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Methodology to Assess the Efficiency of the Russian Federation Foreign Economic Activity

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Abstract: Foreign economic activity is of paramount priority for Russia. At the same time, the historically developed specific economic characters of the country contributed to formation of an inefficient and economically insecure structure of the foreign economic activity which resulted in explicit resource-based nature of the Russian export, concentration of the investment capital in fuel/raw material and trade industry branches, high reliance on the import to the prejudice of the domestic production development, low competitive level of the goods produced locally, etc. These specifics of the Russian foreign economic activity make the state economic welfare highly dependent on global market conditions, scale up foreign economic risks and make the economy vulnerable to crisis developments which require the measures aimed to protect the national interests of the country. In order to justify the structure and value of the foreign economic activity as well as to develop the ways to increase its efficiency in state profile, it is required, first and foremost, to develop new approaches to its analysis. This study proposes a new way to assess the efficiency of the Russian Federation foreign economic activity, justifies the approach from theoretical point of view and includes economic and mathematical methods enabling to improve accuracy when measuring the input of the foreign economic activity into the national economy.

Key words: Foreign economic activity, efficiency, indicators of social and economic development, economic and mathematical models to assess the efficiency, Russia

INTRODUCTION

The importance of the research issue in the contemporary environment is defined by a more significant role of the Foreign Economic Activity (FEA) which became a key factor of financial stability and development of the local production as well as an important tool to achieve competitiveness and an element of economic security. FEA priority, both to separate business entities and to the country as a whole, defines necessity of its analytical support. The latter, in its turn is connected with continuous improvement of the theoretical basis and practical tools of economic and mathematical modelling including tailored methods to assess the efficiency.

The majority of the applied mathematical models, assessment methods and indicators are focused on the FEA micro level and do not permit to assess FEA efficiency with regard to national and regional systems in all aspects. The scientific and theoretical as well as empirical researches dedicated to study of FEA social and economic efficiency are limited by assessment of the main ways of influence on the economic growth (for example, gross domestic product dynamic).

Insufficiency of mathematical and methodological background used to assess the FEA effects and efficiency with regard to national and regional economic systems, increases the necessity to review this issue and to search for new scientifically valid modelling tools.

Distinctive feature of the offered methodology is possibility to register and empirically assess the complex of FEA effects for macro and meso-economical systems. Application of methodologies has high scientific validity as a basis of research becomes fundamental works of economic and mathematical science, national and foreign scientists' classical works and modern researches, devoted to problems of modeling and an assessment of foreign trade activities efficiency.

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Delivery of the foreign economic activity is connected with the assessment of its efficiency. The concept of "foreign economic efficiency" may have a different gist and definition with regard to levels of FEA review. A number of researchers (Kovshar, 2010; Afanasiev, 2008; Mikhailova, 2011) highlight a two-tier FEA delivery level: micro-level (business entities) and macro/meso-level (state or region). This approach encourages ultimate understanding of the researched categories.

The key efficiency criterion of FEA with regard to micro business entities is the ratio of transactions outcome (revenue, income) and the cost of their delivery (initial investment, transaction expenses, taxes). The direct economic effect from foreign economic activity means improvement of the company financial performance, the indirect one-cheaper production, familiarization with new processes, increase of production volumes, saving of financial resources, etc.

On macro/meso-level, the FEA efficiency shall be reviewed from a slightly different point of view. Since on a macro/meso-level of the economy operation the participant of the FEA is a complex entity (region or a state), the efficiency should be assessed with regard to FEA impact on all elements of the regional or national economic system.

According to Lewer and Berg (2003), the efficiency of foreign economic liaisons from the point of macro-level is defined in comparison with other countries and comprises a complex of budget, production and social effects. The researcher considers that "the effect emerges within the in-house environment of companies and national economics, when the achieved efficiency reveals itself against the foreign economic.

Review of the FEA efficiency in terms of macro and meso-economic systems as well as consideration and usage of the FEA effects revealed in social and economic development are theoretically justified and have high practical value. The so called social and economic approach applied to review the FEA efficiency starts to gain popularity. The gist of this approach is as follows: economy development level and population life quality are theoretically dependent on efficient operation of the foreign economic complex of a certain territory. According to Mingaleva within the frames of this approach, the foreign economic activity is a "tool to increase the level of social/economic development and competitiveness of the territory"; efficiency of the latter however is defined with regard to ability to ensure this territory sustainability and life quality improvement".

