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Urban inequity in the performance of social health insurance system: evidence from Russian regions

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Urban inequity in the performance of social health insurance system: evidence from Russian regions

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Abstract

The paper assesses the impact of urbanization on the quality related outcomes of social health insurance systems in 85 Russian regions in 2000-2006. The results of parametric and kernel regressions reveal that controlling for regional income, inequality, geographic variations and organization of health care systems, urbanization is a significant determinant of infant and under-five mortality. Arguably, the influence of urbanization on health outcomes is due to latent processes (e.g. the development of infrastructure). The methods of provider reimbursement are related to infant and under-five mortality, which offers suggestive evidence for selective contracting. Yet, insurer competition might increase urban inequity.

Key words*: social determinants of health, urbanization, social health insurance, infant mortality, provider payment, kernel regression, health care systems*

JEL classification: I10, I18, C14, C26

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1. Introduction

Urbanization is closely related to health outcomes since various socioeconomic determinants of health[2] are uniquely transformed in cities (Vlahov *et al.*, 2007). In particular, urbanization may be associated with the exclusion from health programs (Mercado *et al.*, 2007) and the lack of access to health systems (Ompad *et al.*, 2007; Yusuf *et al.*, 2007). Moreover, the organization of policy making process in urban areas is believed to be a major determinant of health (Barten *et al.*, 2007). Arguably, urbanization becomes a key determinant of health in the Central and East European countries and the former Soviet Union. Indeed, these transition countries faced deep changes both in the overall economy and in the health systems. Specifically, post-Soviet Russia demonstrated better progress in health reforms in urban areas (Twigg, 2001), and larger spread of insurance companies (Twigg, 2006) along with higher efficiency of health systems in highly populated areas (World Bank, 2011).

It should be noted that 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).

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 Russian regions with different SHI systems. To the best of our knowledge Twigg's (2001) statistical analysis of infant mortality in 41 Russian regions in 1999-2001 is the only study measuring the effect of private health insurers on health outcomes related to health care system quality. As for the macro evidence on urbanization and health outcomes, the point estimates in the World Bank (2011) study are based on cross-sectional data for 2006, and do not allow for longitudinal analysis.

The novelty of this paper is twofold. Firstly, the paper is a longitudinal analysis of the impact of urbanization, poverty and inequality on the performance of regional health care systems in Russia. Secondly, the paper follows the approach of Besstremyannaya and Simm (2012) to control for the type of social health insurance system in the region. The performance of health care systems is measured with health outcomes, which are commonly regarded as indicators of the quality of health care systems. The paper analyzes

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[2] Overall, the empirical evidence suggests that these determinants of health include income, inequality, population density, geographic factors, and health governance (Skinner, 2012; Schultz, 2010; Barten *et al.*, 2007; Ompad *et al.*, 2007; Elola *et al.*, 1995).

whether infant mortality, under-five mortality, and maternal mortality in Russian regions in 2000-2006 depended on urbanization, regional income, inequality, and 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 parametric and kernel regressions indicate that controlling for regional income, inequality, and organization of health care systems, urbanization is a significant determinant of 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. The influence of urbanization on health outcomes becomes smaller when regional health insurance system is instrumented by regional infrastructure. 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. Yet, insurer competition might increase urban inequity in the performance of social health insurance systems in Russia.

The remainder of the paper is organized 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 urbanization and other socioeconomic determinants of health on the performance 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 need to create competition between private insurers was emphasized 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 1).

Table 1. 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.

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

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

where **y** is health outcome in the region, **h** is the type of regional SHI system, and **X** is socio-economic variables.

X is the variables which are commonly employed as socioeconomic 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), Gini coefficient and poverty rate as inequality measures (Wagstaff and Claeson, 2004; Filmer and Pritchett, 1999; Bidani and Ravallion, 1997; Anand and Ravallion, 1993). In particular, this paper uses the cross-terms of poverty rate multiplied by per capita GRP, and Gini coefficient multiplied by per capita GRP, since both poverty rate and Gini coefficient were correlated with per capita GRP.

The share of urban population is included in the list of covariates **X** as a common measure of urbanization. The influence of inflation is taken into account by consumer price index. Geographical differences between Russian regions are incorporated through January temperature.

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"), the type of the regional SHI system is treated as a binary variable **h**: unity value is attributed to the regions where SHI is offered exclusively by private insurance companies.[3]

[3] When we introduce 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, the paper presents the findings with only *h* among covariates.

3.1 Parametric models

Baseline model

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

$$\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \theta\mathbf{h} + \boldsymbol{\varepsilon},\ E(\boldsymbol{\varepsilon})=0, \tag{2}$$

where *i* is the index for region, **X** is the determinants of health, and **h** is the type of the regional SHI system.

