The impact of private health insurers on the quality of regional health care systems in Russia

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Abstract

The 1991 law 'On health insurance for the citizens of the Russian Federation' established that social health insurance is to be offered by multiple private insurance companies. The paper is the first econometric analysis measuring the effect of private health insurers on quality related outcomes of social health insurance (SHI) systems in Russian regions. The baseline model introduces regional SHI system as a binary variable with unity value corresponding to the presence of private health insurers as the only agents at the SHI market. The extended model captures endogeneity by employing an instrumental variable approach. The non-parametric model uses kernel regressions.

The results of parametric and kernel regressions reveal that the presence of private insurers is a significant determinant of infant and under-five mortality. The positive impact of private insurers is explained by regional institutional reforms. The methods of provider reimbursement are related to infant and under-five mortality, which offers suggestive evidence for enabling insurer competition through selective contracting with health care providers.

Keywords: social health insurance, infant mortality, under-five mortality, kernel regression, health care systems, health care quality, provider payment
JEL codes: I10, I18, G22, R22

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1 Introduction

Transition countries in the Central and Eastern Europe and the former Soviet Union introduced social health insurance (SHI) as a model for universal coverage, stable financial revenues, and consumer equity through the principle of solidarity (Zweifel and Breyer, 2006; Preker *et al.*, 2002). Only a few countries (among them are the Czech Republic and Slovakia) allowed for competitive insurers as the rest feared adverse selection in competitive insurance markets (Preker *et al.*, 2002). Indeed, while theoretical arguments advocate the presence of properly regulated competitive insurers which would help to control costs, reduce moral hazard, respond to the variety of consumer preferences, and enhance health care quality (Zweifel and Breyer, 2006; Wagstaff, 2010), the empirical evidence on the link between insurer competition and the performance of health care systems is limited and mixed (Dixon *et al.*, 2004).

The need to create competition between private insurers was emphasised at the onset of the emergence of the new health care system in post-Soviet Russia. The 1991 law 'On health insurance for the citizens of the Russian Federation' established that SHI is to be offered by multiple private insurance companies which were expected to become efficient purchasers, compete for subscribers, and sign treaties with providers, which offer health care of better quality (Sheiman, 1994). Managers of private insurance companies were assumed to perform better than government executives (Sinuraya, 2000; Curtis *et al.*, 1995) and, therefore, the intermediary role of private insurance companies was seen as the main instrument for introducing market incentives and increasing the quality of the health care system (Sheiman, 1991).

In fact, several types of SHI systems emerged in the Russian regions in 1990s-early 2000s. The regional SHI fund could be the only agent at the SHI market. The regional SHI fund could have its branches, which might act as insurance companies. SHI could be offered exclusively by private insurance companies or both by private insurance companies and the branches of the regional SHI fund (Table I).

Table I. Types of social health insurance system in Russia in 2000-2006, number of regions

Agents at the health insurance market	2000	2001	2002	2003	2004	2005	2006
Private insurance companies, the regional SHI fund, and possibly, the branches of the regional SHI fund	39	41	42	44	48	55	73
Private insurance companies, the regional SHI fund, and the branches of the regional SHI fund with the rights of SHI companies	22	21	20	21	22	23	9
The regional SHI fund and possibly, the branches of the regional SHI fund. The branches of the regional SHI may have the rights of SHI companies	23	23	23	20	15	7	3
Total	84	85	85	85	85	85	85

Note: In one region SHI system was established only in 2001.

While the current health care reforms in Russia aim at strengthening the role of private health insurers in the quality of the health care system, the prospects for the positive impact of private health insurers are based primarily on theoretical reasoning and a few successful examples in late Soviet times (Isakova *et al.*, 1995). In fact, academic literature commonly analyzes regulatory policy for private insurance companies (Danishevski *et al.*, 2006; Twigg, 1999) and issues of consumer equity (Blam and Kovalev, 2006) in the regions with different SHI systems. To the best of our knowledge Twigg's (2001) statistical analysis of infant mortality in 41 Russian regions is the only study measuring the effect of private health insurers on health outcomes related to health care system quality.

The purpose of this paper is to study the impact of private health insurers in Russia on health outcomes, which are commonly regarded as indicators of the quality of health care systems. We analyze whether infant mortality, under-five mortality, and maternal mortality in Russian regions in 2000-2006 depended on the type of regional SHI system. Three empirical models are used in the analysis. The baseline model introduces regional SHI system as a binary variable with unity value corresponding to the presence of private health insurers as the only agents at the SHI market. The extended model captures endogeneity in regional SHI system by employing an instrumental variable approach. The third, non-parametric model uses kernel regressions and similarly to the baseline model treats regional SHI system as a binary variable.