Similar understanding of the FEA and its efficiency are theoretically justified in the scientific literature. A large number of authors of scientific researches devoted to the foreign economic activity assume FEA to be an actual tool of economic development and a key factor to improve the territory competitiveness.

Molchan state that "participation in foreign economic liaisons traditionally ensures that the resource potential of the territory is used and increased simultaneously; moreover in many cases it becomes the dominant factor of the social and economic development. "According to Yadrevskaya the contemporary foreign economic activity is the main condition of sustainability and way to settle many economic problems". Belozerova considers the foreign economic liaisons to be the key factor defining the state and development of the economy."

There are a lot of researches within the area of FEA management referring to territorial entities which prove that formation of the FEA development strategy is the way to settle the issues of economic growth to improve competitiveness and to realize the social and economic development of the territory. Foreign scientists also consider the foreign economic activity as a factor of economic growth and a way to strengthen the role and influence of the country (region) in the global economy and politics. Among the adherers of this concept are the following founders of the international trade theory: Bhagwati *et al.* (1985) and Mill (2004) and contemporary scientists dealing with researches in the foreign economic scientific area: Daumal and Ozyurt (2011), Jenicek and Krepl (2009), Lewer and Berg (2003), Jurcic *et al.* (2013), Desai *et al.* (2013) and Suranovic (2012).

From the other side, foreign economic activity may negatively impact the territory social and economic position which reveals in expanding of structural disproportions in the economy, appearance of numerous inefficient production elements (raw materials, unskilled labour), deterioration of ecological environment, increase of social and economic division of territories, etc., besides in some cases, the impact of the foreign economic activity on both micro (factories, companies) and macro-entities (regions, countries) leads to overall dependence of the economic position from FEA delivery conditions and environment of the global market; the latter is a major threat to sustainability of the stated entities and impacts the territory economic security.

Therefore, due to significant and versatile influence of the foreign economic activity on the condition of the national economy, the state shall excise a more thorough control over formation of the structure and specialisation

of the foreign economic complex as well as over research of its impact on economic branches and social aspects. This is very critical for the Russian Federation.

MATERIALS AND METHODS

We believe that due to high dependence of the Russian Federation economy from export factors and failure to settle a number of FEA safety issues, the research and forecast with regard to the national foreign economic efficiency the efficiency of foreign economic liaisons in achieving social and economic effects required to operate macro and meso-economic systems are undoubtedly very important.

Under FEA efficiency of macro and meso-systems we understand a complex appraisal category reflecting the state of FEA influence on social and economic positioning of a macro or meso-entity.

This definition is close in its meaning to the national economic as well as social and economic efficiency. The degree of FEA efficiency is considered to be a relative value of social and economic effects (a kind of changes; favourable or negative tendencies in development of an economic system) per a unit of the performed foreign economic activity. The favourable changes may include as follows: improve of the employment, infrastructure development, increase in earnings, structural change of the economy, production modernisation, etc. The negative changes may include destabilisation of economic position of import-substituting productions, environment pollution, obsolete manufacturing, growing exposure to crises, etc.

The traditional efficiency factors include the final results and resources (expenses, investments) spent to achieve them. In this research the factors to assess FEA efficiency of macro and meso-systems are proposed as follows: factor of FEA social and economic efficiency (MEF):

$$MEF = \frac{ME}{FEA} \quad (1)$$

Where:

ME = Social and economic effect of the foreign economic activity

FEA = Scope of the foreign economic activity

Foreign economic security coefficient (KFS) efficiency indirect factor:

$$KFS = \frac{ME}{SED} \times 100\% \quad (2)$$

Where:

ME = Social and economic effect of the foreign economic activity

SED = The level of social and economic development

The versatile appraisal of the efficiency is connected with the fact that as a rule, majority of social and economic effects of foreign economic activities observed during a long period of time increase dependence of macro and meso-systems from FEA entities which unfavourably impacts the level of economic security.

