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Svetlana Ledyaeva and Mikael Linden

Foreign direct investment and economic growth:

Empirical evidence from Russian regions

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China in the world economy
Pekka.Sutela@bof.fi

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Russian economy and economic policy
Private sector development
Tuuli.Juurikkala@bof.fi

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Chinese economy and economic policy
Juuso.Kaaresvirta@bof.fi

Ms Tuuli Koivu, economist
Chinese economy and economic policy
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Tuuli.Koivu@bof.fi

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Iikka.Korhonen@bof.fi

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Aaron.Mehrotra@bof.fi

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Russian economy and economic policy
Russian industrial policy
Simon.Ollus@bof.fi

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Heli.Simola@bof.fi

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Russian regional issues
Public economics
bofit@bof.fi

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Russian regional issues
Merja.Tekoniemi@bof.fi

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Ms Tiina Saajasto, information specialist
Information services
Tiina.Saajasto@bof.fi

Contact us

Bank of Finland
BOFIT – Institute for Economies in Transition
PO Box 160

Phone: +358 10 831 2268
Fax: +358 10 831 2294
E-mail: bofit@bof.fi

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Contents

Svetlana Ledyaeva and Mikael Linden *

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Abstract

Barro and Sala-I-Martin empirical framework of neoclassical Solow-Swan model is specified to determine the FDI impact on per capita growth in 74 Russian regions during period of 1996-2003. The Arellano-Bond GMM-DIFF methodology, developed for dynamic panel data models, is used in estimations. Results imply that in general FDI (or related investment components) do not contribute significantly to economic growth in Russia in the analyzed period. Regional growth in 1996-2003 is explained by the initial level of region's economic development, the 1998 financial crisis, domestic investments, and exports. However some evidence of positive aggregate FDI effects in higher-income regions is relevant. Another interesting result is that natural resource availability seems to be growth-inducing in rich regions, while in poor regions it is not significant. We also found convergence between poor and rich regions in Russia. However FDI seems not to play any significant role in the recent growth convergence process among Russian regions.

Key words: Foreign Direct Investment (FDI), Russian regional economy, and economic growth
JEL Classification: E22, F21, P27

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*Contact information: Department of Business and Economics, P.O. Box 111, FIN-80101 Joensuu, University of Joensuu, Finland. Emails: ledyaeva@joyx.joensuu.fi, mika.linden@joensuu.fi.

Svetlana Ledyaeva and Mikael Linden

Foreign direct investment and economic growth: Empirical evidence from Russian regions

Tiivistelmä

Tässä tutkimuksessa selvitetään ulkomaisten suorien sijoitusten vaikutusta talouskasvuun 74 alueella Venäjällä vuosina 1996–2003. Tutkimuksessa käytetään Barron ja Sala-i-Martinin empiiristä versiota uusklassisesta Solowin ja Swanin kasvumallista. Mallin estimoinnissa käytetään Arellanon ja Bondin GMM-DIFF-metodologiaa. Tulosten mukaan suorat ulkomaiset sijoitukset eivät ole kiihdyttäneet kasvua Venäjällä. Alueiden kasvua näyttävät selittävän kunkin alueen henkeä kohden laskettu bruttokansantuote periodin alussa, vuoden 1998 talouskriisin vaikutukset, kotimaiset investoinnit ja vienti. Rikkailla alueilla ulkomaiset suorat sijoitukset saattavat auttaa kasvua. Raaka-aineiden suuri osuus taloudesta näyttää kiihdyttävän kasvua rikkailla alueilla, kun taas köyhemmillä alueilla se hidastaa kasvua. Tuloksien mukaan Venäjän köyhät alueet saavuttavat rikkaampia alueita, mutta ulkomaisilla suorilla sijoituksilla ei näytä olevan tekemistä tämän prosessin kanssa.

Asiasanat: ulkomaiset suorat sijoitukset, Venäjän aluetalous, taloudellinen kasvu

1 Introduction

In general foreign financing is considered an important engine of economic growth, as it helps to cover the gap between actual investment in the economy and investment needed to sustain economic growth. A huge literature exists concerning different effects of foreign investment on economic development in a recipient economy. Some of this literature focuses on the foreign direct investment (FDI) impact on economic growth. Currently FDI sustains the most dynamic development in the world economy in comparison with other forms of foreign financing. Most theoretical and empirical findings (see Section 2) imply that FDI has a strong positive growth impact on the recipient economy. However, the Russian economy is a unique case, not because it is a transition economy and is quite large, but because during last 15 years the country has not managed to attract significant amounts of FDI (Ledyaeva and Linden 2006). Typically investment risks are so high in Russia that only high profits in export oriented extractive industries (e.g. fuel industry) have attracted foreign investors.

On the general level, export oriented FDI into resource industries may have both positive and negative effects on economic growth. Positive effects may be due to technological spillovers, employment effects, and productivity improvements. Negative effects from resource FDI may occur if the exporting of resources retards the development of domestic industries. Also repatriation of profits from resource exports to the countries of origin of foreign investors negatively influences growth prospects in the host economy.

FDI into other industries in Russia has been modest and concentrated mostly in the trade, food, catering, beverages, and tobacco industries. Note that all these industries have the market structure of monopolistic competition. Markusen and Venables (1999) developed an influential model of FDI effects on domestic firms' performance under monopolistic competition. Barrios, Görg, and Strobl (2005) made further developments to this model and tested it empirically. According to their findings, when FDI amounts are low, the negative competition effects of FDI on development of domestic firms are larger than the positive linkages effects.

For the Russian economy the question of aggregate FDI impact on economic growth remains an open question. This paper attempts to find some answers. To the best of our knowledge there is no extant study on aggregate FDI effects on economic growth in Russia. This study is based on the empirical framework of the neoclassical Solow-Swan model suggested by Barro and Sala-I-Martin (1995). GMM-DIFF methodology developed by Arellano and Bond (1991) for dynamic panel data models is used to control for endogeneity problems found in growth empirics. Following the simple idea of Blomström et al. (1994, p.17) that “the higher income developing countries are (…) the likeliest candidates for spillovers as they have local firms that are advanced enough to learn from the foreigners”, we also divide the sample of Russian regions into two sub-samples of high and low income regions.

The novelty of our study is also that we use Oaxaca-Blinder decomposition methodology to examine the extent to which differences in growth rates between sub-samples can be explained by differences in specified factors of economic growth. According to neoclassical theory lower-income countries tend to grow faster than higher-income countries. The Oaxaca-Blinder decomposition helped us to find further evidence on the factors of convergence between lower-income and higher-income regions in present day Russia.

The reminder of the paper is constructed as follows. Section 2 reviews theoretical and empirical issues on the topic, Section 3 describes the data, empirical model, and its theoretical foundations, Section 4 describes the methodology, Sections 5 summarizes the empirical results, and Section 6 concludes.

2 FDI and economic growth: Some theoretical and empirical issues

2.1 Theoretical issues

Dunning and Narula (1996) were among the first to develop a theoretical model of the relationship between net FDI position of a host country and the country’s economic development. According to their theory of “Investment Development Path”, FDI transfers new technologies and capital for sustaining the host countries positive economic development. The theory of endogenous economic growth (see eg Jones, 1998) gave rise to an explanation of the positive role of FDI in economic development through the existence of positive externalities (FDI spillovers).