Baseline model with provider reimbursement

The model analyzes the impact of the regional SHI system on health outcomes 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"). The variable *fee* is constructed in a way that higher values correspond to capitation and prospective payment (Ensor *et al.*, 1997), which is associated with efficiency and quality-enhancing mechanisms of regional health care systems (Twigg, 2001). Let

$$\mathbf{y} = \mathbf{X_1}\boldsymbol{\beta_1} + \theta_1\mathbf{h} + \boldsymbol{\varepsilon_1},\ E(\boldsymbol{\varepsilon}_1)=0,\ \mathbf{X_1}=(\mathbf{X}, \boldsymbol{fee}), \tag{3}$$

where *i* is the index for region, **h** is the type of the regional SHI system, **X** is the control variables employed in the baseline model, and **fee** is a variable on provider reimbursement.[4]

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 **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 (4) - (6) with latent variable $\mathbf{h}^*$ and the observed variable **h**. Let

$$\mathbf{h}^* = \mathbf{X}\boldsymbol{\beta_2} + \mathbf{Z}\boldsymbol{\delta} + \boldsymbol{\varepsilon_2} \tag{4}$$

$$\mathbf{y} = \alpha\mathbf{h}^* + \mathbf{X}\boldsymbol{\beta}_3 + \boldsymbol{\varepsilon_3} \tag{5}$$

$$h_i = \begin{cases} 0, \text{ if } & h_i^* < c_0 \\ 1, \text{ if } & c_0 \le h_i^* < c_1 \end{cases} \tag{6}$$

$$\boldsymbol{\varepsilon_2} = N(0,\sigma^2\mathbf{I}),\ \boldsymbol{\varepsilon_3} = N(0, \mathbf{I}),\ \boldsymbol{\varepsilon_2} \text{ and } \boldsymbol{\varepsilon_3} \text{ are independent,} \tag{7}$$

$$\boldsymbol{\varepsilon_2} \text{ and } \mathbf{X} \text{ are independent, } \boldsymbol{\varepsilon_2} \text{ and } \mathbf{Z} \text{ are independent,} \tag{8}$$

$$\boldsymbol{\varepsilon_3} \text{ and } \mathbf{X} \text{ are independent, } \boldsymbol{\varepsilon_3} \text{ and } \mathbf{h}^* \text{ are independent,} \tag{9}$$

where **Z** is the instruments for the type of regional SHI system and unknown cutoff points satisfy the condition $c_0 < c_1$. Variable ***fee*** was not introduced in the extended model with instrumental variables, since we believe the methods of provider reimbursement have a direct influence on health outcomes.

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[4] 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.

The system (4)-(6) is estimated with two-stage least squares, and provides for consistent estimates given (7)-(9). The quality of institutions was measured as investment risks and infrastructure potential (Expert RA), based on the assumption that infrastructural potential and investment risks have no other influence on the performance of regional health care systems but through the type of SHI system.

3.2 Non-parametric kernel regressions

Since specifying a parametric model implies a number of restrictions (Hardle and Linton, 1994), this paper uses 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):

$$y_i = g(h_i, \mathbf{X}_i) + u_i \quad (10)$$

u_i and h_i are independent; u_i and X_i are independent (11)

$$\hat{g}(x) = \left(\sum_{i=1}^{n} y_i W_{b,ix}\, l_{\lambda,i}\right) / \left(\sum_{i=1}^{n} W_{b,ix}\, l_{\lambda,i}\right), \quad (12)$$

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, $\mathbf{X}_i$ are socioeconomic determinants of health, h_i is the type of regional SHI system, $W_{b,ix}$ 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.[5]

4. Data

The paper employs the pooled data on health outcomes, the types of regional SHI systems, and socio-economic variables for Russian regions in 2000-2006 (Table 2). The usage of the pooled data is explained by the 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 (i.e. “Implementation of health reform in the subjects of Russian Federation”) for the years 2005 and 2006 – limited the analysis to the period 2000-2006.

[5]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). Bandwidths are selected according to Li and Racine’s (2003) crossvalidation. The code is written in the R language (ver.2.14.1) using “np” package (ver.0.40-12) “Nonparametric kernel smoothing methods for mixed data types” (Hayfield and Racine, 2012; Hayfield and Racine, 2008). The results of the estimations under Li and Racine’s (2003) kernel and Wang and van Ryzin’s (1981) kernel were similar.

Table 2. 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
Socio-economic determinants						
pGRP	Per capita gross regional product, rubles	550	70839.91	68908.45	7751.70	765204.20
urban	Share of urban population, percent	550	69.20	12.62	25.90	100
poverty	Share of population below subsistence level, percent	548	29.89	12.80	9.60	88.00
Gini	Gini coefficient	393	0.36	0.04	0.30	0.62
CPI	Consumer price index, December to December of the previous year, percent	550	114.35	4.59	105.50	138.70
public	Share of public health expenditure in gross regional product, percent. 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, percent	550	0.63	0.46	0.08	3.82
density	Population density, persons per sq.kilometer	550	189.44	1107.55	0.07	9485.36
temperature	Temperature in January, degrees Celsius	550	-11.18	8.39	-37.10	4.30
SHI system						
h	=1 if private health insurers are exclusive agents at the SHI market; 0 otherwise	550	0.58	0.49	0	1
fee	= 0 if line budget, 1 if tariffs set for groups of providers, 2 if set for each provider, 3 if set for types of hospital departments, 4 if set for diagnosis-related groups, 5 if set for each disease	224	2.86	1.26	0	5
Instruments for SHI system						
infrastructural potential	geo-economic location and infrastructural development	427	39.24	23.96	1	88
financial risk	balance of the budgets of enterprises and governments	435	38.82	22.97	1	88
legislative risk	legislative norms for use of production factors and investment	436	38.56	23.40	1	89
ecological risk	pollution level and radiation	435	43.65	23.08	2	85

Notes: All variables are estimated on the annual basis. 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. Each risk is an expertly determined ranked ordered variable, with rank "1" denoting the region with the minimal risk. Infrastructural potential is an expertly determined ranked ordered variable, with rank "1" denoting the region with the minimal potential. Although the paper analyses the data for 85 regions Russian regions, the values of risks/potential are kept in the original scale 1-89 which corresponds to 89 regions in pre-2005 administrative division. The values of variable "fee" are available only in 2004-2006. 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, 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).