The results of our estimations indicate that the regions with only private health insurers have lower infant and under-five mortality and, consequently, higher quality of health care systems. Given the low degree of competition at the SHI market in Russia, the significance of the regional SHI system might be explained by positive structural reforms in the institutional environment. To test this hypothesis we employ an instrumental variable approach and find that regional SHI system looses its significance. Finally we show that the methods of provider reimbursement are related to infant and under-five mortality. The result offers suggestive evidence for allowing private insurers to determine the methods of provider reimbursement, which would enable competition for subscribers through selective contracting with providers.

The remainder of the paper is organised as follows. Section 2 describes various types of social health insurance systems that emerged in Russian regions. Section 3 sets up parametric and non-parametric models for estimating the impact of private health insurers on the quality of regional health systems. Section 4 describes the data on Russian regional health insurance systems, which combines the indicators from national statistics, administrative data, and independent surveys. The results of the empirical estimations are given in section 5. The implications of the results with respect to the effective role of private health insurers in Russia are analyzed in section 6.

2. Variety of SHI models in Russian regions

Russian health care system was created in 1991-1993 as a mixture of budget and insurance models (Sheiman, 1991). The 1991 law 'On health insurance for the citizens of the Russian Federation' established a universal coverage of Russian citizens by mandatory health insurance. The revenues of the new SHI system come from an earmarked payroll tax and regional budgetary payments for health care of non-working population. The main reason for combining certain features of tax-based Beveridge and insurance-based Bismarck systems in Russia was the desire to establish mandatory health insurance as a reliable financial source in the environment with unstable budgetary contributions due to economic transition (Sheiman, 1994). It should be noted that the pattern with a combination of the two types of models is common to other transition countries (Preker *et al.*, 2002).

The accumulation of revenues and the implementation of public policy were conducted by SHI funds established in each Russian region, and a federal SHI fund, which was a body for smoothing the differences in regional SHI funds' activity. The citizens of each region subscribed to SHI through contracts with regional SHI fund, its branches, or private insurance companies. Regional SHI funds were regarded as third-party financing bodies, which prevented cream-skimming on behalf of insurance companies, and insurance companies were to contribute to market incentives and provide quality control (Twigg, 2001; Burger *et al.*, 1998; Sheiman, 1991). The law 'On health insurance for the citizens of the Russian Federation' specified that while private insurance companies have not emerged in the region, the regional SHI fund or its branches could play the role of insurance companies. This led to the appearance of several types of regional SHI systems. The agents at the health insurance market in the region could be branches of regional SHI fund, private insurance companies, or both branches of regional SHI fund and private insurance companies. This diversity emerged in accordance with theoretical predictions about Russia's unreadiness for competitive insurance model and expectations about regional monopsonies with private companies agreeing on market shares (Burger *et al.*, 1998; Sheiman, 1994).

The variety of SHI systems reflects the fact that many regions opposed market entry by private insurance companies (Twigg, 1999). Indeed, the boards of directors of regional SHI funds usually included regional government officials (Tompson, 2007; Shishkin, 2006; Tragakes and Lessof, 2003) who were reluctant to give up their control over the SHI sources (Blam and Kovalev, 2006; Twigg, 2001). Furthermore, regional SHI funds and regional health care authorities created various obstacles to the activity of private insurance companies: enforced rigid assignments of catchment areas and disabled the possibility of subscriber's choice between different insurers (Twigg, 1999); imposed informal agreements with private insurance companies to finance providers regardless of the quality and quantity of the health care offered to subscribers (Blam and Kovalev, 2006); provided per capita reimbursement

for private insurance companies much lower than for branches of the regional SHI with the rights of insurance companies (Shishkin, 2006). The activity of private insurance companies was complicated due to frequently revised reimbursement rates (Zaborovskaya *et al.*, 2005), short term contracts with regional SHI funds, and the low ratio of own assets to premium (Sinuraya, 2000). The controversy with insurance legislation created a substantial confusion at the regional and the municipal level (Danishevski *et al.*, 2006; Reshetnikov, 2002; Twigg, 1999). Only the adoption of the 2005 federal law No.95 on the redistribution of powers between the federal center, the regions and the municipalities along with the 2005 amendments to the federal government resolution on competitive tenders for insurers (resolution No.737 of 04.10.2002) increased the prevalence of the SHI model with health care provided exclusively by private insurance companies (Shishkin *et al.*, 2007).

Due to strict regulatory setting, private insurance companies lacked instruments to compete for insurers. The 1991 law did not provide the means of competition by price or contents of health care. SHI was offered as a basic package, unique for each region. SHI was financed through an earmarked payroll tax with flat rate set by federal legislation and through payments for non-working population determined by the government of each region. Consequently, private insurance companies competed for employers rather than for patients (Tragakes and Lessof, 2003) and mainly aimed at increasing their market shares (Sheiman, 1997). Moreover, private insurance companies did not have incentives to become risk-bearers as they were reimbursed by regional SHI funds in case of overspending (Tragakes and Lessof, 2003).

