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A Dynamic Analysis of Demand for Childcare, Maternal Employment and Child Obesity in Russia

Zafar Nazarov[1] and Tatyana Zhuravleva[2]

Abstract

In this paper, we explore the effect of formal childcare along with maternal employment on the probability of having an obese child. We use the multi-equation framework and data on Russian mother-child pairs for the period from 2000 to 2013. In the given period, the Russian population has experienced the unprecedented growth in living standards increasing population's demand for formal childcare services. However, the supply side has not responded adequately to the increased demand leading to the shortage of formal childcare services in the economy. Using regional variations in living standards and the number of children in the typical childcare setting, we find that formal childcare along with maternal employment has an adverse impact on child physical development such as increasing his/her probability of being an obese child.

Keywords: child obesity, maternal employment, formal childcare.

[1] Ph.D in Economics, Assistant Professor, Indiana University – Purdue University Fort Wayne
[2] Ph.D. in Economics, Research Associate, Russian Academy of National Economy and Public Administration (RANEPA)

Introduction

In this study we estimate the effect of formal childcare and maternal employment on child obesity using data on children raised in Russian Federation for the period between 2000 and 2013. In the literature, there has not yet been a consensus reached about whether maternal employment affects child obesity. The majority of studies report that maternal employment and consequently formal childcare positively affect the propensity of having an obese child. In particular, Anderson's et al (2003) paper is the first to investigate the relationship between maternal employment and child obesity. Using NLSY data the authors conclude that a ten-hour increase in weekly employment increases the probability of child obesity by roughly one percentage point. Ruhm (2008) comes also to a conclusion that maternal employment can be harmful for child's cognitive development and physical development. Nazarov & Rendall (2014) confirm the adverse effect of non-parental childcare and maternal employment on child's obesity, although, the adverse effect is limited to highly educated mothers. Nazarov & Rendall (2014) show that non-parental childcare can be beneficial for low educated mothers' children.

The growth of obesity and in particular of child obesity represents a major public health issue in many developed nations. The revealed relationship between maternal employment and child obesity may be a signal for the appropriate economic policy. This study has a particular interest for the Russian policymakers and advocacy groups since in the last two decades we observe the increase in labor supply among Russian women accompanied with the increase in the prevalence of obesity among children. As Figure 1 demonstrates the prevalence of child obesity in the Russian Federation has increased from 5% at the beginning of 2000 to 9% in 2014. Our paper contributes to the current literature by providing a refined estimate for the effect of formal childcare and maternal employment on child obesity using the sample of Russian children.

There are several theoretical channels through which maternal employment may have its deleterious impact on child's physical development. First, a child of working parents may spend more time indoor watching television or playing video games rather than being engaged in calorie-burning outdoor activities. Second, childcare providers may offer meals with poor nutritional value and high calories. Furthermore, working parents do not have enough time for cooking and this increases the consumption of both food away from home and pre-prepared more high-caloric food. Third, an unsupervised child may make poor nutritional choices when preparing his or her after school snacks. Finally, the mother's long hours of employment may reduce the quality of time spent with a child due to stress and tiredness.

Alternatively, maternal employment may have a positive impact on child physical development. For example, an increase in household income would allow the household to purchase more healthy food or engage a child in a variety of outdoor activities. Since the choice of neighborhood has a positive impact on child development, earned income may have positive consequences on housing and neighborhood choices.

A key problem that hampers research in this area is the complicated selection problem arising due to correlation of maternal employment and her inputs, e.g. in the form of childcare choices with unobserved characteristics of mothers and children and concurrent correlation of these unobserved factors with children's outcomes. First, working mothers whose children in childcare may differ systematically from working or non-working mothers whose children are not in childcare due to unobserved factors. These factors may include the mother's preference for consumption relative to child investments, mother's ability in home work, the child's genetic dispositions towards obesity. Second, children's obesity may affect maternal employment and childcare decisions (a "reverse causation" phenomenon). Most studies in the literature have recognized the existence of these sources of selection bias. For example, some studies utilize the instrumental variables approach that deals with both sources of selection bias; however, in both

studies the set of instruments used to identify the effect of maternal employment was weakly correlated with endogenous variables.