Improve of the country or region economy openness and increase of foreign economic liaisons are favourable for the economy. Given however, dependence of this development from foreign market fluctuations, stability of growth is exposed to high level of risks and dangers. In view that "efficiency" collates with the category of "optimality" (conditional optimum with regard to available constraints), the coefficient of the economic security shall be used as a conditional factor of FEA efficiency. This coefficient is a relative value characterizing specific weight of FEA effects with regard to general level of the social and economic development. It has a threshold value which is identified on base of a rule-of-thumb practice. The proposed FEA efficiency factor relates to indicators of economic security but its meaning is different. The proposed coefficient of FEA security is based on identifying percentage of a part of the value formed under direct influence of the FEA in its general meaning. This may be used to assess FEA efficiency subject to social and economic development of macro and meso-systems being conditionally dependent from the FEA.

On the whole, the direct appraisal of the efficiency will be conducted on base of numeric value of two factors indicated above (FEA social and economic efficiency factor and FEA security factor with regard to its threshold value).

The FEA effects and efficiency assessment system, which permits to fully describe and empirically evaluate the key directions of FEA influence on social and economic condition of regional and national systems is proposed with regard to the specified criteria and values (Fig. 1).

The calculation of the specified factors to assess FEA efficiency is delivered with regard to our bespoke methodology which can be used to specially register and empirically assess the complex of FEA effects by applying the tools of co-integration, correlation and regressive analysis as well as a step out analysis.

The main specific of the proposed FEA efficiency assessment methodology on regional and national levels is a possibility to register and empirically

FEA of macro and meso economical systems includes: EX: Export IM: Import FI: Foreign Investments IA: Investments Abroad	Indicators of the FEA effects and efficiency assessment		
	Impact of FEA on development of social and economic system	Sphere of influence	Approximate list of indicators of an assessment of effects and efficiency of foreign trade activities
		Block 1: Economic growth	GDP (VRP), national income
		Block 2: Production	Commissioning of fixed assets, number of the enterprises, the volume of the shipped goods
		Block 3: Finance	Income of the budget, balanced financial result of the organizations, the credits and deposits provided by org and to physical persons in rubles and foreign currency, volume of issue of securities
		Block 4: Standard of living of the population	Population with the monetary income is lower than the size of a living wage, cash expenditures and savings of the population, acquisition of real estate by the population
		Block 5: Situation in labor market	Occupied in economy, unemployed, compensation of hired workers
		Block 6: Scientific researches and innovations	Number of the organizations which are carrying out scientific researches and development, number of the personnel, internal costs of scientific researches and development, the volume of the shipped innovative goods, works, services
		Block 7: Infrastructure	Amount of works, executed by the form an economic activity "construction", commissioning of highways, the volume of communication services all
		Block 8: Ecology	Emissions of the polluting substances in atmospheric air, dumping of the polluted sewage in superficial water objects
FEA efficiency Direct criterion of efficiency: coefficient of social and economic return of foreign trade activities (MEF): MEF = ME/FEA Indirect criterion: coefficient of the external economic safety (KFS): KFS = ME/SED×100% which has threshold value (thKFS) FEA efficiency: $\begin{cases} MEF \rightarrow max \\ KFS \geq {}^{th}KFS \end{cases}$			

Fig. 1: FEA efficiency assessment system (offered by researcher)

Table 1: Methodology to calculate FEA efficiency assessment indicators for macro and meso-economic systems (offered by the researcher)