Since improperly specified provisions of regulatory legislation became the major obstacle to the emergence of private insurance companies at the SHI market, a clarification of the rules at the SHI market was commonly noted as a prerequisite for establishing proper institutional environment for regional health care systems in Russia (Naigovzina and Filatov, 2010; Tompson, 2007; Reshetnikov, 2006; Twigg, 1999; Chernichovsky *et al.*, 1996; Sheiman, 1994). A step in this direction was made in 1997 when a proposal on amending the 1991 legislation to develop a competitive SHI was debated at the federal level (Twigg, 1999). The 'State Report on the Health Condition of the Russian Population', prepared by the Ministry of Health and Social Development in 2004, became the first federal document to outline the lack of insurance mechanisms in the Russian SHI system. Similarly, the 2004 bill 'On Mandatory Health Insurance' focused at clarification of the activity of private insurers (Machulskaya and Dobromyslov, 2006). Although the 1997 proposal and the 2004 bill were tabled, the year 2010 saw the adoption of a new law 'On Mandatory Health Insurance in the Russian Federation'. The 2010 law created mechanisms for a free choice of insurer by subscriber, with detailed specification for the procedure of changing insurer. Yet, similarly to the 1991 legislation, the 2010 law did not provide the instruments for insurer competition by the price of the SHI contract. Indeed, an earmarked payroll tax with flat rates and budgetary payments for non-working population are preserved as SHI insurance

contributions. The contents of the SHI contract could not become the means of competition either, since determination of the SHI package remains the prerogative of the regional SHI fund and regional health authorities. As a result, quality may be viewed as the only means of insurer competition for subscribers.

3. Methodology

While various performance measures reflect different goals of national and regional health care systems (Joumard *et al.*, 2010; Propper and Wilson, 2006; OECD, 2004; WHO, 2000), aggregate health outcomes directly related to the quality of health care are commonly infant, under-five, and maternal mortality (Gottret and Schieber, 2006; Wagstaff and Claeson, 2004; Filmer and Pritchett, 1999). Consequently, in our analysis we regard these outcomes as parameters reflecting the quality of regional health care systems in Russia.

The paper applies a general approach of estimating aggregate models for health outcomes (Ruhm, 2006). Let

$$\mathbf{y} = f(\mathbf{h}, X), \tag{1}$$

where $\mathbf{y}$ is health outcome in the region, $\mathbf{h}$ is the type of regional SHI system, and $\mathbf{X}$ is socio-economic variables.

Assuming that the presence of insurance companies becomes a positive cause for the quality of health care, with private insurance companies better corresponding to insurance principles than the branches of the regional SHI fund with the rights of SHI companies ('Implementation of health reform in the subjects of Russian Federation'), we treat the type of the regional SHI system as a binary variable $\mathbf{h}$: unity value is attributed to the regions where SHI is offered exclusively by private insurance companies.[3]

$\mathbf{X}$ is the control variables which are commonly employed as determinants of health outcomes: per capita gross regional product, public and private health expenditure (Francisci *et al.*, 2008; Byrne *et al.*, 2007; Ivaschenko, 2005; Lopez-Casasnovas *et al.*, 2005; Preker *et al.*, 2002; Carrin and Politi, 1995), and Gini coefficient as an inequality measure[4] (Wagstaff and Claeson, 2004; Filmer and Pritchett, 1999; Bidani and Ravallion, 1997; Anand and Ravallion, 1993). The influence of inflation is taken into account by consumer price index. To incorporate geographical differences among Russian regions we included share of urban population and January temperature in the list of covariates $\mathbf{X}$.

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[3] When we introduced an additional binary variable for private insurance companies coexisting with the branches of the regional SHI fund which act as insurance companies, the results of our estimations regarding the binary variable *h* did not change. Since the additional binary variable proved to be insignificant in the baseline model, below we present our findings with only *h* among covariates.

[4] We did not employ poverty rate as an inequality measure since it was strongly correlated with per capita GRP.

3.1 Parametric models

Baseline model

The model analyzes the impact of the regional SHI system on health outcomes. Let

$$\mathbf{y} = \mathbf{X\beta} + \theta\mathbf{h} + \mathbf{\epsilon}, \tag{2}$$

where i is the index for region, $\mathbf{h}$ is the type of the regional SHI system, and $\mathbf{X}$ is the control variables.