We address this econometric issue by jointly estimating childcare/maternal employment and earning choices along with the linearized child physical production function characterizing the propensity of having an obese child. For such econometric models, the typical requirement is to include in childcare/maternal employment and wage processes a set of exclusion restrictions. Such exclusions help the analyst identify the main effect in the physical development production function. We introduce two types of exclusion restrictions. First, the demand for formal childcare has been increasing over the study period due to increased fertility among Russian women. Furthermore, as Figure 2 shows, the aggregated statistics show that the number of formal childcare settings has been actually in decline leading to the increased number of children in queues for formal childcare services. Figure 3 demonstrates that the given development has led to the higher number of children in the typical childcare setting along with the percentage of children in childcare queues. We also capture the strong regional variation in the number of children in a typical childcare setting, the variable which we use as the first exclusion restriction. We choose this variable because we expect that the higher number of children in the childcare setting reduces the chance of placing a child in the formal childcare setting along with reducing the chance of maternal employment postpartum until a child reaches school-age.

Our second exclusion restriction relates to regional differences in the rise in the standard of living in the Russian Federation over the study period. Many studies in the literature show that the recent improvement in the standard of living in the Russian Federation has varied by regions. We believe that the increase in living standard should have a positive impact on the affordability of formal childcare. In many instances, formal childcare can be not only unavailable but also can be unaffordable. As the average household's income increases, we expect the typical Russian household should have the higher willingness to place a child in the formal childcare setting.

This paper is structured in the following manner. The next section provides background on the childcare system in the Russian Federation. The third section derives the empirical model and discusses the identification strategy. The fourth section discusses the main data sources and provides descriptive statistics on the main dependent and independent variables used in the analysis. The fourth section discusses the main results. The last section concludes by providing policy implications and some limitations of the study.

Background

According to the federal government's principles, any child regardless of his/her parents' economic status should have access to affordable childcare services before reaching school-age in the Russian Federation. However, for many Russian households with pre-school children childcare services remain to be either inaccessible or unaffordable. The childcare system in the Russian Federation has a dual market feature. The market duality is created by government's heavy involvement in provision of childcare services and subsidies. Thus, along with public childcare settings which provide more inferior childcare services due to lack of public financing, there is a separate market for private childcare services. There are many reasons why quality of childcare services is higher in private childcare settings such as more qualified personnel, the lower number of children per childcare provider and more superior amenities (toys, books, etc.). Differences in quality translate into a substantial gap in prices for childcare services in two markets making private childcare settings more desirable but very unaffordable for the average Russian household.

The government is involved not only in provision of public childcare services but also in controlling service prices in the public market. A simple supply and demand framework suggests that the price ceiling strategy used in the Russian Federation in terms of public childcare services should lead to a market failure with not only lower prices for services than the equilibrium market prices but also to the undesirable feature known as excess demand. The size of excess

demand in the Russian Federation today is close to 2.8 million children who are currently in waiting lists of municipal childcare agencies. These agencies are responsible for receiving applications from parents (in many instances right after child's birth), processing them and then placing children to childcare settings depending on household's place of residence. The overall demand for public childcare services is equal to 8.8 million children implying that every third child is on the waiting list. The main peculiarity of the Russian public childcare system is the existence of the parallel waiting list system besides the major one. The applications for children from disadvantaged families such as disabled-parent, low income, single-mother or many-children families, are placed in the separate waiting list by municipal childcare agencies. As a result, some households have incentives to classify themselves as representatives of the disadvantaged segment of the population. A couple of years ago, in some regions, the electronic tracking system of waiting lists was introduced making the system more transparent. Although there is anecdotal evidence that some of municipal childcare agencies manipulate with waiting lists to reduce the actual level of excess demand in their municipalities.

The federal government attempted to reform provision of pre-school public childcare services by enacting the new law in the beginning of 2013. Specifically, the law abolished the old price control system. Previously, parents were responsible only for 20% of the actual cost of provided services, so 80% of childcare cost was subsidized by federal and local governments. More than that public childcare settings received the right to charge additional fees for food and various physical and educational activities provided to children during their time in childcare facilities. Most importantly, starting from 2013, municipal childcare agencies did not require to process each received application and did not require to meet demand for childcare services in their municipalities. As a result, the number of childcare facilities drastically decreased in some municipalities. All those changes made public childcare services even more inaccessible and unaffordable. Another consequence of the recent laws is a decline in quality of provided services.