Stages	Content of calculations	Instruments of realization	Mathematical description of calculations and their results
Phase 1 (Model FEA impact on the social and economic development)			
1	Choose, justify and formalize a set of numerical values which will describe FEA parameters in full including the factors of social and economic development of the territory being directly influenced by the latter	Formation of numerical massifs	$^{1}FEA_{m,p} = \{fea_{ij}\}_{m,p}$ $SED_{s,p}$ $\{sed_{ij}\}_{s,p}$ (1) where, FEA: indicators of foreign trade activities; SED: indicators of social and economic development; p: time period; m, s: number of indicators of foreign economic activity and social and economic development respectively (for their foreign economic activity there will be no more than four: EX, IM, FI, IA; for social and economic development about thirty, namely indicators of PR, F, L, EG, PLL, SRI, INFR, ECO blocks)
2	Transition to absolute changes of indicators	Arithmetic calculations, formation of the numerical mass $FEA_{m,y}$ $\{fea_{ij}\}_{m,y}$	$\Delta SED = sed_i\text{-}sed_{i-1}$; ΔFEA if $= fea_i\text{-}fea_{i-1}$ $^{2}SED_{s,y} = \{sed_{ij}\}_{s,y}$ (2) where y: time period, y = p-1
3	The analysis of the selected statistical data to detect dependence between foreign trade activities and indicators of social and economic development, determination of its quality and selection of the most relevant communications	Correlation analysis	$r = \overline{cov(XY)}/S_x \times S_y$ where: r-coefficient of linear correlation of Pearson, $\overline{cov(XY)}$ selective coefficient of covariance, S_x, S_y selective mean square deviations $^{3}SED_{l,y} = \{^{2}SED_{s,y} \mid r \geq 0.5;\ p \geq 0.05\}$ (3) where l-number of indicators of social and economic development
4	Research of relationship of cause and effect between indicators of social and economic development and foreign economic activity	Granger Causality Method	$X_t = \varphi_0 + \sum_{i=1}^{m} \alpha_i X_{t-i} + \sum_{i=1}^{m} \beta_i Y_{t-i} + \varepsilon_t$, $Y_t = \kappa_0 + \sum_{i=1}^{m} \chi_i Y_{t-i} + \sum_{i=1}^{m} \delta_i X_{t-i} + \nu_t$ where, X, Y: changes, causal relationships between which are investigated (in our case SED and FEA indicators, respectively) φ_0, κ_0: free members, α_i, β_i, χ_i, δ_i: autoregression coefficients, ε_t, ν_t: errors of measurements. $SED_{n,y} = \{^{3}SED_{l,y} \mid \delta_i = 0\}$ (4), where n: number of indicators of social and economic development
5	Creation of system of regression equations reflecting dependence of social/economic development from the FEA	Regression analysis	$SED_n = F(FEA_m)$ (5)
Phase 2 (Diagnosis of FEA effects and efficiency)			
1	Definition of indicators of sensitivity of change of social and economic development to variability of foreign economic activity	Definition of a derivative for the regression equations, formation of the numerical massif following form	$S_{FEA_i}^{SED_i} = f'(x) = dy/dx$ where, $S_{FEA_i}^{SED_i}$: an indicator of sensitivity of change of social and economic development to variability of foreign economic activity. $S_{z,1} = \{s_{ij}\}_{z,1}$, it has the