One of the most important features of neoclassical growth theory is diminishing returns on capital formation. Thus, investment may stimulate economic growth only in the short run while the economy is shifting from one short-run equilibrium to another. The only source of long-term economic growth is technological progress, which is considered to be independent of investment activities. However in endogenous growth theory, the diminishing returns on investment can be avoided if there are positive externalities associated with investments. For example, technological spillovers occur when technological knowledge obtained through investment in one company stimulates technological development in other companies. Therefore the total return on investment will be higher and marginal productivity of capital will not necessrily decrease with an increase of the capital-to-output ratio (see eg Oxelheim, 1996). If investment brings enough new knowledge and technologies, it can lead to long-run economic growth. As typically FDI brings new technologies and knowledge, in accordance with endogenous growth theory, it can be viewed as a catalyst of long-term economic growth in a host economy.

Borensztein, Gregorio and Lee (1998) introduced a theoretical model for an economy where technological progress is a result of capital deepening in the form of an increase in the number of varieties of capital goods available. Their model shows that FDI reduces the costs of introducing new varieties of capital goods, thus increasing the rate at which new capital goods are introduced and, furthermore, the effect of FDI on the growth rate of the economy is positively associated with the level of human capital. The hypothesis is supported by the empirical results. Gries (2002) provides a model for a small technologically backward economy integrated into world markets. Gries concludes that human capital endowment – not FDI – is the critical factor for the success of technological upgrading and the final technological position. FDI can only accelerate technological growth as long as the economy converges to a steady state.

Markusen and Venables (1999) developed a model that produced the following effects of inward FDI (i.e. multinational firms entry) on the industry's development under monopolistic competition: 1) the competition effect in the product and factor markets tends to reduce profits of local firms and forces them out of the market (so that multinational firms replace domestic firms), and 2) the linkage effects on supplier industries that reduce input costs and raise profits (encouraging the entry of new domestic firms). Barrios, Görg, and Strobl (2005), in the above framework, allow the coexistence of domestic firms and foreign multinationals. The model implies a U-shaped curve of the potential effect of FDI on the number of local firms in the host country.

2.2 Empirical issues

A large number of empirical studies have been done to test the theoretical propositions concerning FDI's role in host economy growth at the macro-level. Different app-roaches are used to estimate FDI impact on economic growth. Some of them are summarized in Table 1. The review of empirical literature on the topic allows us to distinguish three main approaches in the estimation of FDI impact on economic growth. First is the aggregate production function approach, second is the "core variable" approach, and the third is the dynamic panel data approach. The first two approaches are commonly used with cross-sectional or time-series data. Because our empirical study is based on panel data, we use the dynamic panel data approach here.

Table 1. Summary of empirical studies on FDI impact on economic growth: Some recent developments

Authors	Model and measure of FDI impact	Data type	Estimation method	Main results on FDI impact
Balasubramanyam, Salisu and Sapsford (1996)	Aggregate production function approach. The measure of FDI impact is FDI as a percentage of GDP	Cross-sectional data set on 46 countries, annual average over 1985 - 1997	OLS and GIVE	Growth enhancing effects of FDI are stronger in EP countries than in IS countries
Bende-Nabende and Ford (1998)	A simultaneous equa-tion model founded on a supply side approach to growth. The meas-ure of FDI impact: the difference operator of FDI flow	Time series data for Taiwan, 1959-1995	3SLS estimators	FDI promotes growth
Soto (2000)	Dynamic approach with control variables suggested by Barro and Sala-I-Martin (1995). The measure of FDI impact is FDI as a percent-tage of GDP	Panel data on 44 countries, 1986 - 1997	GMM-DIFF estimation	FDI presents positive and significant correlation with growth
Akinlo (2004)	Aggregate production func-tion approach.	Time-series data for Nige-	OLS with Error Cor-rection	Extractive FDI is not as

	The measure of FDI impact is the difference operator of foreign capital stock	ria, 1970-2001	Model	growth enhancing as manufacturing FDI
Alfaro, Chanda, Kalelmi-Ozcan, Sayek (2004)	Economic growth variable is regressed on FDI indicator and core variables. The measure of FDI impact is FDI as a percentage of GDP	Cross-sectional data for 71 countries, annual average over 1975 - 1995	OLS estimation	FDI alone plays ambiguous role in contributing to economic growth. However, count-ries with well-developed financial markets gain significantly from FDI
Durham (2004)	Economic growth variable is regressed on FDI flows indicator and the set of control variables. The measure of FDI impact: lagged FDI flow	Cross-sectional data set on 80 countries, 1979 - 1998	Extreme bound analysis	Results suggest that lagged FDI does not have direct, unmitigated posi-tive effects on growth.
Li and Liu (2005)	Economic growth variable is regressed on “core explanatory variables” and FDI measure. The measure of FDI impact: FDI as a percentage of GDP	Panel data set of 84 countries, 1970-1999	Random/Fixed effects estimation	Strong complementary connection between FDI and economic growth exists in both developed and developing countries
Laureti and Postiglione 2005)	Soto framework above. The measure of FDI impact: FDI as a percentage of GDP	Panel data set for 11 MED countries, 1990-2000	GMM-DIFF estimation	FDI variable is poorly significant in explaining growth

3. Empirical model and data

3.1. Theoretical background

Estimated model is derived from growth theory. The most basic version of the neoclassical Solow-Swan model (1956) establishes that

$$Y(t) = F(K(t), L(t), t) \quad (1)$$

$$\dot{k} = s \cdot f(k(t)) - n \cdot k(t) \quad (2)$$

where

Y(t) is total output at time t, *F(.)* is a first degree homogeneous production function *K(t)* is the stock of physical capital at time t , *L(t)* is the labor force at time t *t* gives the effects of technological progress, *k(t)=K(t)/L(t)* is capital per capita at time t, $\dot{k} = k(t)/dt$ is the derivative of *k*(t) with respect to time, *s* is the constant saving rate, *f(k(t))* is production per capita, and *n* is population growth rate.

It can be shown that this setting leads to the following per capita production growth rate γ_t,

$$\gamma_t = -\phi(k(t))y(t) + \phi(k(t))y^* \ , \quad \text{where } \gamma_t \equiv \frac{\dot{y}}{y(t)} \quad (3)$$

and *y(t)* is output per capita at date t. The steady state *y** depends on several variables, including the constant saving rate s and the population growth rate *n*. The form of the function $\phi(.)$ depends on the production function *F (.)* and on the parameters of the equation system (1) -(2).

In the special case where $F(.)$ is a Cobb-Douglas function. $\phi(k)$ is equal to $\phi(1-\theta)$, where θ is the share of capital in total production. In that case, (3) is a differential equation with the solution

$$y(t) = e^{-\lambda t} y(0) + (1 - e^{-\lambda t}) y^* \quad (4)$$

where $\lambda = \phi(1-\theta)$. λ is the convergence speed parameter. For a given steady state, the larger the parameter λ, the faster the economy converges to its steady state. If λ is 0, there is no convergence and the economy remains stuck at its initial output level y (0). If λ goes to infinity, the economy reaches its steady state instantaneously.