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) – (5). As for the extended model, variable on infrastructural potential which measures geo-economic location and the development of infrastructure, may be regarded as a valid instrument for the type of SHI system. 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 the first stage regression with benchmark figures. The value of 9.3 is slightly 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-percent Wald test (based on TSLS or LIML test) equal to 0.20 (Stock and Yogo, 2002; Staiger and Stock, 1997). Various investment risks proved to be weaker instruments or were endogenous to our model (for instance, management risk which incorporates the value of infant mortality rate).[6]

The estimations demonstrated that the share of urban population was negative and significant in the baseline and the extended models, explaining infant and under-five mortality. The result implies that urbanization is associated with specific mechanisms, which are related to the performance of health care systems. It should be noted that the impact of urbanization is distinct from the economic processes, associated with income, inequality, and health care provision. Indeed, the latter processes were captured in our analysis by the variables on per capita GRP, poverty rate, Gini coefficient, and the type of social health insurance system.

The results of the analysis with the baseline model with the variable on provider reimbursement revealed that 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. However, the influence of urbanization (the absolute value of the coefficient) becomes larger in the presence of the variable on provider reimbursement. Arguably, insurer competition might increase urban inequity in the performance of social health insurance systems in Russia.

The estimations with the extended model showed that the absolute value of the coefficient of urbanization becomes smaller when regional health insurance system is instrumented by regional infrastructure. The finding implies that urbanization is significant in explaining the quality related health outcomes since it serves a proxy for institutional environment in the region. As for other socioeconomic determinants of health, the share of private health care expenditure in GRP generally had 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 had positive estimated coefficients, which may be interpreted as ineffectiveness of public health care expenditure. The type of regional SHI system and the variable on the methods of provider reimbursement were significant in explaining infant and under-five mortality. Both

[6] The results of the first stage estimations for investment risks are presented in the Appendix (Table 5).

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 3).

The density of population was positively significant in explaining infant, under-five, and maternal mortality, which implies that worse health outcomes are linked with higher population density. Higher January temperature was found to decrease the values of the three mortality indicators. The cross-term of log per capita GRP multiplied by poverty rate was generally insignificant. However, the cross-term of log per capita GRP multiplied by Gini coefficient commonly had a negative impact of infant, under-five, and maternal mortality. The findings were generally robust with respect to including Gini coefficient in covariates (Table 7).[7]

Table 3 Explaining health outcomes in Russian regions in 2000-2006

	linfant			**lunder5**			**lmother**		
	baseline	**baseline *f***	**extended**	**baseline**	**baseline *f***	**extended**	**baseline**	**baseline *f***	**extended**
lpGRP	-0.0115	-0.0772	-0.150***	0.0079	-0.0643	-0.131***	-0.0318	0.0278	-0.261**
	(-0.0358)	(-0.0474)	(-0.0445)	(-0.0348)	(-0.0424)	(-0.0420)	(-0.0908)	(-0.1070)	(-0.1070)
urban	-0.0021**	-0.0022	-0.0006	-0.0024***	-0.0029**	-0.0008	0.0029	0.0028	0.00541*
	(-0.0009)	(-0.0013)	(-0.0010)	(-0.0008)	(-0.0012)	(-0.0009)	(-0.0026)	(-0.0040)	(-0.0028)
CPI	0.0003	-0.0033	-0.0020	-0.0027	-0.0029	-0.0024	0.0102	0.0392**	0.0094
	(-0.0048)	(-0.0068)	(-0.0043)	(-0.0045)	(-0.0068)	(-0.0039)	(-0.0126)	(-0.0198)	(-0.0140)
lpGRP*poverty	0.0002*	-0.00003	0.0002	0.0003***	-0.00003	0.0003	0.0002	-0.0003	-0.00003
	(-0.0001)	(-0.0003)	(-0.0002)	(-0.0001)	(-0.0002)	(-0.0002)	(-0.0004)	(-0.0006)	(-0.0004)
public	0.0259***	0.0191**	-0.0046	0.0283***	0.0217***	-0.0013	0.0414**	0.0824***	0.0268
	(-0.0063)	(-0.0089)	(-0.0115)	(-0.0057)	(-0.0083)	(-0.0110)	(-0.0197)	(-0.0292)	(-0.0296)
private	-0.0142	-0.0190	0.0449*	-0.0142	-0.0173	0.0468**	-0.110*	-0.281***	0.0400
	(-0.0177)	(-0.0216)	(-0.0235)	(-0.0153)	(-0.0203)	(-0.0211)	(-0.0655)	(-0.0786)	(-0.0816)
density	-0.00001	-0.00001	0.0002***	-0.00001	-0.000001	0.0001***	-0.00001	-0.00002	0.0004***
	(-0.00001)	(-0.00002)	(-0.00005)	(-0.00001)	(-0.00001)	(-0.00004)	(-0.00002)	(-0.00002)	(-0.0001)
temperature	-0.0110***	-0.0123***	-0.0152***	-0.0122***	-0.0130***	-0.0160***	-0.0210***	-0.0132***	-0.0298***
	(-0.0013)	(-0.0022)	(-0.0018)	(-0.0012)	(-0.0019)	(-0.0016)	(-0.0038)	(-0.0045)	(-0.0051)
h	-0.0639***	-0.112***		-0.0679***	-0.104***		-0.0738	0.0434	
	(-0.0175)	(-0.0298)		(-0.0162)	(-0.0279)		(-0.0529)	(-0.0791)	
fees		-0.0277**			-0.0262***			-0.0056	
		(-0.0110)			(-0.0100)			(-0.0294)	
$\hat{h}^*$			-0.155***			-0.154***			-0.385***
			(-0.044)			(-0.0398)			(-0.116)
Constant	2.272***	3.632***	3.369***	2.578***	3.686***	3.398***	1.793	-2.03	2.51
	(-0.664)	(-0.997)	(-0.711)	(-0.616)	(-0.994)	(-0.667)	(-1.765)	(-2.271)	(-1.815)
Annual dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Years	7	3	7	7	3	7	7	3	7
Observations	548	224	427	548	224	427	513	207	406
Adjusted R2	0.526	0.386	0.468	0.593	0.449	0.518	0.173	0.164	0.174
Chi-squared in the first stage regression			9.3			9.3			9.3