Table 1: Continue

Stages	Content of calculations	Instruments of realization	Mathematical description of calculations and their results
			$SED_1 \begin{bmatrix} S_{FEA_1}^{SED_1} \\ \cdots \\ S_{FEA_1}^{SED_i} \end{bmatrix}$ (6)
2	Definition of indicators of effect of foreign economic activity	Arithmetic calculations, formation of the numerical massif	$ME_{FEA_i}^{SED_i} = S_{FEA_i}^{SED_i} \times fea_{ij}$, $fea_{ij} \in FEA_{y,m}$ where $ME_{FEA_i}^{SED_i}$: effect of a separate type of foreign trade activities on the corresponding indicator of social and economic development, $S_{FEA_i}^{SED_i}$: coefficient of sensitivity of change of the corresponding indicator of social and economic development to variability of foreign trade activities, fea_{ij}: value of the corresponding indicator of change of foreign trade activities in j-year $ME_{z,y} = \{me_{ij}\}_{z,y}$ with the specification of types of foreign trade activities in a section of the studied temporary period has an appearance: $MEF_{FEA_1}^{SED_1} \begin{bmatrix} {}^{y_1}me_{FEA_1}^{SED_1} & \cdots & {}^{y_j}me_{FEA_1}^{SED_1} \\ \vdots & \vdots & \vdots \\ {}^{y_1}me_{FEA_i}^{SED_i} & \cdots & {}^{y_j}me_{FEA_i}^{SED_i} \end{bmatrix}$ (7), where y: the time period
3	Definition of indicators of return of foreign economic activity	Arithmetic calculations, formation of the numerical massif	$MEF_{FEA_i}^{SED_i} = ME_{FEA_i}^{SED_i} / FEA(i)_{m,p}^{1}$, $MEF_{z,y} = \{mef_{ij}\}_{z,y}$ has an appearance $MEF_{FEA_1}^{SED_1} \begin{bmatrix} {}^{y_1}mef_{FEA_1}^{SED_1} & \cdots & {}^{y_j}mef_{FEA_1}^{SED_1} \\ \vdots & \vdots & \vdots \\ {}^{y_1}mef_{FEA_i}^{SED_i} & \cdots & {}^{y_j}mef_{FEA_i}^{SED_i} \end{bmatrix}$ (8)
4	Determination of coefficient of the external economic safety	Arithmetic calculations, formation of the numerical massif	$KFS_{FEA_i}^{SED_i} = \left\lvert ME_{FEA_i}^{SED_i} \right\rvert / FEA(i)_{m,p}^{1} \times 100\%$.$MEF_{z,y} = \{mef_{ij}\}_{z,y}$ has an appearance: $KFS_{FEA_1}^{SED_1} \begin{bmatrix} {}^{y_1}kfs_{FEA_1}^{SED_1} & \cdots & {}^{y_j}kfs_{FEA_1}^{SED_1} \\ \vdots & \vdots & \vdots \\ {}^{y_1}kfs_{FEA_i}^{SED_i} & \cdots & {}^{y_j}kfs_{FEA_i}^{SED_i} \end{bmatrix}$ (9)
5	Determination of threshold value of coefficient of the external economic safety	Expert assessment, formation of the numerical massif	${}^{tv}KFS_{z,1} = \{{}^{tv}kfs_{ij}\}_{z,1}$ has an appearance: $SED_1 \begin{bmatrix} FEA_i \\ KFS_{FEA_1}^{{}^{tv}SED_1} \\ \cdots \\ KFS_{FEA_i}^{{}^{tv}SED_1} \end{bmatrix}$ (10)

assess the complex of FEA effects by applying the tools of co-integration, correlation and regressive analysis as well as a step out analysis.

The objective of this model is to empirically assess FEA effects and efficiency for macro and meso-economical systems. The methodology comprises two phases (Table 1).

Model FEA impact on the social and economic development. Towards this end it is necessary to choose, justify and formalize a set of numerical values which will describe FEA parameters in full, including the factors of social and economic development of the territory being directly influenced by the latter. Thereafter, it is required to select one-directed relevant connections between the researched parameters (correlation analysis, Granger Causality Method) to build a system of regression equations reflecting dependence of social/economic development from the FEA.

Diagnosis of FEA effects and efficiency. It is necessary to correlate the values of FEA social and economic outcome, the coefficients of FEA security and their threshold values; make a conclusion on FEA efficiency. It is also required to analyse the response of social-economic development to FEA changes (regressive analysis, differential calculus).

RESULTS AND DISCUSSION

The testing of the developed methodology was delivered with the use of the Russian Federation data for 1999-2013. The outcome of the exercises were used to state the differences in response to FEA changes in the areas exposed to a certain effect as well as the trends of FEA efficiency alteration during crises and stable growth.

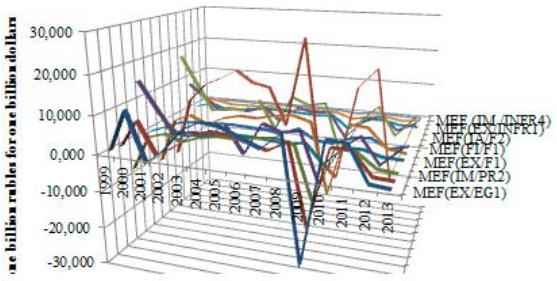
The indicate model of the RF FEA efficiency (Fig. 2) shows different degree of the FEA influence on the social and economic development: maximum influence financial indicators and indicators characterizing economic growth (GDP), production, infrastructure; medium influence indicators reflecting the sphere of

Model of dependence of parameters of social and economic development of the Russian Federation on foreign trade activities

