Foreign Direct Investment as a Driver of Macroeconomic Development and Accretion of Intellectual Capital

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Relevance and Aim of Our Research

Trends after the global financial crisis of 2008-2009:

1) Slowdown in GDP growth of developing countries
2) Search of stable investment growth pattern
3) Tendencies to protectionism and segmentation
4) Volatility in the world commodity markets in 2014-2016

What is the role of FDI in the economy and strengthening of intellectual capital (IC)?

An efficient FDI management policy allows to maximize the advantages and minimize the risks of FDI attraction.

The aim of our work is to analyze and compare the efficiency of FDI management policies in different countries in the context of stable economic and innovation-based growth.

Previous Empirical Research

Analysis of FDI influence on economic growth and IC indicators

Influence on economic growth

Revealing positive influence:
Hansen & Rand (2006); Esso (2010); Ozturk & Kalyoncu (2007); Gursoy et al. (2013)

Revealing negative influence:
Altomonte & Pennings (2009); Spencer (2008)

Influence on IC indicators

Revealing causal relationships:
Zhang and Tao (2012)

Revealing no causal relationships:
Michie (2002)

Conditions of efficient FDI transformation

Qualified labor resources
Hansen & Rand (2006)

Duration of Education
Borensztein et al. (1998); Alfaro et al. (2004)

Economic Climate
Agrawal & Khan (2011)

Institutional Quality
Brahim & Rachdi (2014); Jude & Levieuge (2013)

The results of the previous researches are mixed and controversial.

Influence of FDI on IC is less studied, there are no unambiguous conclusions.

Contribution of Our Research to the Empirical Literature

1) We reveal **causal relationships** between **FDI** inflow and stock and the **wide range of macroeconomic and IC indicators**.

We consider **the extended sample of developed and developing countries in the dynamics**, including the post-crisis period**.**

2) For the first time we perform the **comparative analysis of the FDI management quality by two projections** – the stable **economic growth** and the **innovation-based growth.**

The analysis is based on the **nonparametric DEA method**.

3) We analyze **the role of institutions and economic liberalization** in ensuring the efficient FDI management.

Three Stages of Our Research

Stage 1. Analysis of causal relationships:

FDI inflow and stock ⟷ **Macroeconomic and IC indicators**

Stage 2. Analysis of efficiency of FDI management by 2 projections

Stable economic growth | **Innovation-based growth**

Stage 3. Analysis of institutional determinants of quality (efficiency) of FDI management

Stage 1. Analysis of causal relationships between FDI indicators and macro-indicators

Methodology – the Granger test

FDI indicators

FDI inflow (% GDP)

FDI stock (% GDP)

Macro-indicators

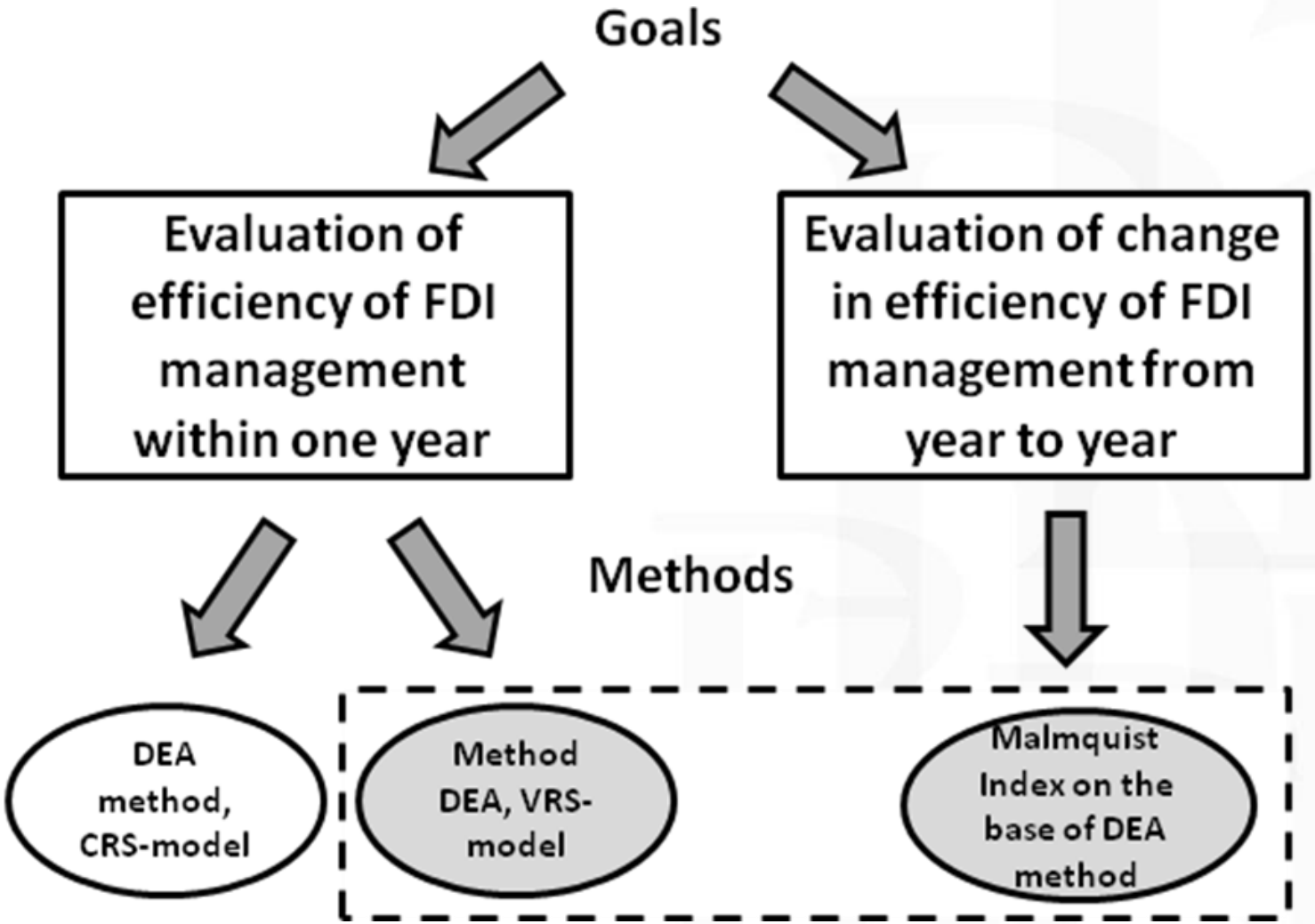
Economic indicators:

- ✓ GDP growth
- ✓ Real GDP per capita
- ✓ CPI
- ✓ Unemployment rate
- ✓ Fixed Capital Investment
- ✓ Market Capitalization
- ✓ Domestic Credit
- ✓ Export and Import
- ✓ Exchange Rate

IC indicators:

- ✓ Patent applications
- ✓ Trademarks applications
- ✓ R&D
- ✓ Scientific journal articles
- ✓ High-tech export
- ✓ Index of Global Competitiveness
- ✓ Worldwide Governance Indicators
- ✓ Index of Economic Freedom
- ✓ Global Innovation Index and its components

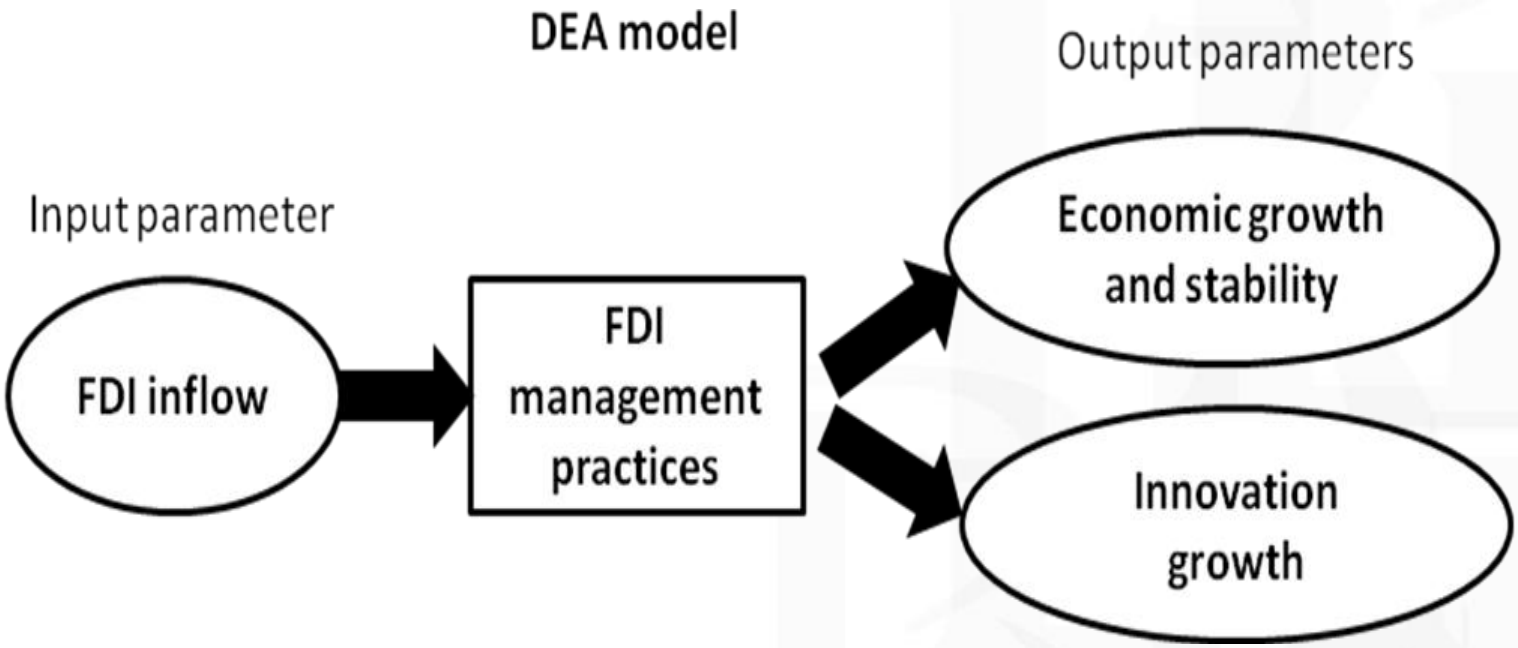
Stage 2. Cross-country Analysis of Efficiency of FDI Management Policy (for Each Year and Change in Time)