Notes: *** Significance at 0.01 level, ** significance at 0.05 level, *significance at 0.1 level. Robust standard errors in parentheses. "*Baseline f*" denotes the baseline model with the variable on provider reimbursement. The extended model uses infrastructural potential as an instrument for h. 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 the variable "infrastructural potential" was defined).

[7] 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. See the Appendix (Table 6) for the results of the estimations in the models with Gini coefficient.

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 (10)-(12).[8] The resulting kernel regressions demonstrated that urbanization 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 variable "urban" equaled correspondingly 0.1076, 0.0608, and 0.1410 (Table 4).

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 3), the result suggests nonlinear relation between log of per capita GRP and health outcomes. Large smoothing parameter for CPI, as well as the absence of variation of the dependent variable on the diagrams for confidence intervals with respect to CPI (Figure 1), 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. The "significance" of other predictors generally correspond to the results of the parametric estimations.

Table 4. Smoothing parameters for explanatory variables and goodness-of-fit statistics in kernel regressions

	linfant	**lunder5**	**lmother**
lpGRP	0.3561	0.4095	0.8557
Urban	0.1076	0.0608	0.1410
CPI	4951391	4260691	2007591
lpGRP*poverty	0.3889	1.1629	2.3753
public	600688	1.5046	0.7711
private	0.2709	0.3327	0.5511
density	0.0037	0.0037	0.0170
temperature	0.8713	0.9073	1.2527
year	0.8356	0.6877	1.9242
h	0.2848	0.3283	0.1823
Goodness-of-fit			
R2	0.9781	0.9741	0.5760
MSE	0.0018	0.0021	0.1717
CV error	0.0188	0.0144	0.2863
Observations	548	548	513

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 minimized 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 the variable "infrastructural potential" was defined).