Model

Following Todd and Wolpin (2003), child's physical development production function for child i at age a can be implicitly given by the following expression:

$$h_{ia} = h_a(e_{ia}, \mu_{i0}, v_{i0}) + \varepsilon_{ia} \quad (1)$$

where h_{ia} child ith obesity level (adiposity level) at age a, e_{ia} is a vector of childcare inputs, μ_{i0} child's genetic risk of obesity, v_{i0} maternal ability and ε_{ia} transitory shock to the child development path and the measurement error of child's adiposity level. The linearization of (1) allows one to estimate parameters of the production function using conventional estimators. If childcare inputs correlate with either child's genetic risk of obesity or maternal ability, then we anticipate inconsistent estimates for the conventional estimators.

To address the above spurious correlation, we explicitly control for the factors associated with the use of formal childcare and maternal postpartum wages. In the linearized version of (1), the child's genetic risk of obesity we approximate with maternal BMI, the variable which is included in the vector of controls, X'_{ia}. Our final model consists of three equations.

Childcare Equation:

$$Logit(Chilcare_{ia}) = ln\frac{\Pr[e_{ia}=1]}{\Pr[e_{ia}=0]} = \beta_0^1 + X'_{ia}\beta_1^1 + Z_{ia}\gamma + v_{0i}^1 \quad (2)$$

Child Obesity:

$$Logit(Obese_{ia}) = ln\frac{\Pr[h_{ia}=1]}{\Pr[h_{ia}=0]} = \beta_0^2 + X'_{ia}\beta_1^2 + v_{0i}^2 \quad (3)$$

Wage Equation:

$$\ln(w_{ia}) = \beta_0^3 + D'_{ia}q + v_{0i}^3 + \vartheta_{ia} \quad (4)$$

The vector of controls, X'_{ia}, includes variables measured at the time of birth such as mother's age and marital, health, education and employment status and time-variant variables such as maternal

BMI, rural status and child's age. The vector of exclusion restrictions, Z_{ia}, includes region's VRP per capita and number of children in the typical formal childcare setting. We discuss the appropriateness of these variables to serve as exclusion restrictions in the subsequent subsection. Finally, the vector of factors affecting the postpartum wage process, D'_{ia}, includes a degree two polynomial in mother's age at birth, mother's health and education status at birth, a degree two polynomial in work experience after child's birth, rural status and one of the exclusion restrictions from vector Z_{ia}, VRP per capita.

In the different specification instead of the childcare equation we introduce the maternal employment equation and in the obesity equation we substitute the indicator of formal childcare with the indicator of maternal employment. The estimation strategy used in this paper assumes that there are M points of support to approximate the distribution of v_{i0}. Conditional on mass points $v^m = (v^{1m}, v^{2m}, v^{3m})$[3], mother-child pair i has the following contribution to the likelihood function:

$$A_{ik}\left(v^m\right) = \prod_{a=1}^{T} P\left(e_{ia} = 1 \mid v^{1m}\right)^{e_{ia}} \left(1 - P\left(e_{ia} = 1 \mid v^{1m}\right)\right)^{1-e_{ia}} P\left(h_{ia} = 1 \mid v^{2m}\right)^{h_{ia}} \left(1 - P\left(h_{ia} = 1 \mid v^{1m}\right)\right)^{1-h_{ia}} \frac{1}{\sigma_1} \phi\left(\ln(w_{ia}) \mid \sigma_1, v^{3m}\right) \tag{5}$$

The unconditional contribution for mother-child pair *i* is:

$$A_i = \sum_{m=1}^{M} \varphi_m A_{im} \tag{6}$$

Finally, the likelihood function can now be written as follows:

$$L = \prod_{i=1}^{I} A_i \tag{7}$$

[3] There are three equations in the model; therefore, v_m consist of three vectors each representing the set of heterogeneity parameters in one of the equations.

The likelihood function is maximized with respect to all parameters as well as the individual's specific mass points and weights. In each equation, we also include a constant term and normalize the individual mass point per equation to zero in order to identify the model. The model is estimated using FORTRAN with the GQOPT optimization library[4].

Exclusion Restrictions

We identify the effect of formal childcare and then maternal employment in the obesity equation by including two variables in equation (2). Specifically, we identify the effect of formal childcare/maternal employment on child obesity using regional variations in the average number of children in the typical childcare setting and the standard of living. Figure 4 demonstrates the significant regional variation in the number of children in the average formal childcare especially for the last 5-6 years. The average number of children is not substantially different across regions in the early 2000. In 2000, with the mean value equal to 82 children per a setting, a 95% confidence interval is quite narrow and in the range of 77.8 and 86.6. After 10 years, we can observe the completely different picture. Not only the mean value increases to 135 children per a setting but also the confidence interval becomes wider in the range of 95.7 and 174.9. The demand for formal childcare has changed across all regions participated in the survey used in this analysis in the study period; however, the regions have experienced the heterogeneous increase in demand for formal childcare.