Stage 2. Cross-country Analysis of Efficiency of FDI Management Policy (for Each Year)

Methodology – the DEA method (Charnes et al. (1978); Cooper et al (2007))

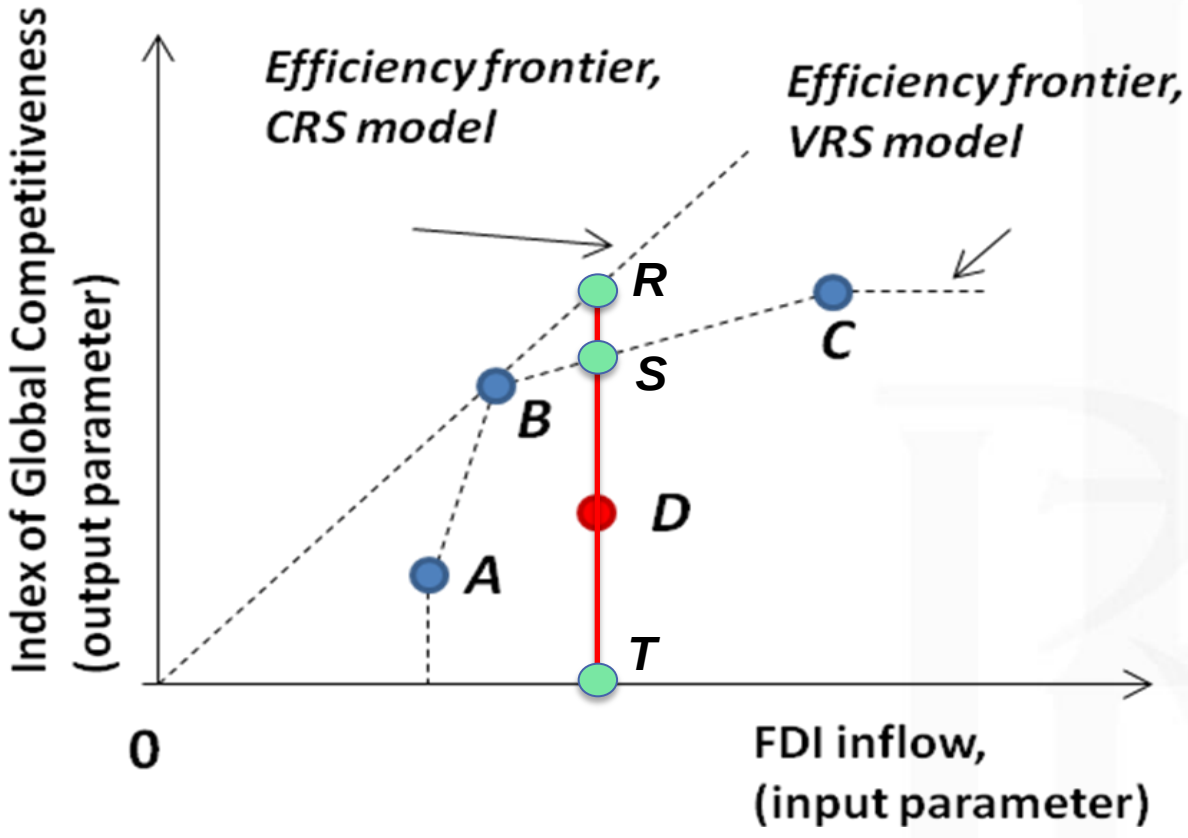
Efficiency is the ratio of the weighted sum of output parameters to the weighted sum of input parameters



1) No restrictions on the number and correlation of parameters
2) No preset weight coefficients for parameters
3) Providing the efficiency frontier

Stage 2. Cross-country Analysis of Efficiency of FDI Management Policy (for Each Year)

Two types of DEA models:
CRS – assumption of constant return of scale,
VRS – variable return of scale



Case of one input and one output parameter

CRS: only B is efficient

VRS: A, B, C are efficient

How should we measure efficiency of D?

CRS: ***Eff (D) = DT / RT***
Eff (B) = 1

VRS: ***Eff (D) = DT / ST***
Eff (A)=Eff (B)=Eff (C)=1

Stage 2. Cross-country Analysis of Efficiency of FDI Management Policy (for Each Year)

DEA: Optimization problem (Charnes et al. (1978); Cooper et al (2007))

$$\max_{\phi,\lambda} \phi$$

$$-\phi y_i + Y\lambda \geq 0$$

$$x_i - X\lambda \geq 0$$

$$e\lambda = 1$$

$$\lambda \geq 0$$

$\phi - a\ scalar, 1 <= \phi$

$the\ efficiency\ = 1/\phi$

$K - the\ number\ of\ input\ parameters$

$M - the\ number\ of\ output\ parameters$

$I - the\ number\ of\ countries$

$x_i - vector\ of\ input\ parameters\ of\ country\ i\ (K*1)$

$X - matrix\ of\ input\ parameters\ (K*I)$

$y_i - vector\ of\ output\ parameters\ of\ country\ i\ (M*1)$

$Y - matrix\ of\ output\ parameters\ (M*I)$

$\lambda - the\ vector\ of\ constants\ (I*1)$

$e - the\ unit\ vector$

Stage 2. Cross-country Analysis of Efficiency of FDI Management Policy (Change from Year to Year)