In order to estimate the described scheme in panel data regressions we use the empirical framework suggested by Barro and Sala-I-Martin (1995). This framework relates real per capita growth rate to initial levels of state variables, such as the stock of physical capital and the stock of human capital, and to control variables. The control variables determine the steady-state level of output in the Solow-Swan model. Following Barro and Sala-I-Martin (1995), we assume that a higher level of initial per capita GDP reflects a greater stock of physical capital per capita. Following Soto (2000), we also assume that the initial stock of human capital is reflected in the lagged value of per capita output in the short-run. The Solow-Swan model predicts that, for given values of the control variables, an equiproportionate increase in initial levels of state variables reduces the growth rate. Thus we can write the model of output per capita growth rate for our panel data set as

$$\frac{y_{it} - y_{i,t-1}}{y_{i,t-1}} = a y_{i,t-1} + X_{it}\beta + v_i + \tau_t + \varepsilon_{it} \qquad (5)$$

where $y_{i,t}$ is per capita gross regional output or product (GRP) in region *i* (*i=1,…,74*)[1] in period *t* (*t=1996,…,2003*), $y_{i,t-1}$ is (initial) per capita GRP in region *i* in period *t-1*, a is a negative parameter reflecting the convergence speed, $X_{i,t}$ is a row vector of control variables in region *i* during period *t* with associated parameters β, v_i is a region-specific effect, τ_t is a period-specific effect common to all regions, and ε_{it} is the model's error term.

If we assume that $\frac{y_{it} - y_{i,t-1}}{y_{i,t-1}} \approx \ln(y_{it} / y_{i,t-1})$, we can approximate equation (5) as

$$\ln(y_{it} / y_{i,t-1}) = a \ln y_{i,t-1} + \ln X_{it}\beta + v_i + \tau_t + \varepsilon_{it}. \qquad (6)$$

[1] Actually there are 89 regions in Russia. We exclude from the analysis the autonomous territories, which are included in other regions. These are Neneckij, Komi-Permyatckij, Hanty-Mansijskij, Yamalo-Neneckij, Dolgano-Neneckij, Evenkijskij, Ust-Ordynskij and Aginskij Buryatskij, and Koryakskij. Regions for which most data are missing, namely Ingushetiya, Chechnya, Kalmykiya, Alaniya, Mari-el and Chukotka, are also excluded.

Moving $lny_{i,t-1}$ from right-hand side to left-hand side, we obtain the dynamic panel data model

$$\ln y_{it} = (a+1)\ln y_{i,t-1} + \ln X_{it}\beta + v_i + \tau_t + \varepsilon_{it} \qquad (7)$$

Among the possible control variables suggested by Barro and Sala-I-Martin include measures of market distortions, domestic investment, degree of openness of the economy, financial development, and political instability. Following Soto (2000) it is assumed that variations in the measures of market distortions, financial development and political instability are small during the relatively short time span. Thus the effects of these variables will not be revealed in the time dimension, but will in the cross-region dimension. However these effects will be embodied in the country-specific effect, which disappears in the difference variable estimation methodology.

We use four control variables, which can be viewed as important factors in the Russian economy's regional development in the analyzed period. First we include a dummy variable for the year 1998, to control for the major financial crisis that occurred in Russia. The second variable is the natural logarithm of per capita investment in physical capital, $ln(I/N)_{i,t}$, in year-2000 prices[2]. According to the existing theory and most empirical findings we expect this to be positively related to the dependent variable. The fourth variable is the natural logarithm of per capita export, $ln(Exp/N)_{i,t}$, in million dollars at year-2000 prices. This variable was included to predict the positive contribution of the degree of openness of the economy to economic growth. The last variable, the natural logarithm of the resource index, $ln(NR/N)_{i,t}$ (for calculation details, see Appendix 1), was included because of the high dependence of Russian economy on natural resources. In accordance with the aggregate production function approach in the short run, the natural resources stock is positively related to economic growth and is treated as an additional input. As we operate with a short period of only 8 years (1996-2003) of the present transitory phase of the Russian economy, we expect this variable to have some importance for the Russian regional growth process.

In order to answer the main question of this paper we include the FDI indicator in the set of control variables. Foreign portfolio investment (*FPI*) and foreign credits (*FC*) measures are also included, the growth impacts of different kinds of foreign financing. We also use an aggregate foreign financing variable (*FF*), the sum of FDI, *FPI* and *FC*, in a separate specification. Therefore we have two specifications of model (6): one with the aggregate foreign financing variable and the other with three variables for types of foreign financing: *FDI, FPI* and *FC*. All variables are in per capita terms, in million dollars at year-2000 prices. Their description is represented in Table 2. The source of all data used is Russia's regions yearbooks published yearly by Goskomstat.

Table 2. Indicators of FDI capital inflow*

Variable	Description
$ln(FF/N)_{i,t}$	Natural logarithm of per capita aggregate foreign financing
$ln(FDI/N)_{i,t}$	Natural logarithm of per capita FDI
$ln(FPI/N)_{i,t}$	Natural logarithm of per capita FDI
$ln(FC/N)_{i,t}$	Natural logarithm of per capita other foreign investment (excluding FDI and FPI) [1)]

*) all variables are for region i =1,…,74 in period t =1996,…,2003 [1)] This category includes trade credits, credits of foreign governments, credits of international financial organizations and other types of foreign credits

4 Econometric methods

Empirical panel data studies on growth are generally carried out for periods of around 30 years, with five-year average observations (see eg Barro and Lee, 1994; Caselli, Esquivel and Lefort, 1996). Because of the relatively short transition period of the Russian economy (15 years) and because capital inflows into Russia have been registered by the state statistical authorities only since 1995, and as the data for all the other variables altogether are available only since 1996, our time period is limited to 8 years (1996-2003). Because of the short length of the sample, we use annual data instead of five-year data.

The OLS estimation of the panel data model with lagged dependent variable in the set of regressors produces biased coefficient estimates with small samples. The basic problem of using OLS is that the lagged dependent variable is correlated with the error term, as the dependent variable lny_{it} is a function of v_i, and it immediately follows that $lny_{i,t-1}$ is also a function of v_i. The fixed effect (FEM) and random effect (REM) estimators are also

[2] The transformation was done using the USA deflator, which is 100 for the year of 2000.

biased and inconsistent unless the number of time periods is large (for details, see eg Baltagi, 2002, pp. 129-131).

In order to cope with the above mentioned problems estimators based on the General Method of Moments (GMM) are employed, which are consistent for $N \to \infty$ with fixed *T*. We exploit the GMM-DIFF procedure of Arellano and Bond (1991), which calls for first differencing and using lags of the dependent and explanatory variables as instruments for the lagged dependent variable as a regressor. First-differencing the dynamic model (7) we obtain

$$\Delta \ln y_{it} = (a+1)\Delta \ln y_{i,t-1} + \Delta \ln X_{it}\beta + \Delta v_i + \Delta \tau_t + \Delta \varepsilon_{it} \quad (8)$$

where $\Delta v_i = 0$, $\Delta \tau_t = \tau$ (constant), and Δ denotes first difference. As the Arellano-Bond GMM-DIFF estimation results are identical for both specifications (6) and (7) we report only the results for model (6).

In general, the GMM estimator can be viewed as simultaneous estimation of a system of equations, one for each year, using different instruments in each equation and restricting the parameters to be equal across equations. First-differencing the equations removes the individual effects v_i, thus eliminating a potential source of omitted variables bias estimation, and removes the problems of series non-stationary. Note also that one of the advantages of using a dynamic model is that both short-run and long-run elasticities can be obtained.

