Influence of Monetary and External Trade Shocks on Russian Economy*

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Relative productivities of Russian Economy in 2000-2010*

$y = -0{,}17x + 52{,}46$
$R^2 = 0{,}50$

$y = -0{,}16x + 50{,}75$
$R^2 = 0{,}53$

| ◆ Technological Productivity | ■ Value added Productivity |
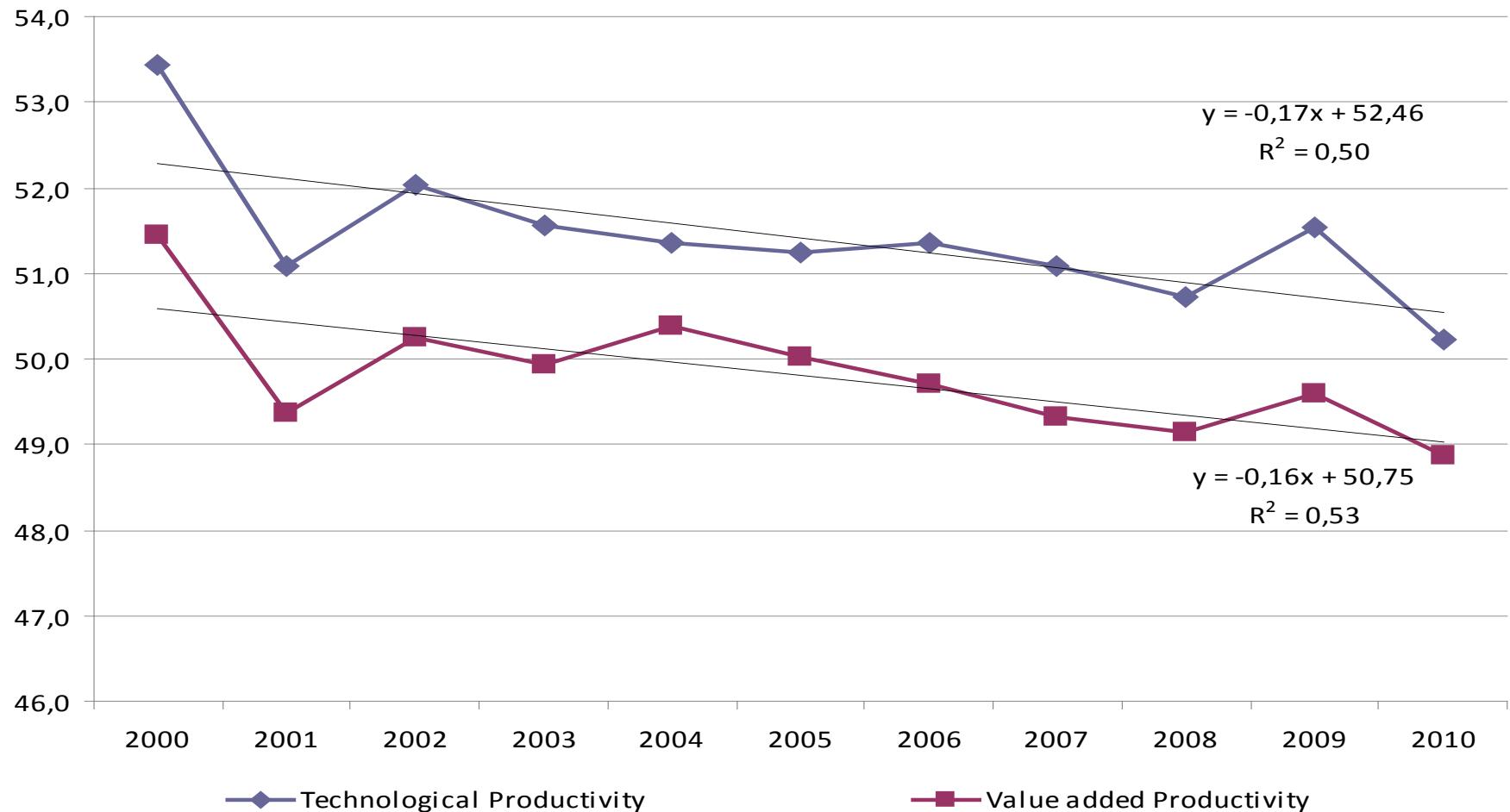
* Value-added relative productivity coefficients are based on official data. Technological relative productivity coefficients are estimated based on an assumption that technological input-output coefficients in 2003-2010 are constant.