Extended model with instrumental variables

As was noted in section 2, the type of regional SHI system is related to the quality of institutions in the region, which in turn, has an influence on health outcomes. Therefore, it is plausible to assume that $\mathbf{h}$ becomes an endogenous variable in empirical models, estimating (1). To account for endogeneity we employ an instrumental variable approach and extend the primary model (2) to the model (3) - (5) with latent variable $\mathbf{h}^*$ and the observed variable $\mathbf{h}$. Let

$$\mathbf{h}^* = \mathbf{X\beta_1} + \mathbf{Z\delta_1} + \mathbf{\epsilon_1} \tag{3}$$

$$\mathbf{y} = \alpha\mathbf{h}^* + \mathbf{X\beta_2} + \mathbf{\epsilon_2} \tag{4}$$

$$h_i = \begin{cases} 0, \text{ if } \quad h_i^* < c_0 \\ 1, \text{ if } \quad c_0 \le h_i^* < c_1 \end{cases} \tag{5}$$

$$\mathbf{\epsilon_1} = N(0, \sigma^2 I), \mathbf{\epsilon_2} = N(0, I), \mathbf{\epsilon_1} \text{ and } \mathbf{\epsilon_2} \text{ are independent,} \tag{6}$$

$$\mathbf{\epsilon_1} \text{ and } \mathbf{X} \text{ are independent, } \mathbf{\epsilon_1} \text{ and } \mathbf{Z} \text{ are independent,} \tag{7}$$

$$\mathbf{\epsilon_2} \text{ and } \mathbf{X} \text{ are independent, } \mathbf{\epsilon_2} \text{ and } \mathbf{h}^* \text{ are independent,} \tag{8}$$

where $\mathbf{Z}$ is the instruments for the type of regional SHI system and unknown cutoff points satisfy the condition $c_0 < c_1$.

Imposing conditions (6)-(8) enables us estimating the system (3)-(5) with two-stage least squares: the fitted values of $\mathbf{h}^*$ are obtained in (3) and then plugged in (4). Since $\mathbf{\epsilon_1}$ and $\mathbf{\epsilon_2}$ are independent, the resulting equation is

$$y = \alpha\, \hat{\mathbf{h}}^* + \mathbf{X\beta_2} + \mathbf{\epsilon_2} + \alpha(\mathbf{h}^* - \hat{\mathbf{h}}^*) \tag{4`}$$

Given assumptions (6)-(8), (4`) provides for consistent estimates since

$$\operatorname*{plim}_{n \to \infty} \alpha(\mathbf{h}^* - \hat{\mathbf{h}}^*) = \mathbf{\epsilon_1} \text{ and } E(\mathbf{\epsilon_1}) = E(\mathbf{\epsilon_2}) = 0.$$

In view of the obstacles to the development of SHI in Russian regions largely related to the policy of coercion by regional authorities, we consider corruption level as an instrument for the type of regional SHI systems. We measured corruption level as investment risks (Expert RA), assuming that investment risks have no other influence on the analyzed health outcomes but through the type of regional SHI system.

3.2 Non-parametric kernel regressions

Since specifying a parametric model implies a number of restrictions (Hardle and Linton, 1994), we use kernel density estimators which make no assumptions about the functional form and become a widely applied instrument for non-parametric regressions with large sample sizes and few explanatory variables. We consider kernel functions for a mixture of discrete and continuous explanatory variables (notations follow Racine and Li, 2004):

$$y_i = g(h_i, \mathbf{X}_i) + u_i \tag{9}$$

$$u_i \text{ and } h_i \text{ are independent; } u_i \text{ and } \mathbf{X}_i \text{ are independent} \tag{10}$$

$$\hat{g}(x) = (\sum_{i=1}^{n} y_i W_{b,ix} l_{\lambda,i}) / (\sum_{i=1}^{n} W_{b,ix} l_{\lambda,i}), \tag{11}$$

where i is the index for region, y_i is health outcome, g is the unknown smooth function, $\hat{g}$ is the estimate of g, h_i is the types of regional SHI system, $\mathbf{X}_i$ are control variables, $W_{b,ix}$ is kernel function for continuous variables $\mathbf{X}_i$ with associated bandwidth b, l is kernel function for discrete variable $\mathbf{h}$, λ is a smoothing parameter for l, and n is the total number of observations.

The analysis below treats W(.) as a local-constant (Nadaraya-Watson) estimator with Gaussian kernel of second order and employs Li and Racine's (2003) kernel functions for mixed discrete and continuous variables, which allow conducting more powerful kernel tests if compared to the estimations with Wang and van Ryzin's (1981) kernel functions for discrete ordered variables (Hsiao *et al.*, 2007; Li and Racine, 2003).[5] Bandwidths are selected according to Li and Racine's (2003) crossvalidation. The code is written in the R language (ver.2.12.2) using 'np' package (ver.0.40-4) 'Nonparametric kernel smoothing methods for mixed data types' (Hayfield and Racine, 2011; Hayfield and Racine, 2008).

4. Data

We employ the pooled data on health outcomes, the types of regional SHI systems, and socio-economic variables for Russian regions in 2000-2006 (Table II). The usage of the pooled data is explained by our desire to conduct both parametric and non-parametric estimations, and, consequently, construct a large sample for kernel regressions. For the purposes of studying Russian regional economies which have overcome the 1998 economic crisis we used the data since 2000. The availability of data on social health insurance systems – the variable is reported by the Federal Mandatory Health Insurance Fund till 2004 and could be reconstructed on the basis of independent surveys (namely, 'Implementation of health reform in the subjects of Russian Federation') for the years 2005 and 2006 – limited our analysis to the period 2000-2006.