As linear GMM estimators, the Arellano-Bond estimators have one- and two-step variants. Bond (2002, p.9-10) pointed out that: "…a lot of applied work using these GMM estimators has focused on results for the one-step estimator than the two-step estimator. This is partly because simulation studies have suggested very modest efficiency gains from using the two-step version, even in the presence of considerable heteroskedasticity… Simulation studies have shown that the asymptotic standard errors tend to be much too small, or the asymptotic t-ratios much too big, for the two-step estimator, in sample size where the equivalent tests based on the one-step estimator are quite accurate. Windmeijer (2000) provides a formal analysis of this issue, and proposes a finite-sample correction for the asymptotic variance of the two-step GMM estimator which is potentially very useful in this class of models." In our study we report two-step variants of the estimators (we also did one-step estimation, but as the results are quite similar we report only the two-step robust estimations). They are obtained using a finite-sample correction to the two-step covariance matrix derived by Windmeijer (2005).

GMM estimation has the further advantage that it can treat the explanatory variables as strictly exogenous, predetermined or endogenous. If we assume that explanatory variables (X_{nt}) are strictly exogenous (i.e. that $E(X_{nt}\xi_{ns})=0$ for all t, s = 1, 2, …, T) then the current and all lagged X_{it} are valid instruments for the lagged dependent variable as a regressor. If X_{nt} are assumed to be predetermined ($E(X_{nt}\xi_{nt})=0$ for all $t \le s$), then only $\left[X_{i1}, X_{i2}, \ldots X_{i,s-1}\right]$ are valid instruments. And, finally, if X_{it} are allowed to be endogenous $(E(X_{nt}\xi_{nt})=0$ for $t < s)$ then only $\left[X_{i1}, X_{i2}, \ldots X_{i,s-2}\right]$ are valid instruments. For further details, see e.g. Bond (2002) and Baltagi (2002, p. 129-136).

5 Results

5.1 Full sample results

The GMM-DIFF robust two-step estimation results are presented in Table 3. We report here the results under two assumptions: 1) the explanatory variables are strictly exogenous, and 2) the explanatory variables are endogenous. The correlation matrix of variables is represented in Appendix 2. Two statistics evaluate the validity of the instruments used. The Hansen statistic of over-identifying restrictions tests the hypothesis that the instruments are not correlated with the residuals. The hypothesis is essential for the consistency of the estimators. The Arellano-Bond methodology assumes also that there is no second order autocorrelation in the first difference errors. Arellano and Bond (1991) suggest a test for this. For all the estimated specifications we can reject the hypotheses that instruments are not valid (i.e. they correlate with residuals). No second order autocorrelation in the first difference residuals was found.

The calculated parameters a are negative, which indicates conditional convergence. The con-vergence is conditional, as it predicts higher growth in response to lower starting GRP per capita when the other explanatory variables are held constant. Dummy variable for financial crisis is negatively related to economic growth in Russian regions, as expected.

Table 3. GMM-DIFF two-step estimation results [2]. Dependent variable: GRP per capita growth rate in region i (i=1,…,74) in period t , (t=1996,…,2003)

Explanatory variables, X_{it}	Panel OLS [1]		X_{it} – strictly exogenous		X_{it} – endogenous	
	Aggregate foreign investment	Disaggregate foreign investment	Aggregate foreign investment	Disaggregate foreign investment	Aggregate foreign investment	Disaggregate foreign investment
Constant	0.211* (1.84)	0.30*** (2.65)				
$lny_{i,t-1}$, a	-0.473*** (-19.69)	-0.468*** (-19.49)	-0.656*** (-18.73)	-0.662*** (-18.01)	-0.732*** (-15.63)	-0.736*** (-17.34)
D_{1998}	-0.206*** (-8.97)	-0.203*** (-8.8)	-0.088*** (-5.2)	-0.09*** (-5.71)	-0.052** (-2.49)	-0.045** (-2.39)
$ln(I/N)_{i,t}$	0.361*** (17.65)	0.365*** (18.21)	0.607*** (22.02)	0.596*** (22.38)	0.732*** (20.4)	0.708*** (21.06)
$ln(Exp/N)_{i,t}$	0.036*** (4.13)	0.034*** (3.69)	0.042** (2.3)	0.048*** (2.99)	0.074* (1.91)	0.092*** (2.64)
$ln(NR/N)_{i,t}$	-0.003 (-0.58)	-0.002 (-0.44)	-0.002 (-0.87)	-0.004* (-1.78)	-0.007* (-1.71)	-0.006 (-1.37)
$ln(FF/N)_{i.t}$	-0.001 (-0.55)		-0.001 (-0.94)		0.001 (0.52)	
$ln(FDI/N)_{i,t}$		-0.0002 (-0.3)		0.0004 (0.43)		0.00001 (0.01)
$ln(FPI/N)_{i,t}$		0.001*** (3.45)		0.0003 (0.66)		-0.0001 (-0.07)
$ln(FC/N)_{i,t}$		-0.001** (-2.54)		-0.001** (-2.48)		-0.003* (-2.05)
Number of obs.	508	508	429	429	429	429
Adjusted R^2	0.68	0.69				
Jarque-Bera N-test (p-value)	32.3 (0.00)	31.8 (0.00)				
White's test (p-value) [3]	70.44 (0.00)	90.14 (0.00)				
M1 (p-value) [4]			-4.05 (0.00)	-3.92 (0.00)	-3.62 (0.00)	-3.42 (0.00)
M2 (p-value) [5]			-1.47 (0.14)	-1.45 (0.15)	-1.40 (0.16)	-1.22 (0.22)
Hansen test (p-value) [6]			67.17 (0.57)	71.26 (0.97)	49.7 (0.68)	60.3 (0.89)
Instrument number			57 [7]	74 [7]	44 [8]	62 [8]

Note: z-statistics in parentheses (for OLS, t-statistics); *, **, *** denote 10, 5 and 1 % significance, respectively. 1) OLS: Heteroskedasticity-consistent standard errors. 2) Estimated with a finite-sample correction to the two-step covariance matrix, as in Windmejer (2005). 3) White's heteroskedasticity test, H_0: No heteroskedasticity in the residuals. 4) Arellano – Bond test of first-order autocorrelation, H_0: No first order-autocorrelation. 5) Arellano – Bond test of second-order autocorrelation, H_0: No second order autocorrelation. 6) Hansen test of overidentified restrictions: H_0: Instruments not correlated with residuals. 7) Dependent variable lagged 2 periods. Explanatory variables in current period and lagged 1 and 2 periods. 8) Dependent variable lagged 2 periods. Explanatory variables lagged 2 and 3 periods.

From the results we also conclude that the most important factor of economic growth in Russian regions in the analysed period was domestic investment, $ln(I/N)$, a typical result in the theoretical and empirical literature. The export variable, $ln(Exp/N)$, also exhibits a positive and significant impact on economic growth, albeit the magnitude of the coefficient is considerably smaller than that of domestic investment. The foreign credit variable is surprisingly negatively related to economic growth. This may indicate that regional authorities do not use foreign credits effectively. However the positive contribution of the foreign credits variable to regional economic development may appear with a considerable time lag, as foreign credits are usually used for infrastructure development and social programs. Moreover regions with lower economic growth tend to take more loans and credits in order to improve their development situation. Thus a negative relationship between foreign credits and economic growth may reflect this tendency. No other variables show any evident statistical relationship with the dependent variable.