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

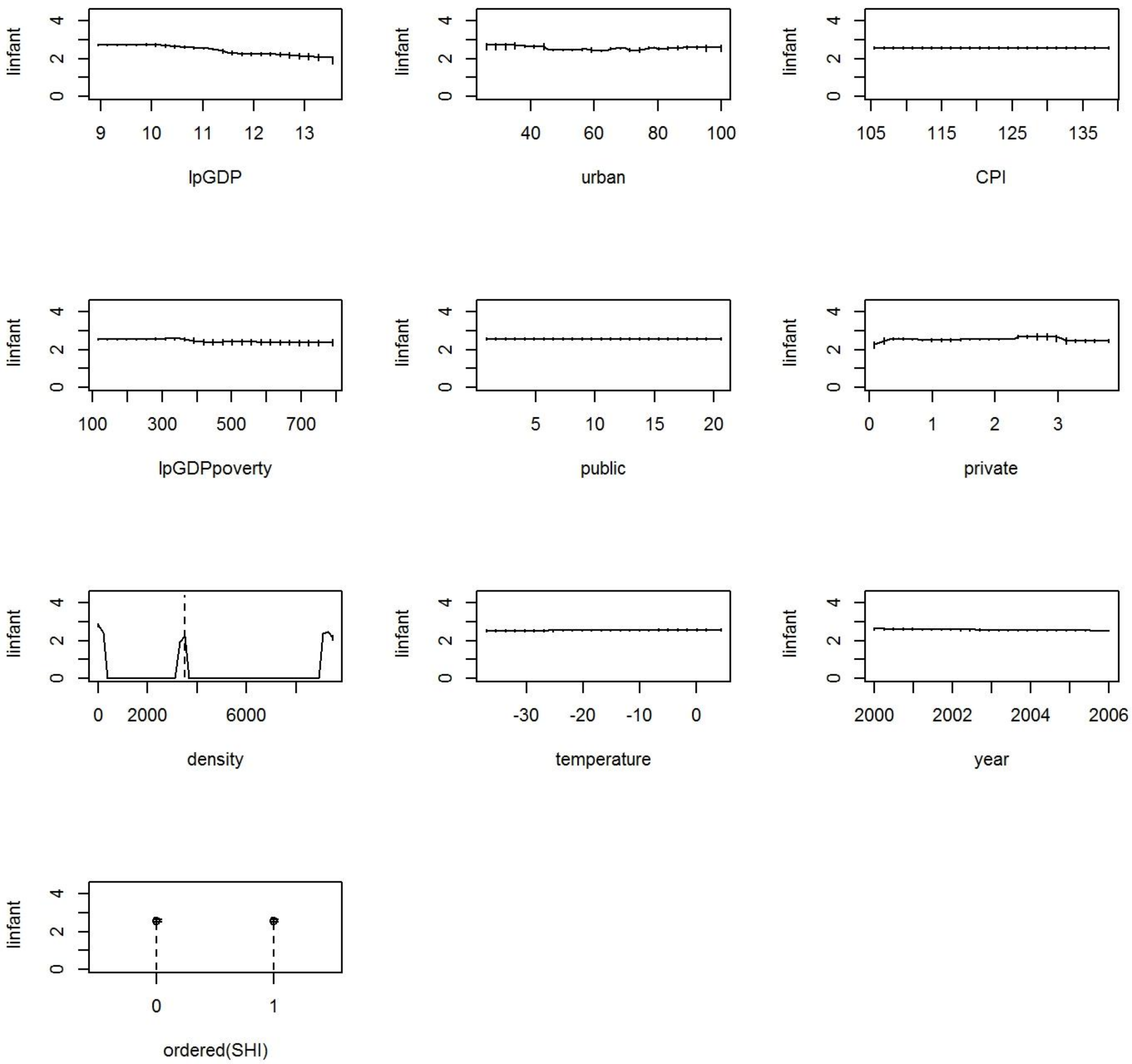

Figure 1. Confidence intervals for log of infant mortality in kernel regressions

Note: “Ordered(SHI)” denotes the binary variable for the type of social health insurance system (variable *h*)

6. Discussion

Guaranteeing equity in health care delivery and utilization is a major challenge for health care systems in developed countries. As is defined in *The Dictionary of Health Economics*, equity "relates in general to ethical judgments about the fairness of income and wealth distributions, cost and benefit distributions, accessibility of health services, exposure to health-threatening hazards" (Culyer, 2005). In particular, the concept of horizontal equity deals with "equal treatment for equal need" (Wagstaff and van Doorslaer, 1991a; Culyer and Wagstaff, 1993) and "means that persons in equal need of medical care should receive the same treatment, irrespective of whether they happen to be poor or rich, old or young, black or white, and so on" (Wagstaff and van Doorslaer, 1991b).

The parametric and non-parametric analyses in this paper uniformly demonstrated the existence of urban inequity in the quality related outcomes of regional health care systems in Russia. Urbanization was found to have a significant negative impact on the values of infant, under-five, and maternal mortality, which is equivalent to the existence of positive urban externality. In this regard transitional Russia is no exception to the stylized fact about "the urban-rural divide" in the low and middle-income countries (Friel *et al.*, 2011). The major mechanisms enabling the influence of urbanization on the three mortality indicators in Russia are better medical equipment (Twigg, 2001), higher quality of medical staff, higher per capita number of doctors (Besstremyannaya, 2009), and more developed infrastructure in urban areas. Note that establishing general practices and investing in medical equipment of municipal health care facilities in the course of the Russian national project "Health" (started in October 2005) were targeted at solving the non-infrastructure causes of urban inequity. As for the impact of infrastructure, the results of our analysis with the variable "infrastructural potential" in the extended model (4)-(9) showed that in case of infant and under-five mortality urbanization has lower absolute values of estimated coefficients in compared to the baseline models. This may be interpreted as the link between infrastructural potential and urbanization. The finding suggests that infrastructure is one of the channels through which urbanization has an effect on the performance of health care systems.

The prospects for decreasing various health inequities in Russia are commonly associated with the development of the model for social health insurance. In short, 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. The findings about the significance of the regional SHI system in explaining quality related health outcomes in this paper do not imply that effective model of competition among private health insurers is realized 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. Our calculations with the data on Russian private insurance companies ("Insurance in Russia", 2011) indicate that in 2005-2010 the total number of private companies operating at the SHI market decreased from 153 to 94, the share of top 10 private companies increased from 53% to 64%, and Herfindahl-Hirschman index went up 1.5 times.[9] Note that the concentration in the segment for SHI is regarded the highest in the Russian insurance market (Sergeeva, 2006). The missing competition for consumers may be revealed from the figures for the law suits on defending patients' rights in SHI,[10] which are rarely submitted to courts through health insurance companies (Federal Mandatory Health Insurance fund, 2005).