Malmquist Index based on DEA method (Malmquist (1953); Fare et al. (1992))

Shift of the efficiency frontier

$$TCng = \sqrt{\frac{te_1^0}{te_1^1} \cdot \frac{te_0^0}{te_0^1}}$$

Malmquist Index

$$MI = TCng \cdot \frac{te_1^1}{te_0^0} = \sqrt{\frac{te_1^0}{te_0^0} \cdot \frac{te_1^1}{te_0^1}}$$

$te_0^0 - efficiency \;\; in \; the \; T_0 \;\; period \;\; at \; the \; T_0 \;\; frontier;$

$te_0^1 - efficiency \;\; in \; the \; T_0 \;\; period \;\; at \; the \; T_1 \;\; frontier;$

$te_1^0 - efficiency \;\; in \; the \; T_1 \;\; period \;\; at \; the \; T_0 \;\; frontier;$

$te_1^1 - efficiency \;\; in \; the \; T_1 \;\; period \;\; at \; the \; T_1 \;\; frontier$

Stage 3. Analysis of Institutional Determinants of Efficiency of FDI Management

H1. Differences in the FDI management efficiency within one year are determined by institutional factors – the Index of Economic Freedom and the Worldwide Governance Indicators.

H2. Differences in changes of the FDI management efficiency while passing from year to year are determined by institutional factors – the Index of Economic Freedom and the Worldwide Governance Indicators.

Sample of Our Research

- G7
- BRICS
- Eastern Europe
- New Industrial Countries
- Next 11

31 countries
Period: 2000-2015
496 observations

**** Next 11: Mexico, Nigeria, Egypt, Turkey, Iran, Pakistan, Bangladesh, Indonesia, Vietnam, S. Korea, Philippines***

Stage 1. Influence of FDI inflow on macro-indicators (*** - 1% level, ** - 5% level, * - 10% level)

Variable	F-statistics and its significance	Time lag (years)
GDP growth	2.94**	3
CPI	2.25**	6
GDP per Capita Growth	3.44**	3
GDP per Capita	2.26*	3
Patent Applications by Nonresidents	9.30***	2
Scientific Journal Articles	2.41**	4
Global Competitiveness Index	3.78** (mutual influence)	2
Receipts for Intellectual Property	2.76**	3
Index of Economic Freedom	5.46*** (mutual influence)	2
Political Stability	4.32** (mutual influence)	2
Government Effectiveness	4.73***	2
Regulatory Quality	12.24*** (mutual influence)	2
Rule Of Law	6.60***	2
Control Corruption	6.93*** (mutual influence)	2
GII: Knowledge Absorption	3.29**	

Stage 1. Influence of FDI stock on macro-indicators (*** - 1% level, ** - 5% level, * - 10% level)

Variable	F-statistics and its significance	Time lag (years)
GDP growth	3.54** (mutual influence)	2
Exchange Rate	5.82** (mutual influence)	
Trademarks Appl. by Nonresidents	6.21***	2
GII: Inputs	2.59*	2
GII: R&D	4.17**	2
GII: Trade and Competition	3.42** (mutual influence)	2
GII: Knowledge Impact	9.27***	2

Stage 2. Choice of Input and Output Parameters for the DEA models

Projection of stable economic growth:

Input parameter – FDI inflow (averaged for 3 previous years)

Output parameters:

- ✓ Real GDP growth
- ✓ CPI

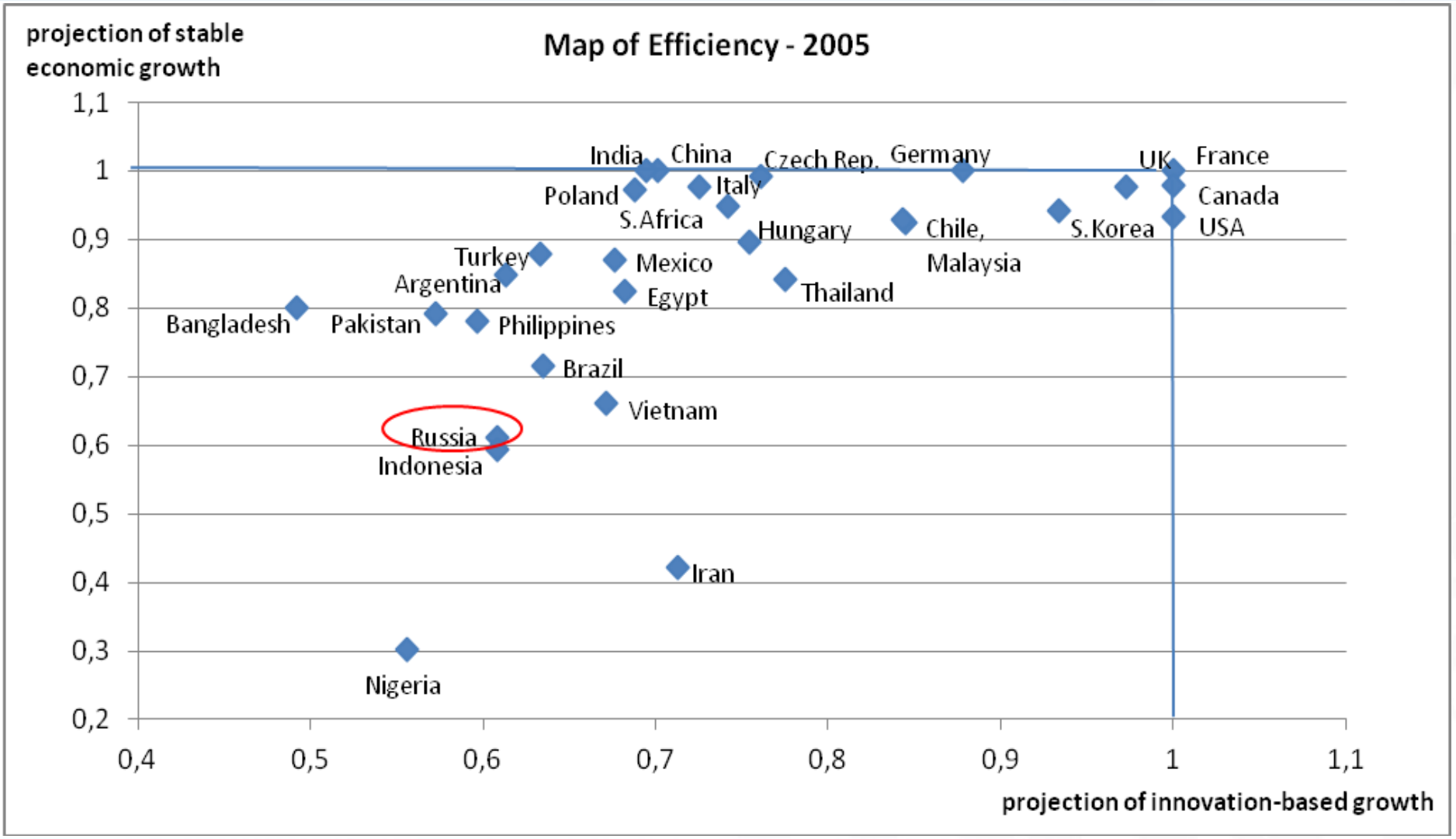
Projection of innovation-based growth:

Input parameter – FDI inflow (averaged for 3 previous years)

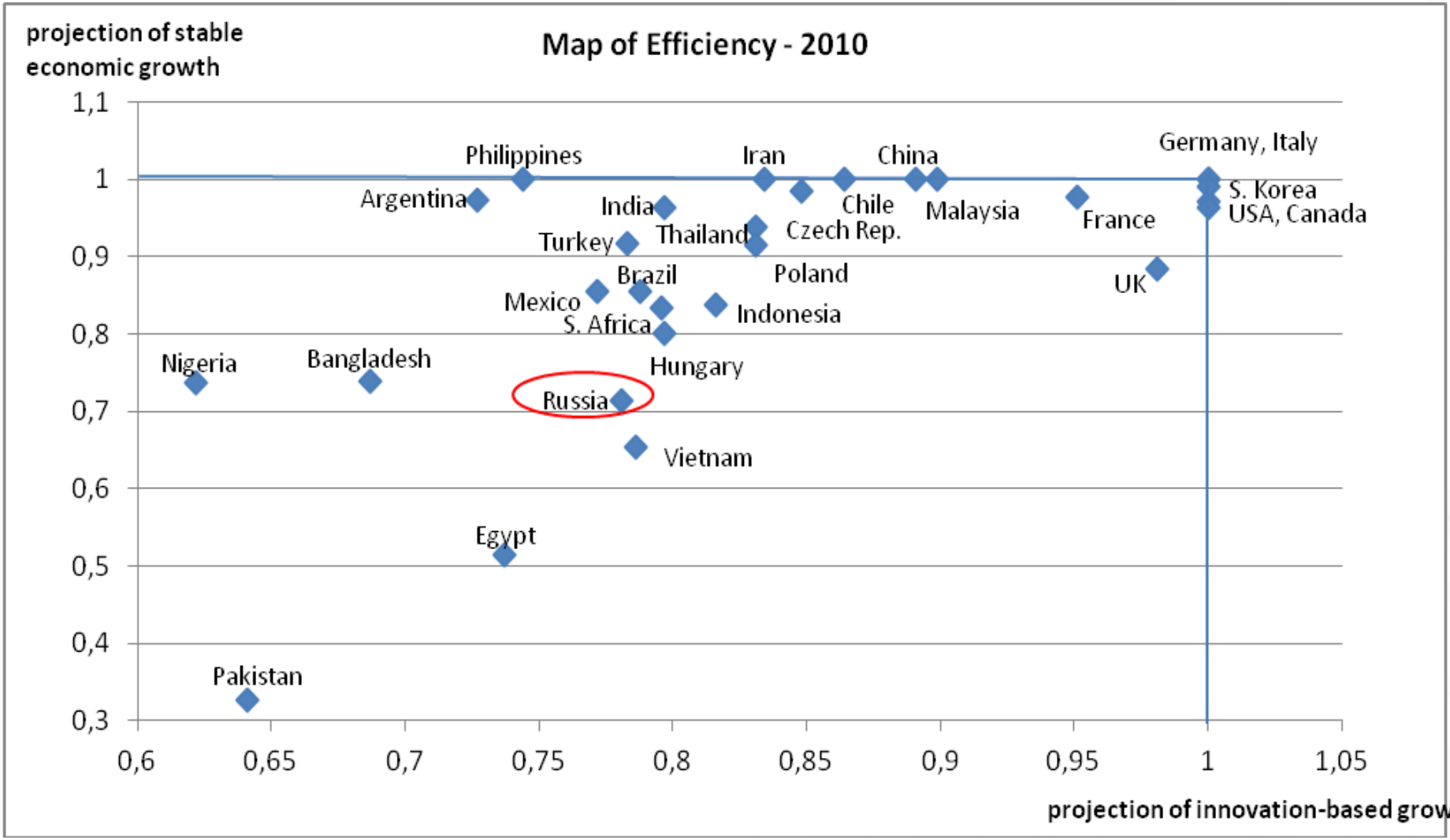
Output parameters:

- ✓ Global Competitiveness Index,
- ✓ Number of patent applications by non-residents,
- ✓ Number of scientific and technical journal articles

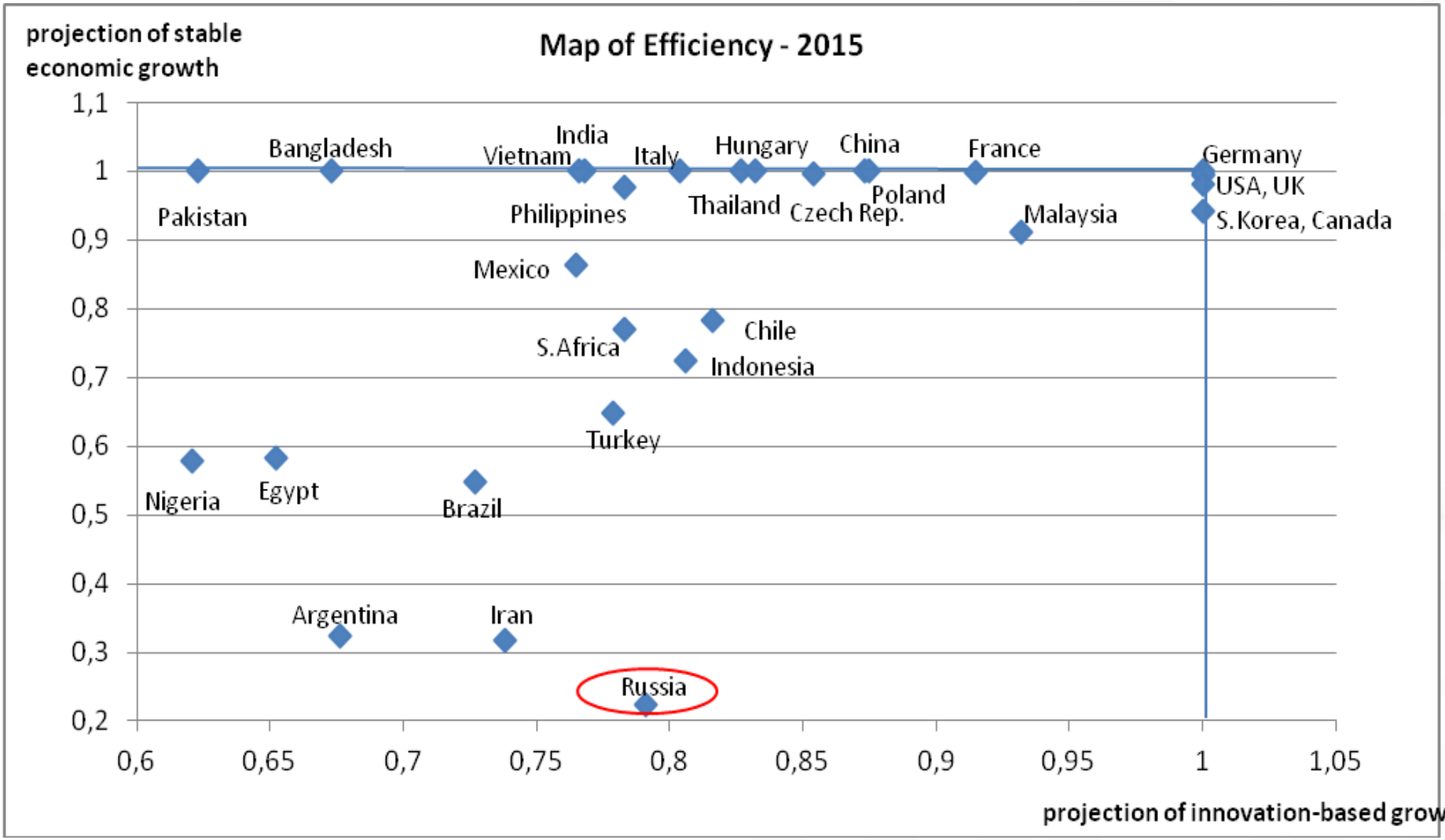
Stage 2. Efficiency - 2005



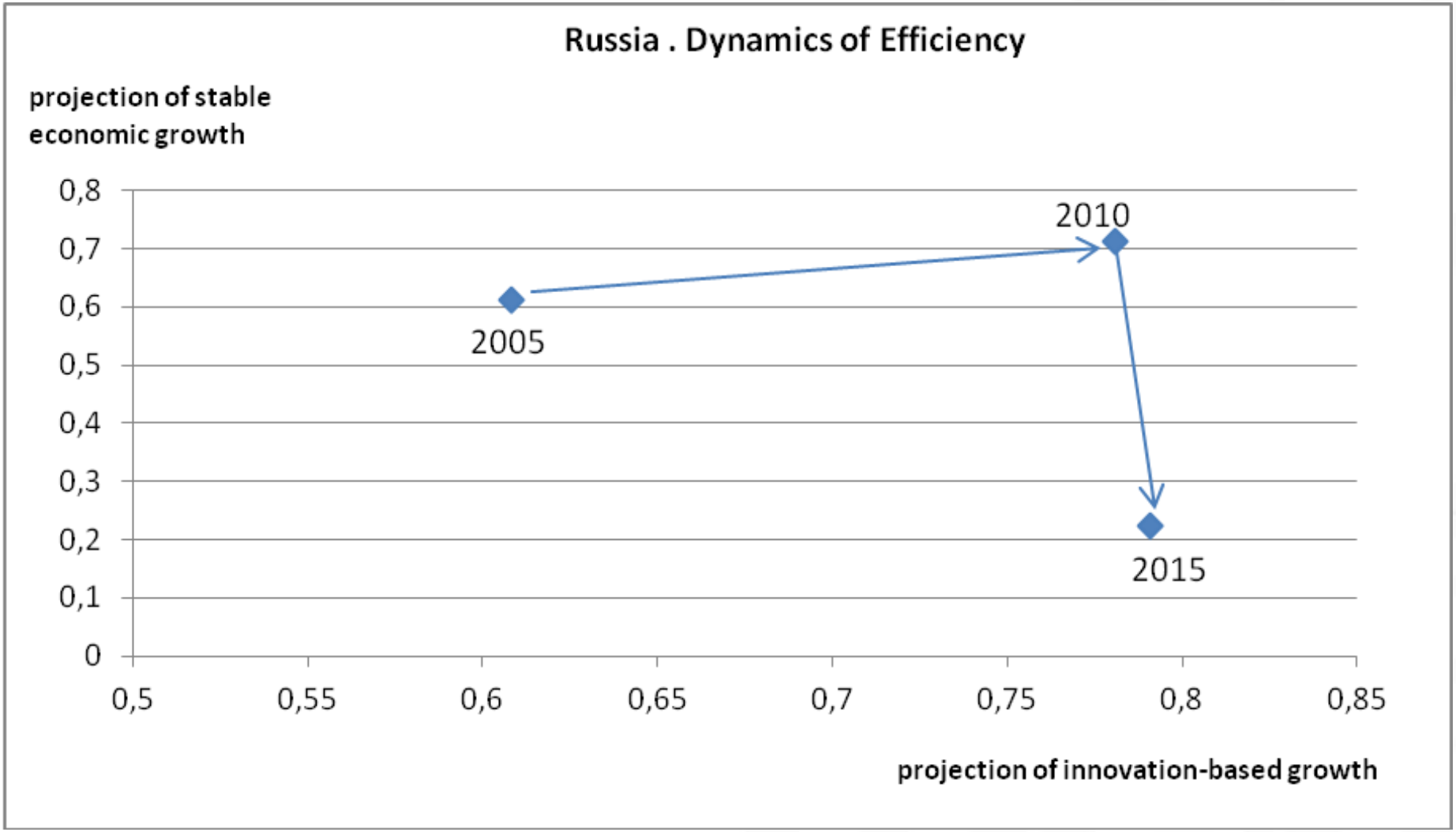
Stage 2. Efficiency - 2010



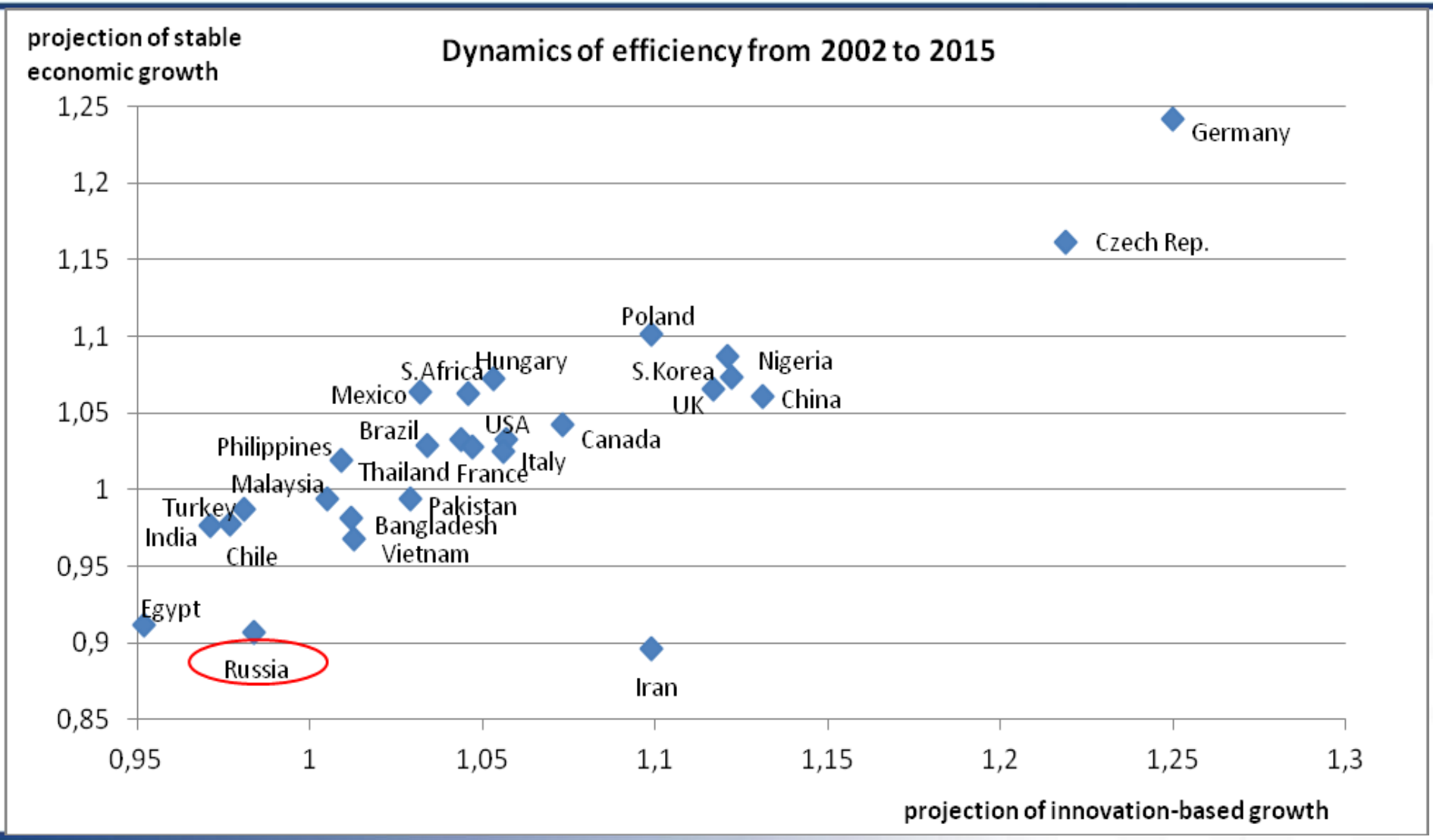
Stage 2. Efficiency - 2015



Stage 2. Russia. Dynamics of Efficiency



Stage 2. Efficiency Change



Stage 3. Institutional Quality: Correlation between Efficiency Scores and Institutional Factors

Projection of innovation-based growth

Indicators	2005	2010	2015	Ranking by significance
Index of Government Effectiveness	0.93***	0.87***	0.93***	1
Index of Rule of Law	0.91***	0.81***	0.87***	2