Foreign investment (both direct and portfolio) seems not to be important for Russian economic development in the analysed period. The result may be due to their small amounts. The insignificance of foreign direct investment may be explained also by its inefficient industrial distribution across industries, as pointed out above.

Natural resources themselves do not necessarily enhance economic growth in the short-run. But still domestic investment in resource industries may be quite productive, especially if it is associated with exports. Thus resources may positively influence economic growth through investment and export variables.

It is well known that crude oil dominates Russian exports. Taking into account the rising trend in world oil prices in the analysed period, one could say that oil resource availability is an important factor in short-run economic growth in Russia. To test this hypothesis we replace the Resource Index with the oil variable in the estimation of specification with disaggregate foreign investment. The oil variable is calculated as

$$OilR_{it} = \frac{Oil_{it}}{\overline{Oil_t}} \tag{9}$$

where Oil_{it} is per capita crude oil production, including gas condensate, in thousands of tonnes in region *i* (i=1,…,74) in time *t* (1997,…,2003). $\overline{Oil_t}$ is the average value of the indicator for the Russian regions in year t. As the estimated coefficients of all the other explanatory variables including the lagged dependent variable, do not change much we report here only the coefficients for the oil variable. To show the robustness of the results, we report both one-step and two-step estimators under the three assumptions, namely with the explanatory variables treated as strictly exogenous, predetermined and endogenous. For all the estimated specifications, we can reject the hypothesis that the instruments are not valid (correlate with residuals). No second order autocorrelation in the first difference residuals were found. The results are presented in Table 4.

Table 4. GMM-DIFF one-step and two-step estimation results for the oil variable. Dependent variable: GRP per capita growth rate in region i (i=1,…,74) in period t (t=1996,…,2003)

Explanatory variables, X_{it}	Panel OLS [1)]	X_{it} – strictly exogenous		X_{it} – predetermined		X_{it} – endogenous	
		One-step	Two-step [2)]	One-step	Two-step [2)]	One-step	Two-step [2)]
$ln(OilR/N)_{it}$	-0.001*** (-3.15)	0.002 (1.28)	0.002 (1.28)	0.007 (1.12)	0.006 (1.00)	0.012 (1.41)	0.011 (1.21)

Note: z-statistics in parentheses (for OLS, t-statistics); *, **, *** denote 10, 5 and 1 % significance, respectively.

1) OLS – Heteroskedasticity-consistent standard errors.
2) Estimated with finite-sample correction to two-step covariance matrix, as in Windmejer (2005).

From the results, we conclude that there is no evidence that oil availability in a region contributes significantly to economic growth in Russian regions. But again oil production may positively influence economic growth in Russia through domestic investment and the export variables. Note that *corr[ln(EXP/N), ln(NR/N)] = 0.313* and *corr[ln(EXP/N), ln(OILR/N)] = 0.175* (see App. 2). Thus if oil prices, not oil production volume, dominate the natural resource growth effects, the above results are in part understandable.

5.2 High-income regions versus low-income regions: Does FDI impact on economic growth depend on absorptive capacity in Russian regions?

Durham (2004, p.3) notes that “more extensive studies with augmented growth specifications generally do not report significant unqualified statistical relations between FDI flows and real variables. Rather, studies suggest that whether FDI enhances growth is contingent on additional factors within the host country.” These factors include financial development, legislation, property rights, human capital availability, etc. and form the countries absorptive capacity for foreign investment. Durham himself emphasizes the importance of institutional and financial factors. Keller (1996) emphasizes the role of labor force skills and trade liberalization in determining the absorptive capacity for technology implementation. Krogstrup and Matar (2005) look at FDI and growth via absorptive capacity in the Arab world in terms of four different aspects of absorptive capacity: technological gap, level of workforce's education, financial development and institutional quality. The results turn out to be highly sensitive to the specific measure of absorptive capacity used. But still there is no consensus in the literature on the exact combination of determinants of absorptive capacity.

We follow the simple logic of Blomström et al (1994, p.16) who point out that the lagging countries “gain relatively little from contacts with foreign firms because there is so little local infrastructure for absorbing foreign influences and that the proposition is difficult to test because it is not clear what characteristics of a country would place it inside or outside the lagging countries”. They divided the targeted countries (in their case developing countries) into higher- and lower-income countries. Similarly we divide Russian regions into two sub-samples on the basis of the average GRP per capita for the regions in the period 1996-2003. The first sub-sample consists of regions with above-average GRP per capita value, and second sub-sample corresponds to lower-income regions.

Taking into account the fact that the Russian economy relies significantly on natural resources, the division into rich and poor regions may be highly influenced by resource availability in the regions, and so the main factor in absorptive capacity may be resource availability. In order to account for this problem, we also divided the regions included in the estimation into two groups: resource-abundant and resource-scarce regions. Resource-abundant regions have a Resource Index value higher than the mean value for the analyzed period. All other regions are resource-scarce regions. According to our calculations, there are 17 resource-abundant regions, 10 of which are in the higher-income regions group (25.6%) and 7 are in the lower-income regions group (20%). Dividing the regions into oil-producers and non-producers does not change the picture much. There are 28 regions that produced oil in the analysed period, 16 of which are rich regions (41%) and 12 poor regions (34%). Thus from these calculations we conclude that both in absolute and in percentage terms rich regions are more resource-abundant and oil-based regions. The question is whether this difference is significant or not. We calculated the average resource index for both groups and found that in rich regions the average resource index is 1.8 times as high as that of poor regions. Thus, resource availability can be considered a very important factor in regional prosperity and absorptive capacity in Russia, and this fact should be taken into account in interpreting the estimation results for the sub-samples.

In analysing the sub-samples we use only the specification with disaggregate foreign financing (with FDI, FPI and FC variables). In order to show the robustness of results we report here both the one-step and robust two-step GMM-DIFF estimators under the three assumptions that explanatory variables are strictly exogenous, predetermined and endogenous. The estimation results are represented in Tables 5 and 6.

The results confirm the importance of domestic investment for economic growth in Russian regions. The convergence parameter also does not differ much between the sub-samples and indicates conditional convergence for both rich and poor regions.

The results also provide evidence that richer regions gain from foreign direct investment as the FDI coefficients turn out to be positive and significant in three cases of six (see Table 4). We also conclude that the financial crisis of 1998 was more harmful for poor regions than for rich ones. The other interesting result is that the export variable turns out to be insignificant in relatively richer regions but it is significant with positive sign, in relatively poorer regions (three cases of six). By contrast, resource variable is significant with positive sign in richer regions (three cases of six) but insignificant or even significant with negative sign (in three cases from six) in poorer regions.

The significance of the resource variable for rich regions and its insignificance for poor regions may reflect the fact that in rich regions the resource sector plays a more significant role in economic development then in poor regions, simply because rich regions are considerably more resource abundant.