The results of our analysis on the significance of provider reimbursement variable 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 new 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 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.

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.[11]

However, the effective model of provider competition may become a negative urban externality. Indeed, the results of the parametric analysis in model (3) with provider reimbursement variable "fee" revealed that the absolute value of the estimated coefficient for urbanization becomes higher than in case of the baseline model (2). In other words, along enhancing the performance of regional health care systems, the structural reforms in Russia's SHI would increase the gap between urban and non-urban areas. Arguably, the reasons

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[9] Pre-2005 data are unavailable.

[10] 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.

[11] 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

are difficulties in the administration (Twigg, 2001) and lower profits of non-urban areas by health insurance companies (Twigg, 2006).

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 that controlling for regional income, inequality, geographic variations and organization of health care systems, urbanization is a significant determinant of infant and under-five mortality. The result implies that urbanization is associated with specific mechanisms, which are related to the performance of health care systems. It should be noted that the influence of urbanization on health outcomes becomes smaller when regional health insurance system is instrumented by regional infrastructure.

The variable on the methods of provider reimbursement proved to be a significant covariate in explaining quality related health outcomes in Russian regions. Arguably, provider incentives induced by the health authorities through reimbursement methods combined with insurers' incentives mimic an efficient insurance mechanism. The finding supports the cause for strengthening the selective contracting with effective means of health care quality control. However, our estimations revealed that the insurer competition might increase urban inequity in the performance of social health insurance systems in Russian regions.

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.

Appendix

Table 5. Results of the first stage regression with dependent variable *h*

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
financial risk	-0.0092**				-0.0069			
	(-0.0040)				(-0.0046)			
legislative risk		0.0030				0.0019		
		(-0.0030)				(-0.0035)		
ecological risk			0.0061				0.00840*	
			(-0.0038)				(-0.0044)	
infrastructural potential				-0.0151***				-0.0107*
				(-0.0050)				(-0.0058)
lpGRP	-0.534**	-0.3400	-0.464*	-0.2540	0.1760	0.3240	0.1870	0.2550
	(-0.2550)	(-0.2370)	(-0.2510)	(-0.2370)	(-0.3660)	(-0.3510)	(-0.3620)	(-0.3410)
urban	0.0067	0.0034	0.0026	0.0016	-0.0014	-0.0048	-0.0069	-0.0016
	(-0.0078)	(-0.0078)	(-0.0077)	(-0.0080)	(-0.0095)	(-0.0094)	(-0.0094)	(-0.0092)
CPI	0.0005	-0.0006	0.0013	-0.0161	-0.0285	-0.0277	-0.0278	-0.0055
	(-0.0333)	(-0.0333)	(-0.0333)	(-0.0333)	(-0.0445)	(-0.0446)	(-0.0448)	(-0.0424)
lpGRP*poverty	0.0009	0.0005	0.0007	0.0009	0.0013	0.0011	0.0014	0.0013
	(-0.0011)	(-0.0011)	(-0.0011)	(-0.0011)	(-0.0013)	(-0.0013)	(-0.0013)	(-0.0014)
lpGRP*Gini					-0.989***	-1.017***	-1.039***	-0.878***
					(-0.3170)	(-0.3150)	(-0.3190)	(-0.3180)
public	-0.140***	-0.169***	-0.164***	-0.0976**	-0.155***	-0.182***	-0.179***	-0.134**
	(-0.0473)	(-0.0462)	(-0.0456)	(-0.0482)	(-0.0535)	(-0.0531)	(-0.0513)	(-0.0534)
private	0.348*	0.364*	0.392**	0.519**	0.3610	0.381*	0.424*	0.480**
	(-0.2040)	(-0.1980)	(-0.1980)	(-0.2210)	(-0.2310)	(-0.2250)	(-0.2260)	(-0.2400)
density	0.0028	0.0045	0.0048	0.0010	0.0041	0.0056	0.0061	0.0011
	(-0.0032)	(-0.0032)	(-0.0032)	(-0.0026)	(-0.0040)	(-0.0039)	(-0.0039)	(-0.0028)
temperature	-0.0341**	-0.0283**	-0.0280**	-0.0542***	-0.0363**	-0.0335**	-0.0318**	-0.0458***
	(-0.0132)	(-0.0129)	(-0.0130)	(-0.0138)	(-0.0157)	(-0.0156)	(-0.0156)	(-0.0167)
constant	-7.0800	-4.9400	-5.9860	-5.5870	-6.6790	-5.0800	-6.5130	-2.6640
	(-4.4130)	(-4.3080)	(-4.3560)	(-4.4530)	(-5.6530)	(-5.5850)	(-5.6560)	(-5.5020)
Annual dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Years	7	7	7	7	5	5	5	5
Observations	435	436	435	427	331	332	331	331
Adjusted pseudo R2	0.139	0.131	0.135	0.136	0.157	0.153	0.16	0.16
Chi-squared	5.26	1.01	2.67	9.30	2.28	0.29	3.61	3.39

Notes: *** Significance at 0.01 level, ** significance at 0.05 level, *significance at 0.1 level. Robust standard errors in parentheses. The dependent variable is h (the type of regional social health insurance system), as defined in Table 2. Models 1 through 4 denote the models with the instrument financial risk, legislative risk, ecological risk, or infrastructure potential, respectfully. Models 5 through 8 are extensions of the corresponding models 1 through 4 with an additional cross-term lpGRP*Gini. Gini coefficient is reported in Russian national statistics since 2002, which decreases the number of observations in models 5-8 relative to models 1-4.