Starting from the early 2000s until 2014, the Russian economy has experienced the unprecedented level of economic growth. The standard of living has increased across all Russian regions and across all socio-demographic groups. However, Figure 5 shows that the level of heterogeneity in VRP per capita becomes wider across regions over time. If, in 2000, the average VRP per capita is only 108 million rubles with the width of the 95% confidence interval equal to

[4] The Fortran code is provided by Professor Guilkey (University of North Carolina at Chapel Hill)

40.3 million rubles, the given number takes off to 254.1 million rubles along with the width of the confidence interval, 79.3 million rubles.

Data and Sample

This research is based on fifteen rounds of the Russian Longitudinal Monitoring Survey (RLMS). Although RLMS started in 1992 in this paper we use data starting from 2000. This can be considered as a good starting point due to two reasons. First, this is the year associated with the end of transition of the Russian economy from the socialistic form to the market-based principles. Second, we start observing households annually after the given round. We restrict to any children who were born in 2000 and we end up with 2,536 mother-child pairs. Since we observe children until they reach school-age (7 years old), the number of observations in analytical sample for 2,536 pairs is 15,802 mother-child x year observations.

Table 1 provides information on mean statistics of variables used in this analysis. We have multiple BMI measures for each child. The average propensity of having an obese child in the sample is 11%. There is a 24% chance that the average child is placed to formal childcare by his/her mother until reaching school-age. On average, a typical mother had a 43% chance of employment in any given year. 35% of mothers resided in rural areas and the average age of the child at the time of the survey interview was 4.9 years. The average maternal BMI is 24.3, well below the critical weight level. The cumulative household income since child's birth is 88 thousands rubles (all ruble variables are normalized to 2010 rubles). The average work tenure of the mother before her child joining school is 2 years.

Table 1 also provides information on maternal characteristics at the time child birth. The average age of the typical mother at birth is 26.6 years. 90% of mothers at the time of birth had a partner. Employment at child's birth year was only 8 %. 54% of mothers rated their health as good and only 27% had low educational attainments.

Results

In Table 2, we present the coefficients of the probability of formal childcare after child's birth. The coefficients are from the logit regression; therefore, we only discuss directions of the coefficients. We start with the discussion of the coefficients associated with the exclusion restrictions. Table 2 shows that the use of formal childcare is negatively affected by the average size of a childcare setting. As we hypothesized, the greater demand for childcare reduces the chance that the child would be placed in a childcare setting reducing probably further maternal employment. Table 2 also shows that the higher living standard translates into a higher chance of placing a child in the formal childcare setting. Finally, the coefficients corresponding to the year dummies, which control for any other changes in macroeconomic/environmental conditions over time, are positive and all statistically significant. These coefficients increase until 2006 and then decline until 2012.

Results for the probability of formal childcare reveals other interesting facts. As is expected the use of formal childcare increases with child's age. Also, a mother who worked at the year of birth has probably a higher likelihood of returning to employment after birth and using formal childcare. A less educated mother has a higher likelihood of placing her child in the formal childcare setting. Finally, the results show that unobserved heterogeneity plays a substantial role in utilization of formal childcare.

In our model, we also control for maternal wages that should help us identify the distribution of unobserved heterogeneity (See Table 3). Surprisingly, maternal age has a negative impact on postpartum wages. Although, our results confirms the parabolic relationship between maternal age at birth and postpartum wages. Maternal work experience after child's birth increases wages, although the effect of experience decreases with more years of experience. Wages of low educated mothers lag wages of higher educated counterparts by 35 percent.

Likewise, wages of rural mothers lag wages of urban counterparts by 20%. Postpartum wages increase higher in the areas with the higher standard of living. Finally, the year fixed effects parameters reveal that wages increased over time probably due to favorable macroeconomic conditions that the population of the Russian Federation experienced in the study period.

Our main results, the coefficients associated with the factors associated with the probability of obesity, we report in Table 4. Results show that the use of childcare increases the probability of having an obese child. The coefficient is positive and strongly significant at the conventional significance level. However, maternal employment may create an offsetting effect in the form of increased household income. The higher is the accumulated household income the lower is the probability of child obesity. This offsetting factors has been widely discussed in the literature and our study provides the empirical justification for the multitude effect of employment on child development.