Different results for the export variable between sub-samples may be explained by correlation coefficients of export and resource variables (the correlation matrixes for both sub-samples are presented in Appendix 2). For rich regions the coefficient is 0.7 and for poor regions it is 0.3. So the high correlation between export and resource variables for rich regions may cloud the results and so explain the insignificance of the export variable. For rich regions there is also a high correlation between the export and domestic investment variables (0.56). In general, the high correlations among domestic investment, exports and resource index in richer and more resource-abundant regions may indicate a notable dependence of Russian regions` economic development on resource availability.

We did some additional estimations to control for the correlation problem in the rich regions` sub-sample (not reported here) and found that the export variable becomes significant (with positive sign) only when domestic investment and resource variables are excluded from the estimation. The significance of the export variable for poor regions and its low correlation with the resource variable suggest that non-resource exports are rather important for economic growth in relatively poor regions.

In general, the sub-sample results infer that further research is needed to explore the relationship between domestic investment, exports and resource availability in the Russian economy, in order to draw more precise conclusions concerning these variables' influence on economic growth.

Table 5. GMM-DIFF estimation results for the sub-sample of higher- income regions. Dependent variable: GRP per capita growth rate in high income region i (i=1,…,39) in period t (t=1996,…,2003)

Explanatory variables, X	Panel OLS 1)	X – strictly exogenous		X - predetermined		X – endogenous	
		A-B GMM-DIFF one-step	A-B GMM-DIFF two-step 2)	A-B GMM-DIFF one-step	A-B GMM-DIFF two-step 2)	A-B GMM-DIFF one-step	A-B GMM-DIFF two-step 2)
Constant	0.51*** (3.6)						
$lny_{i,t-1}$, a	-0.450*** (-13.9)	-0.702*** (-10.14)	-0.705*** (-10.5)	-0.729*** (-12.33)	-0.698*** (-9.01)	-0.825*** (-11.51)	-0.836*** (-11)
D_{1998}	-0.201*** (-6.22)	-0.062* (-1.7)	-0.062* (-1.95)	-0.043 (-1.61)	-0.043 (-1.26)	-0.02 (-0.7)	-0.011 (-0.33)
$ln(I/N)_{i,t}$	0.358*** (13.73)	0.595*** (12.56)	0.598*** (13.94)	0.652*** (12.65)	0.646*** (11.82)	0.748*** (8.87)	0.751*** (9.65)
$ln(Exp/N)_{i,t}$	0.054 (3.17)	0.045 (1.01)	0.044 (1.08)	0.099 (1.32)	0.126 (1.47)	0.001 (0)	0.021 (0.16)
$ln(NR/N)_{i,t}$	-0.017** (-1.91)	0.03 (0.67)	0.029 (0.67)	0.22** (2.28)	0.224* (1.69)	0.181*** (2.83)	0.142* (1.8)
$ln(FDI/N)_{i,t}$	0.001 (0.96)	0.005* (1.9)	0.005** (2.06)	0.005 (1.63)	0.005 (1.4)	0.006* (1.88)	0.006 (1.47)
$ln(FP/N)I_{i,t}$	0.001** (2.33)	0.0003 (0.19)	0.0004 (0.33)	0.002 (0.94)	0.002 (0.83)	-0.002 (-0.79)	-0.002 (-0.86)
$ln(FC/N)_{i,t}$	-0.002** (-2.49)	-0.009*** (-3.76)	-0.009*** (-3.68)	-0.003 (-1.44)	-0.005* (-1.87)	-0.002 (-0.46)	-0.001 (-0.12)
Number of obs.	269	228	228	228	228	228	228
Adjusted R^2	0.690						
Jarque-Bera N-test (p-value)	17.2 (0.00)						

White's test (p-value) [3]	64.7 (0.02)						
M1 (p-value) [4]		-2.77 (0.01)	-2.73 (0.01)	-2.61(0.01)	-2.26 (0.02)	-2.44 (0.02)	-2.24 (0.03)
M2 (p-value) [5]		-1.30 (0.19)	-1.28(0.20)	-1.35 (0.18)	-1.25 (0.21)	-1.43 (0.15)	-1.53 (0.13)
Hansen test (p-value) [6]		34.35 (0.64)		32.58 (0.49)		23.26 (0.72)	
Instrument number		36 [7]		31 [8]		27 [9]	

Note: z-statistics in parentheses (for OLS, t-statistics); *, **, *** denote 10, 5 and 1 % significance, respectively.

1) OLS – Heteroskedasticity consistent standard errors.

2) Estimated with a finite-sample correction to two-step covariance matrix as in Windmejer (2005).

3) White's heteroskedasticity test, H_0: No heteroskedasticity in the residuals.

4) Arellano – Bond test of first-order autocorrelation, H_0: No first order-autocorrelation.

5) Arellano – Bond test of second-order autocorrelation, H_0: No second order autocorrelation.

6) Hansen test of overidentified restrictions: H_0: Instruments not correlated with residuals.

7) Dependent variable lagged 2 periods. Explanatory variables in current period and lagged 1 period (in instrument list FF=FDI+FPI+FC, used to keep the number of instruments reasonably small ("rule of thumb": number of groups (35) $\geq$ number of instruments)).

8) Dependent variable lagged 2 periods. Explanatory variables lagged 1 period (same as for (7)).

9) Dependent variable lagged 2 periods. Explanatory variables lagged 2 period (same as for (7)).

Table 6. GMM-DIFF estimation results for the sub-sample of lower- income regions. Dependent variable: GRP per capita growth rate in low income region i (i=1,…,35) in period t (t=1996,…,2003)

Explanatory variables, X	Panel OLS [1]	X – strictly exogenous		X - predetermined		X – endogenous	
		A-B GMM-DIFF one-step	A-B GMM-DIFF two-step [2]	A-B GMM-DIFF one-step	A-B GMM-DIFF two-step [2]	A-B GMM-DIFF one-step	A-B GMM-DIFF two-step [2]
Constant	0.115 (0.58)						
$lny_{i,t-1}$, a	-0.491*** (-13.27)	-0.616*** (-15.17)	-0.633*** (-12.78)	-0.621*** (-11.08)	-0.642*** (-8.37)	-0.682*** (-12.75)	-0.722*** (-10.21)
D_{1998}	-0.206*** (-5.94)	-0.102*** (-4.57)	-0.111*** (-4.27)	-0.093*** (-3.47)	-0.108*** (-3.08)	-0.063** (-2.29)	-0.081** (-2.08)
$ln(I/N)_{i,t}$	0.378*** (12.05)	0.618*** (19.69)	0.629*** (15.52)	0.671*** (14.07)	0.682*** (11.58)	0.710*** (16.79)	0.73*** (12.31)
$ln(Exp/N)$	0.020* (1.67)	0.038 (1.45)	0.036 (1.19)	0.075* (2)	0.084 (1.57)	0.099*** (2.77)	0.103** (2.25)
$ln(NR/N)_{i,}$	0.0002 (0.04)	-0.0004 (-0.12)	-0.002 (-0.46)	-0.005 (-1.01)	-0.006 (-1.29)	-0.008*** (-2.72)	-0.009*** (-2.81)
$ln(FDI/N)_{i,t}$	-0.001 (-1.1)	-0.003 (-1.52)	-0.003 (-1.34)	0.001 (0.5)	0.002 (0.71)	0.0004 (0.19)	0.001 (0.41)