Table 6 Explaining health outcomes in the models with Gini coefficient

	linfant			**lunder5**			**lmother**		
	baseline	**baseline *f***	**extended**	**baseline**	**baseline *f***	**extended**	**baseline**	**baseline *f***	**extended**
lpGRP	0.0343	-0.0095	0.0427	0.0309	-0.0160	0.0414	-0.1140	0.0234	0.1120
	(-0.0465)	(-0.0557)	(-0.0540)	(-0.0441)	(-0.0525)	(-0.0490)	(-0.1370)	(-0.1670)	(-0.1480)
urban	-0.0026**	-0.0029**	-0.0022*	-0.0031***	-0.0034***	-0.0024**	0.0028	0.0029	0.0042
	(-0.0011)	(-0.0014)	(-0.0011)	(-0.0010)	(-0.0013)	(-0.0010)	(-0.0032)	(-0.0042)	(-0.0032)
CPI	0.0046	-0.0041	-0.0012	0.0033	-0.0035	-0.0018	0.0289**	0.0392*	0.0213
	(-0.0056)	(-0.0069)	(-0.0058)	(-0.0051)	(-0.0069)	(-0.0051)	(-0.0142)	(-0.0201)	(-0.0147)
lpGRP*poverty	0.0002	-0.0001	0.0003	0.0002	0.0000	0.0003	0.0001	-0.0003	0.0002
	(-0.0002)	(-0.0003)	(-0.0003)	(-0.0002)	(-0.0002)	(-0.0002)	(-0.0005)	(-0.0006)	(-0.0005)
lpGRP*Gini	-0.0778*	-0.101*	-0.342***	-0.0553	-0.0721	-0.309***	0.0731	0.0060	-0.573**
	(-0.0404)	(-0.0518)	(-0.0751)	(-0.0343)	(-0.0473)	(-0.0646)	(-0.1090)	(-0.1420)	(-0.2240)
public	0.0248***	0.0159*	-0.0264*	0.0254***	0.0195**	-0.0208	0.0385	0.0825***	-0.0019
	(-0.0068)	(-0.0089)	(-0.0144)	(-0.0062)	(-0.0083)	(-0.0134)	(-0.0239)	(-0.0291)	(-0.0391)
private	-0.0185	-0.0164	0.105***	-0.0131	-0.0155	0.104***	-0.187**	-0.281***	0.0715
	(-0.0164)	(-0.0217)	(-0.0332)	(-0.0151)	(-0.0206)	(-0.0294)	(-0.0800)	(-0.0792)	(-0.1130)
density	0.00001	0.00002	0.00032***	0.00001	0.00002	0.0003***	-0.00004	-0.00002	0.0006***
	(-0.00002)	(-0.00002)	(-0.0001)	(-0.00001)	(-0.00002)	(-0.0001)	(-0.00003)	(-0.00004)	(-0.0002)
temperature	-0.0116***	-0.0130***	-0.0189***	-0.0125***	-0.0135***	-0.0193***	-0.0184***	-0.0132***	-0.0306***
	(-0.0018)	(-0.0023)	(-0.0025)	(-0.0015)	(-0.0019)	(-0.0022)	(-0.0046)	(-0.0045)	(-0.0063)
h	-0.0852***	-0.122***		-0.0817***	-0.111***		-0.0171	0.0441	
	(-0.0209)	(-0.0299)		(-0.0193)	(-0.0282)		(-0.0625)	(-0.0815)	
fees		-0.0253**			-0.0244**			-0.0058	
		(-0.0112)			(-0.0102)			(-0.0299)	
$\hat{h}^*$			-0.274***			-0.264***			-0.574***
			(-0.0648)			(-0.0587)			(-0.187)
Constant	1.661**	3.436***	2.918***	1.986***	3.546***	3.075***	0.489	-2.013	0.413
	(-0.798)	(-0.983)	(-0.854)	(-0.744)	(-0.987)	(-0.8)	(-2.064)	(-2.278)	(-1.941)
Annual dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Years	5	3	5	5	3	5	5	3	5
Observations	393	224	331	393	224	331	365	207	312
Adjusted R2	0.466	0.394	0.36	0.524	0.453	0.424	0.127	0.159	0.177
Chi-squared in the first stage regression			3.39			3.39			3.39

Notes: *** Significance at 0.01 level, ** significance at 0.05 level, *significance at 0.1 level. Robust standard errors in parentheses. "Baseline *f*" denotes the baseline model with the variable on provider reimbursement. The extended model uses infrastructural potential as an instrument for h. 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 the variable "infrastructural potential" was defined). The instrument "infrastructural potential" is valid since prob>chi-squared was 0.07, but may be regarded weak since chi-squared statistics is low in view of the benchmark figures in Stock and Yogo (2002) and Staiger and Stock (1997).