Relative productivities of main branches of the Russian Economy, %

	2003		2010	
	FP to TO	VA to TO	FP to TO	VA to TO
Agriculture	44,6	55,3	35,3	51,9
Coal	21,9	34,7	17,7	46,2
Oil	57,9	72,2	42,5	68,1
Natural Gas	22,1	54,9	14,1	58,5
Other minerals	14,9	47,4	2,9	52,6
Food, beverages, etc.	56,5	25,1	55,8	29,3
Clothes	14,0	28,0	-18,4	39,7
Pulp industry	22,1	33,7	12,1	35,4
Oil refinery	46,6	19,0	47,2	26,2
Chemistry industry	7,9	24,8	16,9	30,3
Construction materials	-8,0	31,9	-23,8	30,8
Ferrous metallurgy	20,8	29,0	8,1	23,5
Non-ferrous metallurgy	35,9	37,5	30,5	31,0
Metal products	32,9	30,0	43,5	28,4
Machinery	32,9	31,2	24,4	29,5
Other industrial products	32,3	33,9	27,6	31,7

Relative productivities of main branches of the Russian Economy, %

	2003		2010	
	FP to TO	VA to TO	FP to TO	VA to TO
Energy	13,4	37,6	-1,1	35,7
Water supply	13,4	43,6	-17,9	52,5
Construction	81,5	49,4	84,6	42,7
Trade	58,8	71,8	66,4	62,1
Transport	41,6	51,2	32,2	47,2
Communication	47,3	54,2	67,3	63,1
Finance and Insurance	77,0	75,4	84,8	70,0
Real Estate and Consulting	77,0	34,9	77,6	67,8
R&D	26,8	45,8	0,7	46,5
Education	97,1	59,1	96,5	73,9
Health, Culture, etc.	97,1	60,8	96,8	59,8
Utilities	53,1	56,2	45,2	51,4
Total Economy	**51,6**	**49,9**	**50,2**	**48,9**
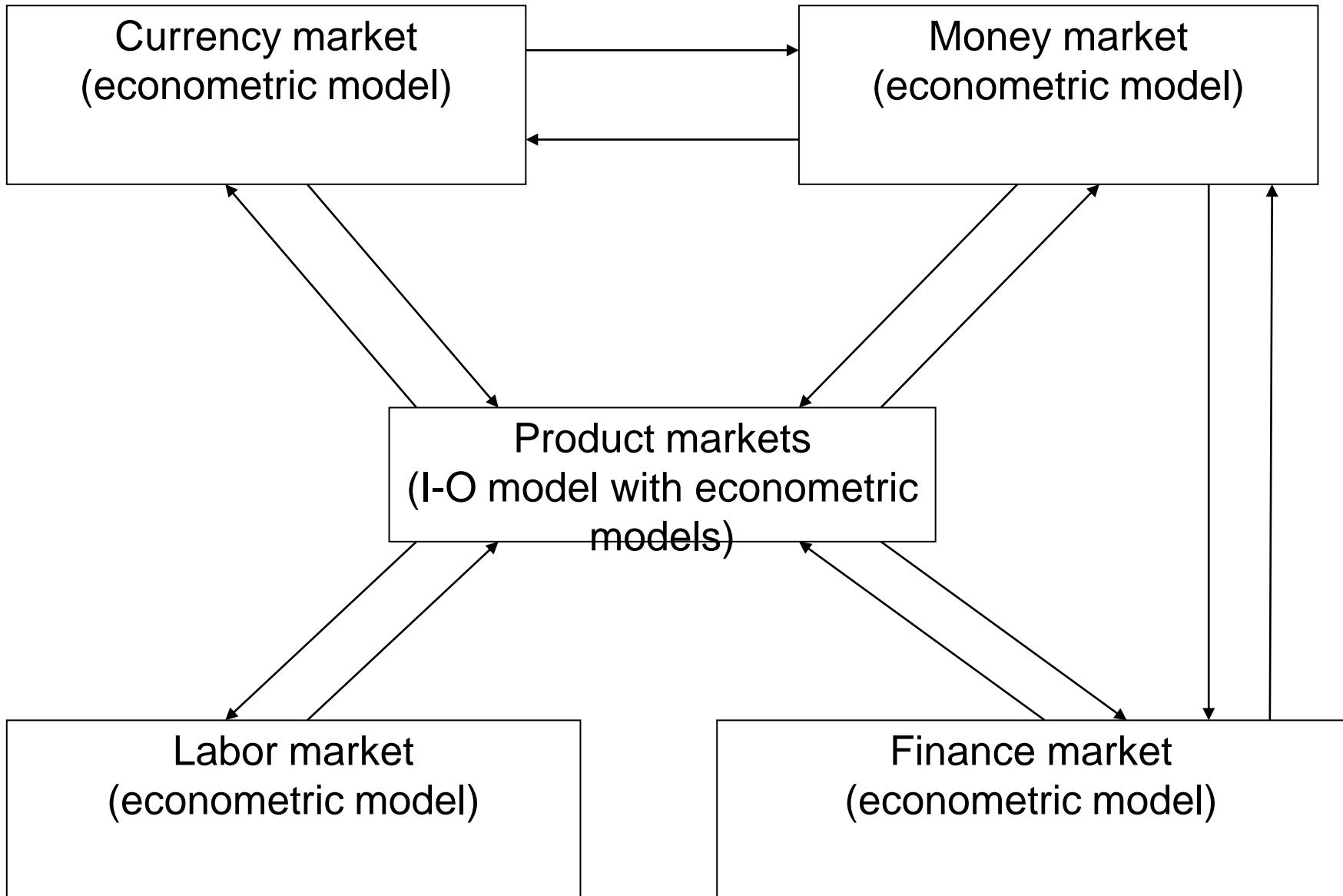
Scheme of development of IO-GE Model of the Russian Economy