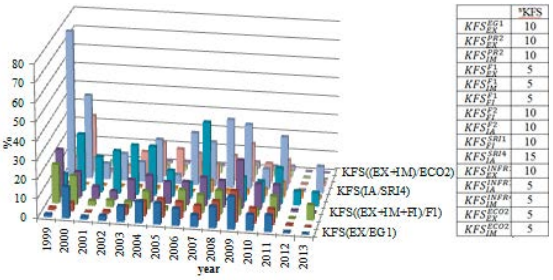
SED	FEA			
	Regression equation SED(FEA$_x$)	Fischer's criterion	Determination coefficient R^2	p-value
1	2	3	4	5
EG1	EG1=39,391·EX + 3063,542	44,659	0,78	0,00002
PR2	PR2=26,167·EX+16,954·IM+3209,124	6,4007	0,69	0,03274
PR4	PR4=17,8221·IA+504,4512	8,9451	0,61	0,02986
F1	F1=6,5474·EX+22,8613·IM+3,9170·FI+925,8113	16,445	0,82	0,00022
F2	F2=47,2186·FI+20,5040·IA+875,1482	7,8400	0,67	0,00664
SRI1	SRI1=3,8619· FI-67,5815	16,540	0,66	0,00133
SRI4	SRI4=9,5122IA+103,6602	11,583	0,67	0,00471
INFR1	INFR1=4,5304·EX+2,1781·IA+212,6127	13,913	0,699	0,00075
INFR4	INFR4=0,66143·IM+90,71573	5,0359	0,68	0,04287
ECO2	ECO2=0,011849·EX–0,00303·IM-1,27911	7,2928	0,65	0,00846

Условные обозначения

EG1	GDP
PR2	The volume of the shipped goods of own production, the performed works and services as own forces
PR4	Commissioning of fixed assets
F1	Income of the consolidated budget of the Russian Federation
F2	Deposits and deposits org. and physical. persons in rubles. And foreign currency, attracted with the credit organizations, on the end of the year
SRI1	Number of the organizations which are carrying out scientific researches and development
SRI4	The volume of the shipped innovative goods, works, services
INFR1	Amount of works, executed by the form economic activity "Construction"
INFR4	The volume of communication services - all
ECO2	Dumping of the polluted sewage in superficial water objects
EX	Export
IM	Import
FI	Foreign investments into economy of the Russian Federation
IA	Foreign investments of the Russian Federation



Returns indicators of foreign economic activity in Russia in 1999-2013.



Coefficients of the external economic safety in Russia in 1999-2013.

Fig. 2: The Russian Federation FEA Efficiency Model (offered by researcher)

scientific researches and innovations; minimum influence indicators characterizing environmental conditions. The indicators of the economic growth, production and financial sphere prove a stronger response to decrease of FEA scope than to its growth.

The negative effects caused by FEA decrease during crises are compensated by increase of the favourable influence in post-crisis period. Starting from 2010, FEA efficiency indicators demonstrate a tendency to decrease.

The subsequent statistical test and analytical verification of the indicative model of the RF FEA efficiency proved its adequacy, relevance to tendencies within the researched period and its correlation with the exiting values. In this case, it deals of high exposure of the production and finical sectors to foreign economic risks as well as of the recently observed weakening of the FEA potential as a factor of further intensive development of the economy.

CONCLUSION

The recent analysis proved that within the recent years the efficiency of the foreign economic activity showed a tendency to decrease. Starting from 2010, the parameters of the Russian social and economic development have ceased to response to increase of the FEA scope or foreign investments supply as was observed in early 2000's by significant growth. However, the elements of the Russian social and economic development still demonstrate high sensitivity towards decrease of the FEA scope. It proves that the current form (commodity, industry-specific and geographical structure) of the foreign economic activity ceased to be a driver of the economic growth. Within the contemporary economic and political global environment, the Russian foreign economic activity is the reason of economic growth suppression and a risk to the country economic security since economic welfare of the country is highly dependent from global prices and third parties' political decisions which further expose the economy to crisis developments.

In view of significance of foreign economic liaisons for Russia, it is currently of paramount importance to improve the efficiency of the foreign economic activity and to increase its favourable influence on the social and economic environment of the territories with the aim to mitigate possible negative effects.

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