There are many other interesting associations reported in Table 4. Specifically, the results show that child obesity increases with child's age. The older mother at birth has a higher likelihood of confronting with child obesity than the younger counterpart. The two maternal health indicators are positively correlated with child's obesity. Specifically, good health at birth and high current BMI increase a chance of having an obese child in the future. Finally, children raised in rural areas have a higher likelihood of obesity than the urban counterparts.

Robustness Check

For robustness check, we have estimated the similar model where instead of formal childcare we control for maternal employment. In Table 5, we report results only for the probability of child obesity since results associated with maternal employment and maternal wages are not qualitatively different from the results reported for the baseline case.

The coefficients for the factors associated with the probability of child obesity are also not significantly different whether we control for formal childcare or maternal employment. Like in the previous case, child obesity increases with child's age, mother's current BMI, rural status and her good health at birth. Also, maternal employment increases the probability of child obesity, probably, through less time spent with the child but it has a negative impact through the increased household income.

Conclusions

There is a concern among policymakers that the rapidly rising labor force participation rates of mothers, and an increase in the percentage of children raised in formal childcare settings, may have negative consequences on overall child physical development. In this paper we jointly estimate the probability of formal childcare and children obesity in Russia and conclude that formal childcare and consequently, maternal employment has a strong adverse effect on child obesity. These results suggest that the time spent with mother cannot be substituted with the time spent in formal childcare. We conjecture that the overall quality of formal childcare has decreased over time since we observe that the number of childcare settings has declined while the number of children per a formal setting has increased. We anticipate that the results of this study would have important implications for the further policy analysis and recommendations.

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Table 1. Descriptive Statistics on Key Variables Used in the Analysis

Variables	# of Obs	Mean	SD
Child Obese	5,702	0.11	0.31
Formal Childcare	15,825	0.24	0.43
Maternal Employment	15,825	0.43	0.50
Maternal Wage	6,878	11,771	9,985
Rural	15,825	0.35	0.48
Child's Age	15,825	4.88	3.29
Maternal Current BMI	15,825	24.25	4.84
Cumulative Household Income	15,825	88.18	102.65
Work Tenure after Birth	15,825	1.94	2.69
Mother's Age at Birth	2,536	26.56	5.24
Married at Birth	2,536	0.90	0.31
Employment at the Year of Birth	2,536	0.08	0.27
Good Health at Birth	2,536	0.54	0.50
Lower Educated Mother	2,536	0.27	0.44

Table 2. Determinants of Childcare Use after Birth

Variables	Coefficient	St. Errors	Z-stat
Child's Age	0.12367	0.0120	10.307
Mother's Age at Birth	-0.00691	0.0081	-0.855
Married at Birth	-0.00707	0.1305	-0.054
Employed at Birth	0.37199	0.1270	2.929
Good Health at Birth	-0.05634	0.0774	-0.728
Low Education at Birth	-0.35422	0.0973	-3.639
Rural Area	-0.10839	0.0918	-1.180
Maternal BMI	-0.00956	0.0082	-1.165
Size of Childcare	-0.00404	0.0007	-5.901
VRP per Person	0.00092	0.0003	3.655
Year 2001	0.43748	0.5676	0.771
Year 2002	0.87652	0.5496	1.595
Year 2003	1.64386	0.5128	3.206
Year 2004	1.91870	0.5151	3.725
Year 2005	2.05815	0.5141	4.003
Year 2006	2.15252	0.5137	4.190
Year 2007	2.00264	0.5145	3.892
Year 2008	1.92231	0.5187	3.706
Year 2009	1.76764	0.5167	3.421
Year 2010	1.51127	0.5154	2.932
Year 2011	1.29540	0.5168	2.507
Year 2012	1.26354	0.5197	2.431
Year 2013	1.41645	0.5209	2.719
Constant	-3.87438	0.6243	-6.206
d1	1.77234	0.2513	7.053
d2	1.14256	0.3829	2.984
d3	Normalized to 0.000		