Index of Control of Corruption	0.91***	0.77***	0.85***	3
Index of Regulatory Quality	0.83***	0.74***	0.86***	4
Index of Political Stability	0.69***	0.72***	0.77***	5
Index of Economic Freedom	0.81***	0.63***	0.74***	6

Projection of stable economic growth

	2005	2010	2015	Ranking by significance'15
Index of Regulatory Quality	0.71***	0.40**	0.56***	1
Index of Economic Freedom	0.57***	0.33*	0.56***	2
Index of Rule of Law	0.72***	0.44**	0.53***	3
Index of Government Effectiveness	0.70***	0.58***	0.49***	4
Index of Control of Corruption	0.62***	0.46**	0.44**	5
Index of Political Stability	0.59***	0.49***	0.36*	6

Conclusions

✓ **FDI inflow is the reason, according to Granger, for:**
GDP growth, CPI, Real GDP per capita and its growth,
Patent applications by non-residents, Knowledge absorption,
Number of scientific journal articles, Receipts for intellectual property.

✓ **Projection of economic growth: China and Germany steadily remain at the efficiency frontier in 2005, 2010 and 2015.**

✓ **Projection of innovation-based growth: USA steadily remain at the efficiency frontier in 2005, 2010 and 2015.**

✓ **In Russia the effective transformation of the FDI inflow into the economic and innovation-based growth is not achieved.**

✓ **The efficiency of FDI transformation in economic and innovation-based growth is determined by the quality of institutional development.**