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[5] In fact, with our data the results of the estimations under Li and Racine's (2003) kernel and Wang and van Ryzin's (1981) kernel were similar.

Table II. Descriptive statistics for the pooled data in 2000-2006

Variable	Definition	Obs	Mean	Std.Dev.	Min	Max
Health outcomes						
infant	Infant mortality= infant deaths per 1,000 live births	550	13.40	4.07	4.70	42.10
under5	Under-five mortality = the probability of death from birth to five years of age per 1,000 aged 0-5	550	16.96	5.36	6.70	61.40
mother	Maternal mortality = maternal mortality per 100,000 live births	515	35.66	24.08	3.80	291.50
SHI system						
h	=1 if private health insurers are the only agents at the SHI market; 0 otherwise	550	0.58	0.49	0	1
Controls						
pGRP	Per capita gross regional product	550	70839.91	68908.45	7751.70	765204.20
public	Share of public health expenditure in gross regional product, per cent. Public health expenditure = the expenditure of the regional budget on health care and sports + expenditure of the regional SHI fund	550	5.32	2.48	0.89	20.58
private	Share of private expenditure on medical services in gross regional product, per cent	550	0.63	0.46	0.08	3.82
Gini	Gini coefficient	393	0.36	0.04	0.30	0.62
CPI	Consumer price index, December to December of the previous year, per cent	550	114.35	4.59	105.50	138.70
temperature	Temperature in January, degrees Celsius	550	-11.18	8.39	-37.10	4.30
urban	Share of urban population, per cent	550	69.20	12.62	25.90	100
Instrument for SHI system						
finance	Financial risk in the region. Reflects the balance of the budgets of enterprises and governments in the regions. Discrete variable, regions are ordered according to their ranks, with rank '1' denoting the region with the minimal risk.	435	38.82	22.97	1	88

Notes: All variables are estimated on the annual basis. Financial variables are measured in rubles. Gini coefficient is reported in national statistics since the year 2002. Financial risk in the years 2000-2003 is estimated only for 51-54 regions. Private expenditure does not include expenditure on drugs and informal payments.
(Sources: Russian Statistical Agency (Demographic Yearbook, Health care in the Russian Federation; Regions of Russia, Socio-Economic Situation and the Level of Life of Russian Population); Russian Statistical Agency (2010a,b); Federal Mandatory Health Insurance Fund of the Russian Federation ('An overview: 10 years of Mandatory Health Insurance in the Russian Federation. 1993–2003' and annual yearbooks on Mandatory Health Insurance in the Russian Federation, Expert RA).

5. Empirical analysis

5.1 Parametric models

Following most of the models for aggregated health production, health outcomes and per capita GRP were taken in logs (denoted by prefix '*l*'). To eliminate trend we added annual dummies to the right hand side of equations (2) – (4). We chose financial risk as the instrument for the type of SHI system in the extended model with instrumental variables.[6] Financial risk is an expertly determined rank ordered variable which reflects the balance of the budgets of enterprises and governments in the region, with lower ranks corresponding to smaller risk (Expert RA). Since the existing theory on testing for weak instruments (Stock and Yogo, 2002; Staiger and Stock, 1997) deals with the values of F-statistics, we can only make a rough comparison of chi-squared statistics obtained in our estimations with the corresponding benchmark figures. Chi-squared statistics in the first stage regression with financial risk as an instrument was 6.81.[7] This is below the rule of thumb value of 10, yet it is above the minimal value of 5 and implies the maximal size of a 5 per cent Wald test (based on TSLS or LIML test) equal to 0.20 (Stock and Yogo, 2002; Staiger and Stock, 1997).

The estimations with the baseline model (Table III) demonstrated the significance of the type of regional SHI system in explaining infant and under-five mortality. The results of the analysis with the extended model showed that the fitted values for the type of regional SHI system ($\hat{\mathbf{h}}^*$) were insignificant in explaining infant and under-five mortality. The findings were robust with respect to including Gini coefficient in covariates.[8]

Note that the share of private health care expenditure in GRP has negative estimated coefficient in explaining infant and under-five mortality. This implies that an increase in the share of private health care expenditure in GRP leads to a decrease in both mortality indicators. At the same time, the share of public health care expenditures in GRP has positive estimated coefficients, which may be interpreted as ineffectiveness of public health care expenditure.

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[6] Other investment risks proved to be weaker instruments (political, legislative, ecological, infrastructural risk) or were endogenous to our model (for instance, management risk which incorporates the value of infant mortality rate).

[7] The results of the first stage estimations are presented in the Appendix (Table IX).

[8] Gini coefficient started to be reported in the national statistics in 2002. Therefore, considering it as a regressor decreases the time period to 2002-2006. Since the results of the estimations were robust with respect to the inclusion of Gini coefficient in covariates, to analyze the data for the longer time period (namely, 2000-2006) we used the models without Gini coefficients.