ln(FPI/N$_{i,t}$	0.001* (1.93)	0.001 (0.99)	0.002 (1.45)	0.002 (1.23)	0.002 (1.1)	0.001 (0.65)	0.001 (0.67)
ln(FC/N)$_{i,t}$	-0.001 (-1.3)	0.0002 (0.08)	0.001 (0.17)	0.0003 (0.1)	0.002 (0.65)	-0.002 (-0.57)	-0.002 (-0.52)
Number of obs.	239	201	201	201	201	201	201
Adjusted R^2	0.702						
Jarque-Bera N-test (p-value)	19.6 (0.00)						
White's HT-test (p-value) [3)]	55.8 (0.10)						
M1 (p-value) [4)]		-3.34 (0.00)	-3.32 (0.00)	-2.89 (0.00)	-3.01 (0.00)	-2.70 (0.01)	-2.64 (0.01)
M2 (p-value) [5)]		-0.01 (0.99)	0.31 (0.76)	0.59 (0.56)	0.77 (0.44)	0.60 (0.55)	0.73 (0.46)
Hansen test (p-value) [6)]		31.27 (0.77)		27.11 (0.75)		21.27 (0.81)	
Number of instruments		36 [7)]	35 [7)]	31 [8)]	31 [8)]	27 [9)]	27 [9)]

Note: see Table 5.

5.3 Oaxaca-Blinder decomposition of economic growth difference

We use the Oaxaca-Blinder decomposition approach (see eg Wei, 2005; Blinder, 1973; Oaxaca, 1973) to examine the contribution of control factors to the difference in GRP per capita growth between the two sub-samples. As predicted by neoclassical growth theory, the poor countries (here regions) tend to grow faster than richer ones. In Russian regions for the analysed period this proposition is true (see Table 7). The result motivates use of the Oaxaca–Blinder method in analysing the factors determining convergence.

Table 7. Growth rate difference between lower-income and higher-income regions

Mean of lower-income regions growth rates in the period of 1997-2003[3] (1)	-0.027
Mean of higher-income regions growth rates in the period of 1997-2003 (2)	-0.030
Difference (1-2)	0.003

[3] Period after adjustment.

As long as the expected means of the error terms in the regressions are both zeros, the total estimated difference in average GRP per capita growth between the sub-samples can be represented by

$$\overline{ln(y_{it} / y_{i,t-1})_{li}} - \overline{ln(y_{it} / y_{i,t-1})_{hi}} = \hat{\beta}`_l \overline{lnX_{li}} - \hat{\beta}`_h \overline{lnX_{hi}} \,, \qquad (10)$$

where $\hat{\beta}`_h$ and $\hat{\beta}`_l$ represent, respectively the estimated panel OLS[4] coefficients of regressions for higher-income and lower-income regions sub-samples (including constant). $\overline{lnX_{hi}}$ and $\overline{lnX_{li}}$ represent the averages of modeled factors of economic growth for the two sub-samples. The total estimated difference or gap can be further decomposed into the following three components:

$$\overline{ln(y_{it} / y_{i,t-1})_{li}} - \overline{ln(y_{it} / y_{i,t-1})_{hi}} =$$

$$\hat{\beta}`_h(\overline{lnX_{li}} - \overline{lnX_{hi}}) \; + \; (\hat{\beta}`_l - \hat{\beta}`_h)\overline{lnX_{hi}} \; + \; (\hat{\beta}`_l - \hat{\beta}`_h)(\overline{lnX_{li}} - \overline{lnX_{hi}}) \qquad (11)$$

$$= E + C + CE$$

The first component on the right-hand side (E) is the portion of the gap due to the difference in structural and control factors. The second coefficient component C is attributable to differences unexplained by these factors. CE is the interaction factor between these two components. Note that method also generates detailed decomposition results for individual regressors (specified factors of economic growth).

[4] Oaxaca-Blinder decomposition was originally derived for classical OLS regression (see eg Yun, 2004). The GMM approach allows in theory for decomposition but practical problems are great. We are currently working on the issue

5.4. Difference in growth rates between higher-income and lower- income Russian regions: Factors of convergence

Table 8 reports the (predicted) difference decomposition of growth rates between lower-income and higher-income regions[4] from estimated panel OLS model. As the results are based on pooled panel OLS estimation, the conclusions are preliminary and approximate, but since the relative importance of specified factors is similar in all estimations in Tables 5 and 6, the inferences drawn can be useful.

Table 8. Predicted growth rates and decomposition of growth rates differences between lower-income and higher-income regions, 1997-2003

Mean predictions and predicted gap

Mean prediction for lower-income regions	-0.023
Mean prediction for higher-income regions	-0.031
Predicted gap	0.0086 (0.33)

Detailed linear decompositions

	Total	Factors	Coefficients	Interaction
$lny_{i,t-1}$	0.453	0.176*** (7.19)	0.261 (0.86)	0.016 (0.85)
D_{1998}	0.0008	0.002 (0.24)	-0.001 (-0.1)	0.000 (0.02)
$ln(I/N)_{i,t}$	-0.317	-0.151*** (-6.62)	-0.158 (-0.54)	-0.008 (-0.54)
$ln(Exp/N)_{i,t}$	0.265	-0.029*** (-3.13)	0.275* (1.91)	0.018* (1.74)
$ln(NR/N)_{i,t}$	-0.019	0.012* (1.68)	-0.019* (-1.87)	-0.012 (-1.57)
$ln(FDI/N)_{i,t}$	0.036	-0.005 (-1.07)	0.033 (1.64)	0.008 (1.4)
$ln(FPI/N_{i,t}$	-0.004	-0.007* (-1.86)	0.003 (0.09)	0.0004 (0.09)
$ln(FC/N)_{i,t}$	-0.014	0.011** (2.05)	-0.019 (-1.11)	-0.006 (-1.02)
Constant			-0.391 (-1.59)	
Total	0.0086	0.008 (0.35)	-0.016 (-0.88)	0.016 (1.16)

Note: z - statistics in parentheses; *, **, *** denote 10, 5 and 1 % significance, respectively; variances/standard errors of components are computed as in Jann (2005).

The mean predictions do not differ significantly across the sub-samples. There is little evidence of the convergence process between higher-income and lower-income Russian regions based on the estimated OLS models. Nonetheless, the results in Table 7 are of some interest. The greater the initial gap in GRP per capita, the larger the gap in per capita growth. This accords with the convergence proposition of neoclassical growth theory. Smaller amounts of domestic investment and exports in poor regions in comparison with rich regions retard convergence, as expected. The same holds for foreign portfolio investment ($ln(FPI/N)_{it}$). We also conclude that less resource availability helps poor regions to converge with rich regions. The same conclusion can be made for foreign credit variable.

Coefficients decomposition shows the unexplained difference in growth effects. They operate mainly via the export variable, positively influencing convergence process.[5] The result was expected, as we found that in lower-income regions there is much more statistical evidence of export-led growth. The opposite result is obtained for the resource variable. It indicates that resource availability is a factor that retards convergence between rich and poor regions in Russia. It is also expected from the estimation results and the finding that rich regions are more resource abundant than poor ones.

The interaction decomposition result shows that export variable is the only significant one. These results clearly show again that the export and resource variables play different roles in high and low-income regions. However, we would not put too much weight on these preliminary OB results, as they are based on biased estimates, and the predicted growth gap is much larger than the actual gap.