Description of the Model

The core of the Model is a quarterly Dynamic IO Model. The last one has inward and backward links with econometric models, which describes aggregated markets (currency and money markets in current version of the Model). Links between IO model and econometric models of aggregated markets are based on the making of some key variables of aggregated markets (such as exchange rate and interest rate) endogenous.

$$dx_{i,t} = \sum_{k=1}^{K} e_{i,k} \cdot \varphi_{k,t}, \qquad i = 1,..,n$$

where

n – Number of branches (in this Study n = 28);

K – Number of variables of aggregated markets (in this Paper K = 3);

dxi,t – change in total output of branch i in quarter t to last year (quarter t-4), i=1,..,n;

ei,k – elasticity of total output of branch i to variable of aggregated markets k;

φk,t – change in variable of aggregated markets k in quarter t (with assuming a lag).

The final product of branch i in quarter t (yi-,t) can be obtained from traditional IO balance equations:

$$x_{i,t} = \sum_{j=1}^{n} a_{i,j} \cdot x_{j,t} + y_{i,t}, \qquad i = 1,...,n$$

$$x_{i,t} = (1 + dx_{i,t}) * x_{i,t-4}, \qquad i = 1,...,n$$

Elasticities of the branch total output to macroeconomic variables in the Russian Economy

	Real exchange rate (Rub in USD)	Real wage	Real interest rate	R^2
Agriculture	-0,06 (1)		-0,19 (3)	0,20
Coal	0,95 (0)	-0,58 (0)	1,16 (0)	0,63
Oil		0,26 (0)	0,30 (0)	0,17
Natural Gas	-0,44 (4)	0,53 (0)	-0,28 (0)	0,78
Other minerals	-0,25 (4)		-0,54 (0)	0,30
Food, beverages, etc.	-0,10 (4)	0,41 (0)		0,63
Clothes	-0,30 (4)	0,51 (0)	-0,26 (0)	0,65
Pulp industry	-0,31 (4)	-0,07 (0)	-0,58 (0)	0,83
Oil refinery			-0,20 (0)	0,25
Chemistry industry	-0,39 (4)	-0,06 (2)	-0,60 (0)	0,61
Construction materials	-0,30 (4)	1,20 (0)	-0,67 (0)	0,79
Ferrous metallurgy	-1,10 (3)	0,36 (0)	-0,96 (3)	0,81
Non-ferrous metallurgy	-0,27 (4)	0,46 (0)	-0,47 (0)	0,68
Metal products	-0,45 (4)	0,46 (0)	-0,50 (0)	0,65
Machinery	-0,57 (4)	0,79 (0)	-1,43 (0)	0,62
Other industrial products	-0,11 (4)		-0,56 (0)	0,71

Elasticities of the branch total output to macroeconomic variables in the Russian Economy

	Real exchange rate (Rub in USD)	Real wage	Real interest rate	R^2
Energy	-0,13 (4)		-0,34 (0)	0,49
Water supply	-0,13 (4)		-0,34 (0)	0,49
Construction	0,15 (4)	0,75 (0)	-0,75 (0)	0,61
Trade	0,06 (3)	0,67 (0)	-0,43 (0)	0,92
Transport		0,41 (0)	-0,40 (1)	0,53
Communication		0,41 (0)	-0,40 (1)	0,53
Finance and Insurance	-0,27 (2)	1,28 (0)	-1,08 (2)	0,86
Real Estate and Consulting	-0,30 (1)	1,02 (0)	-0,79 (1)	0,62
R&D	0,08 (4)	0,47 (0)	-0,20 (0)	0,76
Education		0,14 (0)		0,59
Health, Culture, etc.		0,08 (0)		0,41
Utilities	0,06 (4)	0,30 (0)	-0,33 (0)	0,78

A model of money market

A model of money market is based on the Baumol-Tobin model. Based on quarterly statistics for 2003-2011 we've estimated following econometric model:

$\text{Ln}((1+IRN_t)/(1+IRN_{t-4}) = -0,02+0,16*\text{Ln}(P_{t-4}/P_{t-8}) - 0,08* \text{Ln}(M_t/M_{t-4}) + 0,16* \text{Ln}(X_{t-5}/X_{t-9})$, $R2 = 80,2$

where

IRN_t – average nominal Interest Rate in period t;

P_t – Total Output's Deflator in period t;

M_t – Money Supply in period t;

X_t – Total Output in constant prices in period t.