Table 3. Determinants of Maternal Wage after Birth

Variables	Coefficient	St. Errors	Z-stat
Mother's Age at Birth	-0.07561	0.0273	-2.774
Mother's Age at Birth Squared	0.00146	0.0005	3.033
Good Health at Birth	0.05332	0.0470	1.135
Low Education at Birth	-0.35016	0.0505	-6.931
Experience After Birth	0.04594	0.0138	3.331
Experience After Birth Squared	-0.00374	0.0009	-4.368
Rural Area	-0.20458	0.0555	-3.685
VRP per Person	0.00169	0.0001	13.468
Year 2001	0.31006	0.2358	1.315
Year 2002	0.25241	0.2288	1.103
Year 2003	0.31721	0.2211	1.435
Year 2004	0.36147	0.2192	1.649
Year 2005	0.45281	0.2187	2.070
Year 2006	0.53015	0.2188	2.423
Year 2007	0.60809	0.2200	2.764
Year 2008	0.66996	0.2205	3.038
Year 2009	0.73142	0.2223	3.290
Year 2010	0.72237	0.2244	3.220
Year 2011	0.71370	0.2273	3.140
Year 2012	0.75983	0.2290	3.318
Year 2013	0.82196	0.2302	3.571
Constant	8.07649	0.3915	20.632
d1	0.79560	0.0750	10.607
d2	1.55411	0.0902	17.223
d3	Normalized to 0.000		

Table 4. Determinants of Child Obesity after Birth (Childcare)

Variables	Coefficient	St. Errors	Z-stat
Child's Age	0.13600	0.0218	6.243
Mother's Age at Birth	0.01893	0.0115	1.644
Married at Birth	0.09652	0.1540	0.627
Employed at Birth	-0.26341	0.2725	-0.967
Good Health at Birth	0.23834	0.1133	2.103
Low Education at Birth	-0.00809	0.1370	-0.059
Rural Area	0.46000	0.1194	3.851
Mother's Current BMI	0.02436	0.0106	2.302
Child is in Childcare	0.61746	0.1232	5.013
Household Income since Birth	-0.00162	0.0010	-1.672
Constant	-4.03377	0.4621	-8.730
d1	-0.35463	0.3024	-1.173
d2	-0.03969	0.4588	-0.087
d3	Normalized to 0.000		

Table 5. Determinants of Child Obesity after Birth (Employment)

Variables	Coefficient	St. Errors	Z-stat
Child's Age	0.10354	0.0236	4.395
Mother's Age at Birth	0.01542	0.0118	1.304
Married at Birth	0.09646	0.1576	0.612
Employed at Birth	-0.41603	0.2833	-1.468
Good Health at Birth	0.24358	0.1157	2.105
Low Education at Birth	0.00100	0.1388	0.007
Rural Area	0.42837	0.1220	3.512
Mother's Current BMI	0.02448	0.0106	2.309
Maternal Employment	0.75477	0.1425	5.296
Household Income since Birth	-0.00181	0.0009	-2.017
Constant	-4.40847	0.4422	-9.969
d1	0.20819	0.2198	0.947
d2	0.67179	0.2146	3.130
d3	Normalized to 0.000		

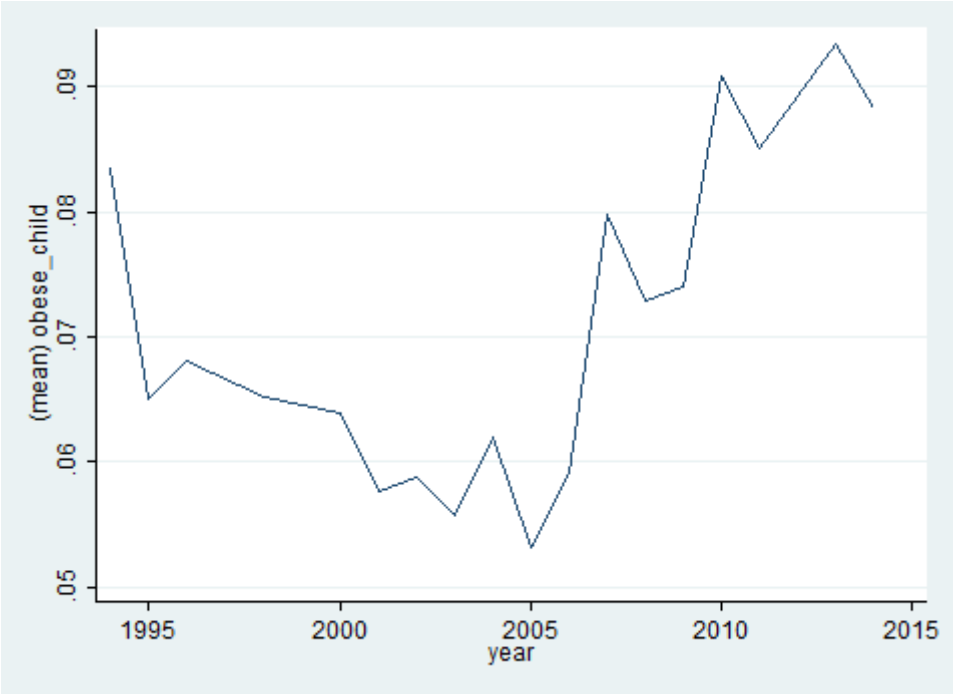

Figure 1. Prevalence of child obesity for the Russian Federation for the period between 1994-2014.