Table III. Explaining health outcomes

	linfant		lunder5		lmother	
	baseline	extended	baseline	extended	baseline	extended
h	-0.066***		-0.071***		-0.072	
	(0.017)		(0.016)		(0.052)	
ĥ*		-0.035		-0.024		-0.209
		(0.055)		(0.050)		(0.153)
lpGRP	-0.040	-0.054	-0.028	-0.040	-0.055	-0.134
	(0.031)	(0.040)	(0.030)	(0.038)	(0.078)	(0.010)
public	0.027***	0.013	0.031***	0.019*	0.043**	0.032
	(0.006)	(0.011)	(0.005)	(0.010)	(0.019)	(0.029)
private	-0.016	-0.011	-0.017	-0.016	-0.111*	-0.096
	(0.018)	(0.029)	(0.016)	(0.026)	(0.066)	(0.098)
urban	-0.003***	-0.002**	-0.003***	-0.003***	0.002	0.006*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
temperature	-0.012***	-0.012***	-0.013***	-0.013***	-0.022***	-0.023***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.003)	(0.004)
CPI	0.001	-0.003	-0.002	-0.003	0.011	0.017
	(0.005)	(0.005)	(0.005)	(0.005)	(0.013)	(0.014)
Constant	2.613***	3.040***	3.017***	3.134***	2.044	0.922
	(0.626)	(0.761)	(0.581)	(0.729)	(1.657)	(1.780)
Annual dummies	Yes	Yes	Yes	Yes	Yes	Yes
Years	7	7	7	7	7	7
Observations	550	435	550	435	515	411
Adjusted R2	0.525	0.388	0.588	0.438	0.179	0.123
Chi-squared in the first stage regression		6.81		6.81		6.81

Notes: *** Significance at 0.01 level, ** significance at 0.05 level, *significance at 0.1 level.
Robust standard errors in parentheses. For each health outcome the results of the estimations with the baseline model were robust with respect to using subsamples of observations, employed in corresponding extended models (namely observations for which variable *finance* was defined).

5.2 Kernel regressions

To account for the time trend we entered variable *year* in the list of continuous regressors X_i in the model (9)-(11). [9] The resulting kernel regressions demonstrated that regional SHI system was 'significant' explanatory variables in case of all the three analyzed health outcomes. Indeed, in the models explaining infant mortality, under-five mortality, and maternal mortality the values of smoothing parameters for **h** equaled correspondingly 0.311, 0.327, and 0.240 (Table IV).

Small smoothing parameters for log of per capita GRP may be interpreted as 'significance' of this variable. Given insignificance of the variable in parametric estimations (Table III), the result suggests nonlinear relation between log of per capita GRP and health outcomes. Large smoothing parameter for

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[9] This approach is justified by the fact that the estimations within model (2) and model (3)-(8) were robust with respect to including the annual dummies or introducing the linear trend.

CPI, as well as the absence of variation of the dependent variable on the diagrams for confidence intervals with respect to CPI, indicate that CPI may be disregarded as a regressor. Note that 'insignificance' of CPI corresponds to the results of parametric estimations. Arguably, variable *year* captures annual macroeconomic effects including those related to the dynamics of CPI.

Table IV. Smoothing parameters for explanatory variables and goodness-of-fit statistics in kernel regressions

	linfant	lunder5	lmother
h	0.311	0.327	0.240
lpGRP	0.347	0.417	0.684
public	2.467	0.835	0.625
private	0.230	0.262	0.419
urban	0.056	0.053	0.294
temperature	0.561	0.617	0.492
CPI	6.437	5344225	4272184
year	0.679	0.637	1.521
Goodness-of-fit			
R2	0.958	0.963	0.564
MSE	0.003	0.003	0.178
CV error	0.021	0.016	0.292
Observations	550	550	515

Notes: For binary variable h the table presents the value of the smoothing parameter.
For continuous variables the table presents bandwidths divided by the standard deviation.
R2 denotes coefficient of determination defined for nonparametric regressions.
MSE denotes mean squared error. CV error is computed for minimised least squares crossvalidation function with leave-one-out kernel estimator (see Hsiao *et al.*, 2007, eq.2.6).
For each health outcome the results of the estimations were robust with respect to using subsamples of observations, employed in corresponding extended models (subsamples for which variable *finance* was defined).

6. Discussion

Academic and policy related literature in Russia concentrates at promoting competition among private health insurers, assuming that it is a prerequisite for raising quality of the health care system. However, competition is capable of enhancing quality only if patients' interests become the major priority (Twigg, 1998) and an effective model with selective contracting is implemented (Sheiman, 1991).

The empirical analysis in this paper demonstrated that the presence of private health insurance companies as the only agents at the SHI market is positively related to the quality of regional health care systems in Russia. The estimations with the baseline model showed the significance of the type of the SHI in regressions explaining infant and under-five mortality (Table III). Kernel regressions revealed that the type of SHI system was significant in explaining infant, under-five, and maternal mortality. Our results are consistent with Twigg's (2001) finding that the presence of private health insurance companies is related to the decline in infant mortality.