6. Conclusions

In recent years many empirical studies have investigated the role of FDI in economic growth. Most of them conclude that FDI does contribute positively to economic growth if the level of absorptive capacity is high enough. In this paper we examine the FDI impact on short-run economic growth in Russian regions in the transition period (1996-2003). We use the Barro-Sala-I-Martin empirical framework for the neoclassical Solow-Swan model and the advanced Arellano-Bond estimation method developed for dynamic panel data.

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[4] Mean values of explanatory variables 1997-2003 for both sub-samples used in the calculations are presented in Appendix 3.

[5] Note that $(\hat{\beta}`_l - \hat{\beta}`_h)\overline{lnX_{hi}}$ corresponds to growth differences unexplainable by structural factors, i.e difference due to (unobserved) group differences.

The results suggest that FDI is hardly a significant factor in explaining economic growth in Russia on the regional level. Taking into account existing theories and previous empirical findings concerning FDI impact on economic growth in other countries the result is unexpected. However, the low amounts of FDI in the Russian economy and their ineffective industrial structure may help to explain this. As for the other specified factors of economic growth, domestic investment and exports are the most important ones for stimulating economic growth in Russia. Of the other specified control variables, natural resource availability surprisingly does not contribute significantly to short-run economic growth in Russian regions, although the Russian economy is traditionally considered to rely heavily on natural resources. The same result was found when we replaced the natural resources variable with the oil variable. A possible explanation is that natural resources (especially oil resources) influence short-run economic growth, not directly but through the domestic investment and export variables.

We also divided the sample into two sub-samples - higher-income regions and lower-income regions - suggesting that GRP per capita level reflects the absorptive capacity of a region. The results imply that higher-income regions tend to gain positive, albeit small, effects from FDI while the FDI impact on economic growth in lower-income regions remains insignificant. In general, the results enabled us to conclude that further research is needed to determine the factors of absorptive capacity for the different regions with respect to FDI in Russia.

We also found that high correlation between domestic investment, export and resource variables may reduce the reliability of estimators of the mentioned factors. This problem is especially serious for rich regions, which are in general almost twice as resource abundant as poor regions. An interesting result here is also that the financial crisis of 1998 was more harmful for lower-income regions than for higher-income ones.

Growth convergence between poor and rich regions in Russia was found for the period studied. However, FDI does not play a significant role in this convergence process. Some preliminary results for the Oaxaca-Blinder (OB) decomposition of growth rate differences between higher-income and lower-income regions were also provided. OB analysis produced some evidence on the relative magnitudes of different factors of convergence across Russian regions, eg that initial GRP per capita plays a major role here along with domestic investments and exports.

Appendix 1

The Resource Index was calculated using the following formula of integrated coefficient:

$$Resource\ index_{it} = \frac{1}{m}\sum_{j=1}^{m}\left[100*\left(\frac{F_{j,it}}{\overline{F_{jt}}}\right)\right],$$

where *i=1,…,74* in period *t=1997,…,2003.* $F_{j,it}$ is the actual resource indicator j for a region i in period t, $\overline{F_{jt}}$ is the sample mean of the indicator in period t (in our case the mean value for Russian regions, which is $\overline{F_{jt}} = \frac{1}{n}\sum_{i=1}^{n} F_{ijt}$, where n is the number of Russian regions involved in the computation(74)), m is the number of indicators included in the index computation (adopted from Ndikumana, 2000). Indicators, included in the computation of the resource index are presented in Table A1.1.

Table A1.1. Indicators included in the resource Index

N	Indicator
1	Electricity production per capita, kilowatt - hour
2	Oil digging including gas condensate ¨per capita, thousands of tones
3	Natural gas digging per capita, millions cubic meters
4	Coal digging per capita, thousands of tones
5	Black metals production per capita, thousands of tones

Appendix 2

Table A2.1. Correlation matrix for dependent and explanatory variables in the estimation:Whole sample

	ln(GRP/N)	D1998	ln(I/N)	ln(EXP/N)	ln(NR/N)	ln(OILR/N)	ln(FDI/N)	ln(FPI/N)
ln(GRP/N)	1							
D1998	0.006	1						
ln(I/N)	0.889	-0.045	1					
ln(EXP/N)	0.670	-0.055	0.607	1				
ln(NR/N)	0.295	-0.031	0.322	0.312	1			
ln(OILR/N)	0.158	-0.006	0.239	0.175	0.156	1		
ln(FDI/N)	0.889	-0.045	0.316	0.607	0.322	0.239	1	
ln(FPI/N)	0.159	-0.092	0.109	0.307	0.090	-0.021	0.109	1
ln(FC/N)	0.353	-0.018	0.360	0.476	0.283	0.115	0.360	0.343

Table A2.2. Correlation matrix for dependent and explanatory variables in the estimation: Rich regions

	ln(GRP/N)	D1998	ln(I/N)	ln(EXP/N)	ln(NR/N)	ln(OILR/N)	ln(FDI/N)	ln(FPI/N)
ln(GRP/N)	1							
D1998	0.0058	1						
ln(I/N)	0.8875	-0.0519	1					
ln(EXP/N)	0.6693	-0.0587	0.5594	1				
ln(NR/N)	0.5409	-0.0037	0.4924	0.6913	1			
ln(OILR/N)	0.2325	0.0217	0.3393	0.3197	0.3929	1		
ln(FDI/N)	0.27	0.0834	0.2288	0.3255	0.2497	-0.0095	1	
ln(FPI/N)	0.112	-0.0759	0.0509	0.3008	0.0664	-0.0799	0.2191	1
ln(FC/N)	0.2986	0.0091	0.274	0.4242	0.2092	0.1233	0.4323	0.2987

Table A2.3. Correlation matrix for dependent and explanatory variables in the estimation: Poor regions

	ln(GRP/N)	D1998	ln(I/N)	ln(EXP/N)	ln(NR/N)	ln(OILR/N)	ln(FDI/N)	ln(FPI/N)
ln(GRP/N)	1							
D1998	0.024	1						
ln(I/N)	0.865	-0.0226	1					
ln(EXP/N)	0.6476	-0.0592	0.6215	1				
ln(NR/N)	0.3505	0.0597	0.3887	0.2873	1			
ln(OILR/N)	-0.0497	-0.0411	0.0261	-0.0874	0.0377	1		
ln(FDI/N)	0.3597	0.1101	0.3636	0.2792	0.3134	-0.0591	1	
ln(FPI/N)	0.1316	-0.1193	0.0912	0.2683	0.0746	-0.011	0.1275	1
ln(FC/N)	0.3887	-0.007	0.4052	0.5125	0.3433	0.0414	0.3654	0.3487

Appendix 3

Table A3.1. Mean values of explanatory variables for 1997-2003, higher-income and lower-income regions sub-samples

Variable	Lower-income regions	Higher-income regions
ln(I/N)	-8.595	-8.173
ln(EXP/N)	-8.722	-8.186
ln(NR/N)	-1.782	-1.097
ln(FDI/N)	-17.294	-13.918
ln(FPI/N)	-48.098	-41.449
ln(FC/N)	-24.777	-18.807

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Bank of Finland
BOFIT – Institute for Economies in Transition
PO Box 160
FIN-00101 Helsinki

☎ + 358 10 831 2268
bofit@bof.fi
http://www.bof.fi/bofit