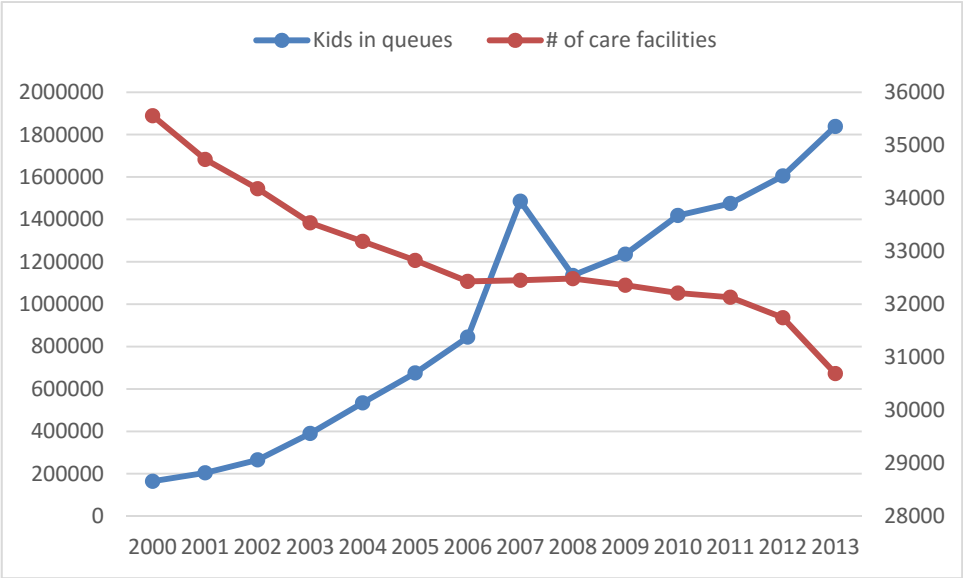

Figure 2. Numbers of Children in Childcare Queues and Formal Childcare Facilities for the Regions in the Sample

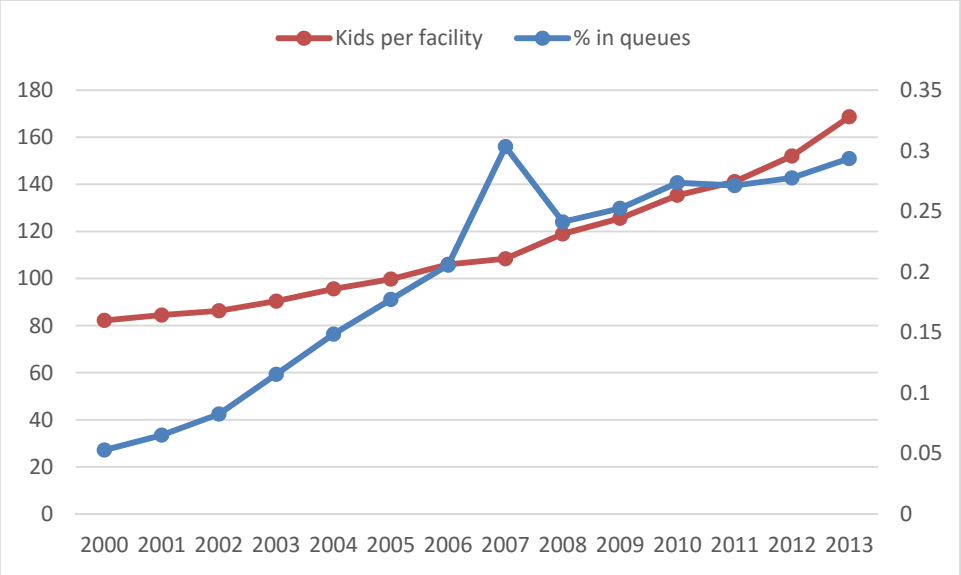

Figure 3. Number of Children in the Typical Formal Childcare Facility and Percent of Children in Queues for the Regions in the Sample