However, the significance of the regional SHI system in explaining quality related health outcomes does not imply that effective model of competition among private health insurers is realised in Russian regions. Indeed, as is noted by the heads of Russian private health insurance companies, competition for consumers is practically absent in the SHI market (Reshetnikov, 2002; Twigg, 1999). Similarly, consumer surveys demonstrate that the reasons for subscribers' change of their health insurance company are commonly related to change of work or residence, and not to dissatisfaction with the insurer (Baranov and Sklyar, 2009). The failure of private health insurance companies to compete for subscribers may be implied from the indicators for market concentration in SHI. The data on Russian private insurance companies (Table V) indicate that in 2005-2010 the total number of private companies operating at the SHI market decreased, the share of top 10 private companies increased, and Herfindahl-Hirschman index went up.[10] Note that the concentration in the segment for SHI is regarded the highest in the Russian insurance market (Sergeeva, 2006).

Table V. Concentration at the market for SHI in Russia

Parameter	2005	2006	2007	2008	2009	2010
Herfindahl-Hirschman index	441	527	533	518	570	586
Market share of top 10 private companies, per cent	53	58	61	61	63	64
Total companies at the market	153	133	110	104	98	94

Notes: Authors' calculations according to the data for all Russian insurance companies ('Insurance in Russia'). Herfindahl-Hirschman index is calculated with respect to companies' revenue from SHI. The 2010 original figures are reported in 'Insurance in Russia' for the period January-June.

The missing competition for consumers may be revealed from the figures for the law suits on defending patients' rights in SHI, which are rarely submitted to courts through health insurance companies (Table VI). The suits deal with patients' complaints on organization of work in health care facilities, health care quality, drug provision, refusals to provide health care or charging price for health care that should be provided for free within SHI.

Table VI. Number of law suits on defending patients' rights in SHI

Plaintiff	2000	2001	2002	2003	2004
Patient	691	619	479	543	458
Regional SHI funds	15	54	49	48	65
Health insurance companies	70	58	37	30	66
Other	58	58	36	40	24
Total number of suits	834	789	601	661	613

Data source: Federal SHI fund (2005; 1999).

The estimations with the extended model showed that instrumented by financial investment risk, the type of SHI system became an insignificant covariate in explaining infant and under-five mortality. The

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[10] Pre-2005 data are unavailable.

result implies that the type of SHI system is significant in explaining the quality related health outcomes since it serves a proxy for institutional environment in the region.

Finally, we analyzed whether the result about the significance of the type of regional SHI in the baseline model is robust with respect to controlling for the development of regional health care systems. We employed the 2004-2006 regional data on the methods for setting fees in the regional SHI systems ('Implementation of health reform in the subjects of Russian Federation').[11] The variable *fees* (Table VII) is constructed in a way that higher values correspond to capitation and prospective payment (Ensor *et al.*, 1997) and consequently, it reflects the development of organization and management of regional health care systems. We included the variable on the methods of provider reimbursement in **X** in the baseline model (2).[12]

Table VII. Methods of provider reimbursement

Rank	Definition
1	for groups of providers
2	for each provider (each policlinic and hospital)
3	according to specialization of hospital department
4	according to diagnosis-related groups
5	for each disease

Source: Methodology for regional typologies ('Implementation of health reform in the subjects
of Russian Federation'. Ministry of Health and WHO/CIDA Health Care Policy and Stewardship
in Russia Programme. Regional typologies).

We found that the type of regional SHI system and the variable on the methods of provider reimbursement are significant in explaining infant and under-five mortality. Both explanatory variables have negative estimated coefficients, which implies that more effective methods of provider reimbursement as well as the presence of private health insurers as the only agents at the regional SHI market lead to lower infant and under-five mortality (Table VIII).

The finding suggests the existence of quasi-insurance mechanism in the Russian SHI market. Operating in institutional environment with provider reimbursement based on capitation and prospective payment, private insurance companies in fact shift a part of their risk to providers (Sheiman, 2007; Glied, 2000; Chernichovsky *et al.*, 1996). However, private health insurers in Russia have limited means to directly influence the quality of health care and are unable to implement selective contracting. Indeed, both the 1991 and the 2010 legislation obliges health insurers to sign treaties with all health care providers. Therefore, imposing financial penalties on hospitals and policlinics becomes the most prevalent instrument for quality control by private health insurance companies. Moreover, the methods of provider reimbursement are primarily determined by the regional SHI fund, possibly, with a

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[11] Although the original variable is discrete, in our estimations we used it as continuous to avoid increasing the number of regressors through introducing corresponding dummy variables.