A model of currency market

A model of currency market describes nominal Exchange Rate of the Russian Rouble to USD (ExRNt) and based on estimations of currency inflows and outflows in a balance of payment of Russia.

Import of goods and services (*Imt*) is defined by its share in total output in current prices:

Ln(1+Imt/Pt*Xt) = 0,125 + 0,025*Ln(ExRRt /ExRRt-4), PV = 99,7%,

where ExRRt – real exchange rate of Russian Rouble to USD.

Export of goods and services (*Ext*) is defined by a normative equation:

Ext = ExNonO&Gt + OilPricet *ExpOilVolt /0,54, where

ExNonO&Gt – non oil&gas export in period *t*;

OilPricet – export price of Urals in period *t*, USD per barrel;

ExpOilVolt – export of Urals in period *t* (in barrels);

0,54 – average share of oil export in oil&gas export of Russia.

A model of currency market

A model of nominal Exchange Rate of the Russian Rouble to USD:

$\text{Ln}(\text{ExRNt}/\text{ExRNt-4}) = -0{,}04 +$

$+1{,}20*\text{Ln}(1+\text{dPrivateReservest}/\text{CurrenceInflowst}) -$

$-0{,}49*\text{Ln}(1+\text{dCurrenceInflowst}/\text{CurrenceInflowst}), R2 = 79{,}5\%,$

where

dPrivateReservest/CurrenceInflowst – relation of net currency changes in private sector to total currency inflows in period t.

dCurrenceInflowst/CurrenceInflowst – relation of net currency inflows to total currency inflows in period t.

Influence of one-percent change in macroeconomic variables on relative productivity of the Russian Economy (in percent)

	Real exchange rate (Rub in USD)	Real wage	Real interest rate
Total Russian Economy			
Total output	-0,03	0,27	-0,32
Final Product	0,01	0,25	-0,27
Change in productivity	0,02	-0,01	0,03
Industry			
Total output	-0,17	0,17	-0,35
Final Product	-0,29	-0,11	-0,16
Change in productivity	-0,04	-0,09	0,06
Extraction			
Total output	0,14	-0,25	0,25
Final Product	1,07	-0,33	1,78
Change in productivity	0,34	-0,03	0,57
Manufacture industry (without oil refinery)			
Total output	-0,27	0,34	-0,53
Final Product	-0,55	0,27	-0,61
Change in productivity	-0,09	-0,02	-0,03
Services			
Total output	0,08	0,37	-0,32
Final Product	0,12	0,40	-0,31
Change in productivity	0,03	0,02	0,01

Forecast of the Russian Economy in 2011-2025 (optimistic scenario)

	2010	2015	2020	2025
Exogenous parameters				
Urals export price, USD per barrel	86,2	119,1	131,5	145,1
Growth rate of nominal money supply to year 2010	1,00	2,06	3,48	5,25
Total output deflator to year 2010	1,00	1,49	1,90	2,19
Growth rate of real wage to year 2010	1,00	1,30	1,74	2,33
Endogenous variables				
Nominal exchange rate, Russian Roubles per USD	30,4	33,7	39,2	40,2
Nominal interest rate, in percent	10,8	7,6	4,3	1,8
Growth rate of real exchange rate USD per Russian Roubles to year 2010	1,00	1,19	1,15	1,14
Growth rate of real total output to year 2010	1,00	1,17	1,44	1,84
Growth rate of real GDP to year 2010	1,00	1,16	1,41	1,78
Value added relative productivity, in percent	48,9	48,8	48,1	47,2

Forecast of the Russian Economy in 2011-2025 (pessimistic scenario)

	2010	2015	2020	2025
Exogenous parameters				
Urals export price, USD per barrel	86,2	101,6	92,0	83,4
Growth rate of nominal money supply to year 2010	1,00	1,74	2,49	3,29
Total output deflator to year 2010	1,00	1,55	2,19	2,86
Growth rate of real wage to year 2010	1,00	1,18	1,37	1,59
Endogenous variables				
Nominal exchange rate, Russian Roubles per USD	30,4	35,3	45,6	51,3
Nominal interest rate, in percent	10,8	9,0	7,2	5,4
Growth rate of real exchange rate USD per Russian Roubles to year 2010	1,00	1,18	1,14	1,17
Growth rate of real total output to year 2010	1,00	1,11	1,25	1,43
Growth rate of real GDP to year 2010	1,00	1,11	1,24	1,40
Value added relative productivity, in percent	48,9	49,0	48,5	47,8

Thank you for your Attention!