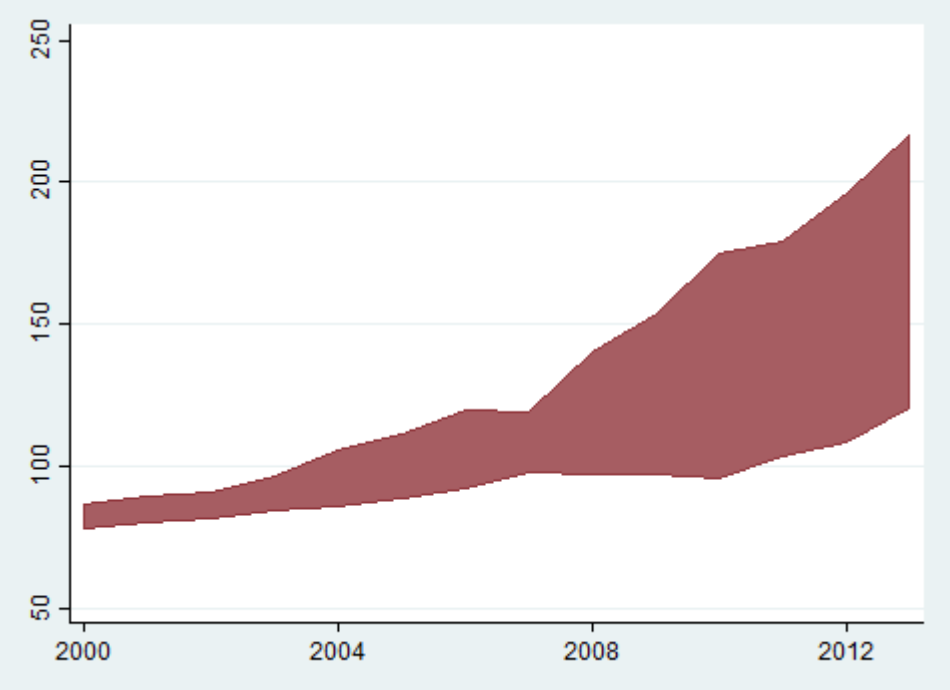

Figure 4. Regional Variation in the Number of Children per Formal Childcare Setting (Only Regions included in the Survey)

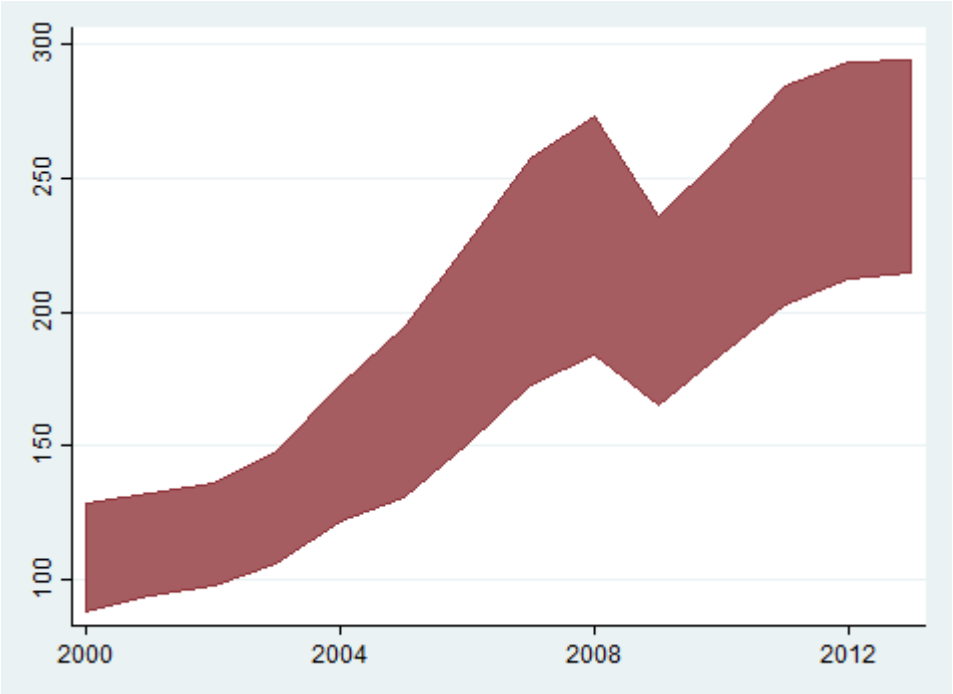

Figure 5. Regional Variation in VRP per capita (in 2010 rubles) (Only Regions included in the Survey)