[12] We did not employ the extended model (3) – (8) with IV estimations since we believe the methods of provider reimbursement have a direct influence on health outcomes.

participation of the executives from regional health departments. Albeit guaranteed by the 1991 law (article 15), the right of private health insurers to set provider fees remained declarative for a long period of time. While the 'Regulation on tariff commission in the SHI of St.Petersburg' allowed the representatives of private insurers to participate in tariff commissions since 2000, in most other Russian regions similar documents appeared only in 2008-2009.

Table VIII. Explaining health outcomes: baseline model with the variables on provider reimbursement

	linfant		lunder5		lmother	
	a	**b**	**a**	**b**	**a**	**b**
h	-0.123***	-0.113***	-0.114***	-0.104***	0.037	0.040
	(0.030)	(0.030)	(0.028)	(0.028)	(0.077)	(0.079)
lpGRP	-0.076*	-0.079*	-0.061	-0.063*	0.022	0.022
	(0.042)	(0.042)	(0.038)	(0.038)	(0.108)	(0.108)
public	0.018*	0.018**	0.021**	0.021***	0.075***	0.076***
	(0.009)	(0.009)	(0.008)	(0.008)	(0.025)	(0.025)
private	-0.028	-0.018	-0.026	-0.017	-0.281***	-0.277***
	(0.023)	(0.022)	(0.021)	(0.020)	(0.080)	(0.080)
urban	-0.002	-0.002*	-0.003**	-0.003**	0.003	0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)
temperature	-0.012***	-0.012***	-0.013***	-0.013***	-0.013***	-0.013***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)
CPI	-0.003	-0.003	-0.002	-0.003	0.040**	0.040**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.020)	(0.020)
fees		-0.029***		-0.026***		-0.009
		(0.011)		(0.010)		(0.028)
Constant	3.467***	3.633***	3.510***	3.664***	-2.108	-2.058
	(0.950)	(0.933)	(0.929)	(0.922)	(2.329)	(2.317)
Annual dummies	Yes	Yes	Yes	Yes	Yes	Yes
Years	3	3	3	3	3	3
Observations	224	224	224	224	207	207
Adjusted R2	0.373	0.391	0.438	0.455	0.174	0.17

Notes: *** Significance at 0.01 level, ** significance at 0.05 level, *significance at 0.1 level. Robust standard errors in parentheses. Baseline model and model with the variable on provider reimbursement are denoted correspondingly models 'a' and 'b'.

Our estimations offer suggestive evidence for enhancing the efficiency of regional SHI systems through effective participation of private insurers in the joint commissions of the regional SHI fund and regional health authorities on determining the methods of provider reimbursement. Indeed, the methods of reimbursement would motivate hospitals and policlinics to operate efficiently. The insurer competition for consumers would induce the desire to attract subscribers by higher quality health care, and would lead to selective contracting with higher quality health care facilities. Given an effective quality control, this would become an incentive for providers to offer health care of better quality.

Note that Russian private health insurance companies do have the ability to monitor health care quality, as is mentioned by the heads of private health insurance companies (Twigg, 1999) and by the

heads of hospitals and policlinics (Baranov and Sklyar, 2009). Moreover, the 2010 law made a step towards fostering provider competition. While previously only public providers could participate in SHI, the 2010 law allowed any private providers to enter the SHI market. An increase in the number of health care providers would decrease the bargaining power of hospitals and policlinics, and would increase bargaining power of providers in the joint commissions on setting tariffs.

7. Conclusion

The findings of parametric and non-parametric analyses conducted in this paper for quality related health outcomes in Russian regions in 2000-2006 demonstrate the significance of regional SHI system with private health insurers as the only agents at the market. However, the influence of private health insurers on the quality of regional health care systems care is arguably related to institutional settings in Russian regions, rather than the existence of insurance mechanisms or competition between insurers. Indeed, instrumented by a variable reflecting financial risks in the region, regional SHI system became insignificant.

 The variable on the methods of provider reimbursement proved to be a significant covariate in explaining quality related health outcomes in Russian regions. The result implies that provider incentives induced by the health authorities through reimbursement methods combined with insurers' own incentives mimic an efficient insurance mechanism. The finding supports the cause for strengthening the selective contracting with effective means of health care quality control. In this model providers have incentives to offer higher quality health care to be selected by private health insurers. At the same time providers are motivated to operate efficiently, since a part of risk is transferred to them through capitation and prospective payment methods.

Appendix

Table IX. Results of the first stage regression

	h
finance	-0.0010***
	(0.0038)
lpGRP	-0.5110**
	(0.2222)
public	-0.1039**
	(0.0446)
private	0.3525*
	(0.2021)
urban	0.0136*
	(0.0073)
temperature	-0.0246**
	(0.0116)
CPI	0.0002
	(0.0329)
Constant	-6.6215
	(4.1631)
Annual dummies	Yes
Years	7
Observations	435
Adjusted pseudo R2	0.12

Notes: *** Significance at 0.01 level, ** significance at 0.05 level, *significance at 0.1 level. Robust standard errors in parentheses.

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