithm. Dummy variables for competitiveness factors. Two-step difference GMM estimation using xtabond2 module for Stata. Asymptotic robust standard errors are reported. Lagged dependent and differenced explanatory variables used as instruments.



# Main Results

## D) Market share

- Market share as a function of lagged value of market share and export share
- Statistically significant, but relatively small effect of one sectoral and one macro factor (but relatively low p-value for Hansen test)
- Energy costs at the macro level
- Customer demandingness at the sectoral level
- None of the top 5 company level factors, only additional – corporate relationships with other companies – was statistically significant

|                  |  |       | Model 1             | Model 2              | Model 3             |
|------------------|--|-------|---------------------|----------------------|---------------------|
|                  |  |       | market share        | market share         | market share        |
|                  | <b>market share (-1)</b>               | coef. | <b>.32945553**</b>  | <b>.28947073*</b>    | <b>.25185153***</b> |
|                  |  | s.e.  | 0.0367              | 0.0531               | 0.0015              |
|                  | <b>export share</b>                    | coef. | <b>.13332103*</b>   | <b>.14836742**</b>   | <b>.14800113**</b>  |
|                  |  | s.e.  | 0.065               | 0.0262               | 0.0253              |
| company factors  | corporate relations (med)              | coef. | 0.00197313          |                      |                     |
|                  |  | s.e.  | 0.9244              |                      |                     |
|                  | <b>corporate relations (high)</b>      | coef. | <b>.09026464**</b>  |                      |                     |
|                  |  | s.e.  | 0.0111              |                      |                     |
| sectoral factors | <b>customer demandingness (med)</b>    | coef. |                     | <b>-.04260075***</b> |                     |
|                  |  | s.e.  |                     | 0.0014               |                     |
|                  | <b>customer demandingness (high)</b>   | coef. |                     | <b>-.03270222**</b>  |                     |
|                  |  | s.e.  |                     | 0.022                |                     |
| macro factors    | <b>energy costs (med)</b>              | coef. | <b>-.02419362*</b>  |                      | <b>-.02164415*</b>  |
|                  |  | s.e.  | 0.0641              |                      | 0.0793              |
|                  | <b>energy costs (high)</b>             | coef. | <b>-.0583884***</b> |                      | <b>-.0402226**</b>  |
|                  |  | s.e.  | 0.0078              |                      | 0.0188              |
|                  | Number of observations                 |       | 452                 | 397                  | 470                 |
|                  | Number of groups                       |       | 64                  | 64                   | 66                  |
|                  | Number of instruments                  |       | 26                  | 21                   | 24                  |
|                  | Arellano-Bond test for AR(1)           |       | -0.50183086         | -1.0264606           | -0.97642172         |
|                  | Prob (Arellano-Bond test for AR(1))    |       | 0.6157865           | 0.30467452           | 0.32885552          |
|                  | Arellano-Bond test for AR(2)           |       | 1.1005134           | 2.0280328            | 1.4082994           |
|                  | Prob (Arellano-Bond test for AR(2))    |       | 0.27110851          | 0.0425569            | 0.15904245          |
|                  | Hansen test for over-id. restrictions  |       | 29.382024           | 25.697044            | 31.201589           |
|                  | Prob (Hansen test for over-id. restr.) |       | 0.08050512          | 0.08015978           | 0.05258477          |

legend: \* p<.1; \*\* p<.05; \*\*\* p<.01

Note: : Dependent variables, lagged dependent variables and quantitative explanatory variables in logarithm. Dummy variables for competitiveness factors. Two-step difference GMM estimation using xtabond2 module for Stata. Asymptotic robust standard errors are reported. Lagged dependent and differenced explanatory variables used as instruments.



# Conclusion

- The regression analysis showed statistically significant impact of presence of foreign manager in the company on its competitiveness (but only based on productivity and export)
- Econometric analysis has confirmed statistically significant impact of most of the competitiveness factors (identified by a survey) on the analysed companies' competitiveness
- Their impact differs across considered competitiveness indicators, they seem to explain much larger part of profitability than productivity, export or market share
- There were only three variables statistically significant for at least 2 indicators (energy costs, EU membership and developed consumer sectors)
- Dominance of management and leadership related factors suggested by the survey was not confirmed