Table 7. Smoothing parameters for explanatory variables and goodness-of-fit statistics in kernel regressions with Gini coefficient among covariates

	linfant	**lunder5**	**lmother**
lpGRP	0.3525	0.8440	1.2555
urban	1.6827	0.1134	1.0102
CPI	615614	711474	4749115
lpGRP*poverty	0.5033	893861.9	1.2241
lpGRP*Gini	0.4000	0.3983	0.2005
public	1.0388	0.8930	0.6463
private	0.2908	0.5056	0.6966
density	0.0019	0.0017	3630137
temperature	1.2817	86800.08	0.6097
year	0.6302	0.7141	0.0998
h	0.1615	0.3204	0.4230
Goodness-of-fit			
R2	0.9834	0.9710	0.7768
MSE	0.0012	0.0020	0.0855
CV error	0.0186	0.0144	0.2772
Observations	393	393	365

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 minimized 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 the variable "infrastructural potential" was defined).

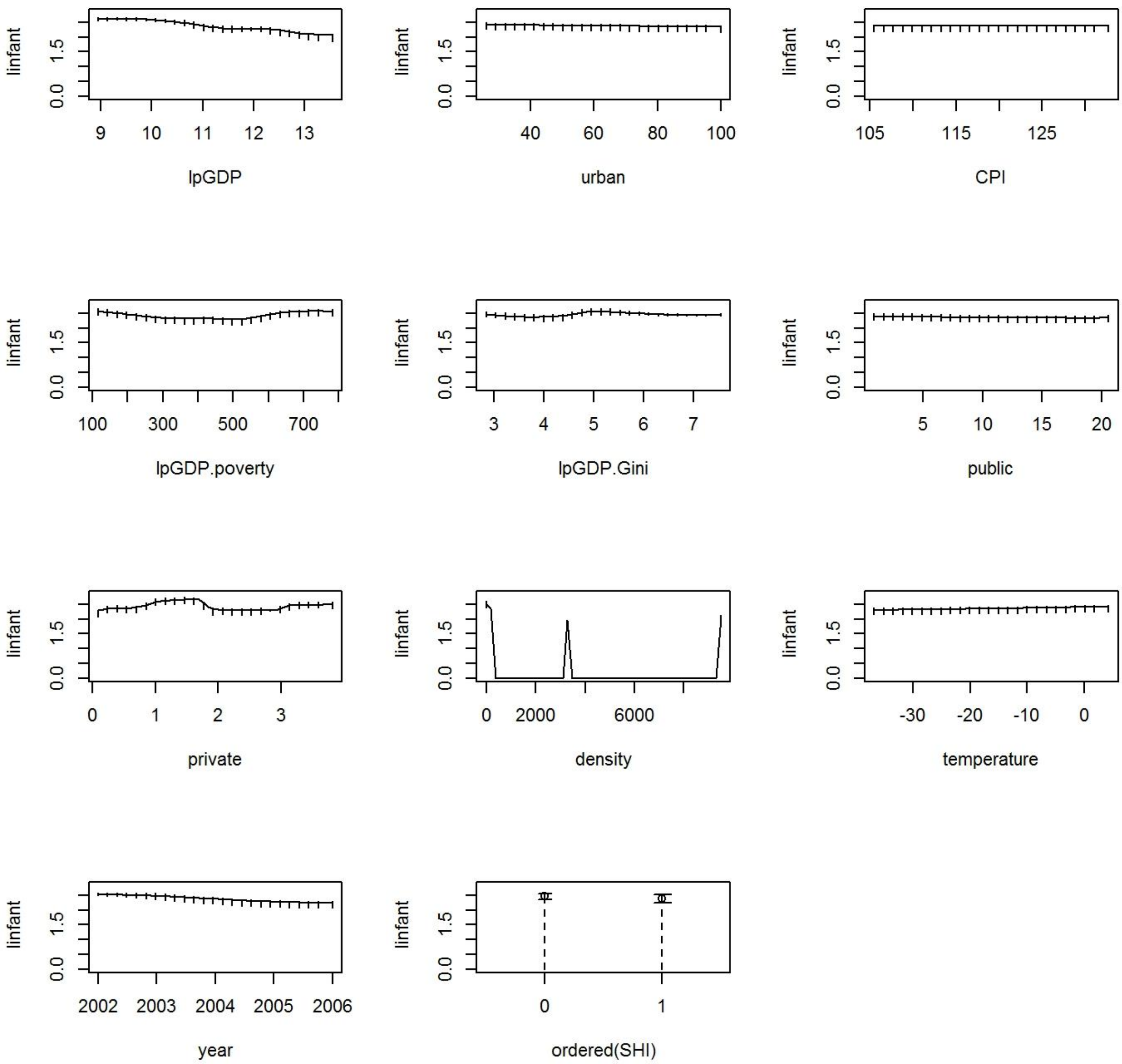

Figure 2. Confidence intervals for log of infant mortality in kernel regressions with Gini coefficient among covariates

Note: “Ordered(SHI)” denotes the binary variable for the type of social health insurance system (variable *h*)

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