ISSN 1883-1656

Центр Российских Исследований
RRC Working Paper Series No. 85

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March 2020

RUSSIAN RESEARCH CENTER
THE INSTITUTE OF ECONOMIC RESEARCH
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Regional Determinants of Marriage Rates in Russia: A Dynamic Panel Data Analysis*

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Abstract: This study examines the regional determinants of marriage rates in Russia using panel data from 2005 to 2015. The estimation results of a system generalized method of moments (GMM) dynamic model strongly supported our predictions concerning the impact of migration inflow, employment, educational opportunities, and housing supply, on marriage rates. Further, significant differences exist between the estimation results for the entire federation and those for federal district groups, indicating considerable difficulties in designing effective nationwide policy measures to promote family formation.

JEL classification numbers: C23, J11, J12, P25, R23

Keywords: marriage rates, regional determinants, dynamic panel data estimation, Russia

* This research was financially supported by grants-in-aid for scientific research from the Ministry of Education, Culture, Sports, Science and Technology of Japan (Nos. 26245034; 19H01478).

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1. Introduction

In Russia, the proportion of children born out of wedlock is lower compared to the ratio in Western European countries and, consequently, there is a close linkage between marriage and fertility. Given that the declining population has become a serious problem in Russia, trends relating to the marriage rate in the country, are of major importance. To solve the population crisis, various policies promoting family formation have been adopted by the Putin administration. However, these measures are applied uniformly, despite notable differences among regions. Many researchers emphasize the consideration of regional disparities while formulating policies (Dolinskaya and Tytell, 2002; Benini and Adam, 2007). This paper similarly questions the adoption of policies that do not pay adequate attention to regional dissimilarities. To examine this issue, this study analyzes the impacts of regional factors on marriage rates in Russia.

It is well known that the economic analysis of marriage began with Becker (1974). This pioneering study explained that marriages occur because of benefits such as division of labor, the sharing of investment goods, and the smoothing of risk. In line with Becker's theory, empirical research on marriage in Russia revealed that having a high income makes it easier to find a partner (Cartwright, 2000) and that the marriage rate increases when employment is stable (Roschin and Roschina, 2007). Using household-level survey data, these previous studies examined the determinants of marriage rates from the perspective of individual characteristics. However, in the case of Russia—a country that has a large regional differences in society and economy—it is also important to consider the relationship between regional characteristics and marriage rates, as stressed by a series of Russian studies (Revich, 2008; Kurushina and Druzhinina, 2015; Popova and Shshikina, 2017).

Following the theoretical arguments in Iwasaki and Kumo (2019), who empirically examined the regional determinants of fertility rates in Russia; we expect that factors such as climate hardship, the presence of a Slavic population, migration inflow, poverty, and ecological risks negatively affect regional marriage rates, while economic growth, employment opportunity, favorable local business conditions, educational opportunity, quality of social infrastructure, and housing supply positively influence marriage rates, as indicated in **Table 1**. We test our predictions using panel data of federal entities (states or provinces) from 2005 to 2015.

The remainder of the paper is organized as follows: Section 2 presents an overview of the trend of marriage rates in Russia. Section 3 describes our empirical

methodology and Section 4 reports the results. Section 5 concludes.

2. Trends of marriage rates in Russia

Figure 1 shows that, from the 1950s to the 1980s, Russia had a marriage rate of approximately 9–13 couples per 1,000 people. However, this number declined to 5.9 in 1996, amidst an economic crisis following the collapse of socialism. From 1997, the marriage rate staged a gradual recovery. For the period between 2005 and 2015, it hovered around 8.5. **Figure 1** indicates a strong correlation between marriage and fertility rates, implying that the reduction in the number of marriages is one of the factors that brought about the country's present demographic crisis.

Figure 2 shows that the above trend is common across federal districts as well. However, the dynamics of marriage rates differ for each district due to disparities in socio-economic conditions. In fact, through the period from 2005 to 2015, the coefficient of variation for the marriage rate was 0.109 in the North-Caucasian Federal District (FD), but only 0.051 in the Central FD. In other districts, it ranged from 0.056 (Far East FD) to 0.071 (Privolzhsky (Volga) FD). At the same time, the hierarchy among federal districts in terms of the marriage rate remained stable throughout the observation period.

The differences in marriage rate dynamics among federal districts apply to federal entities as well. **Figure 3** shows the averages and coefficients of variation of marriage rates in each federal entity between 2005 and 2015. As shown in this figure, it is highly likely that changes in the marriage rates are closely related to geopolitical differences between federal entities. Therefore, this paper investigates the determinants of marriage rates in Russia from a regional perspective.

3. Empirical methodology

We verify our predictions, summarized in **Table 1**, by employing panel data of marriage rate in 78 federal entities for the period between 2005 and 2015, during which fertility rate showed stable increase. We employ the system generalized method of moments (GMM) dynamic model that takes the marriage rate in each federal entity in the left-hand side of a regression equation. It introduces a lagged endogenous variable and three-year moving averages of factors that could affect marriage behavior into the right-hand side of the equation.[1]

[1] Lagged three-year moving averages accord with the assumption of past referential integrity

As independent variables, we utilize the following 11 variables:

Climate hardship is represented by the average temperature in January, which is the coldest time in Russia. The presence of a Slavic population on the fertility rate is tested by the share of three Slavic ethnicities, namely Russian, Ukrainian, and Belorussian, in the total population of the region concerned. The effect of migration inflow is assessed using the number of migrants per 10,000 residents. To examine the effect of economic growth, the real growth rate of gross regional product (GRP) is employed. Employment opportunity and local business conditions are represented by the number of firms and organizations per 10,000 residents and the proportion of firms and organizations in fiscal deficit, respectively.

To evaluate the impact of poverty risk on the fertility rate, we utilize the share of the total population whose monetary income is lower than the poverty line defined by the minimum living expenses as determined for each region by the federal government. The availability of educational opportunity and the quality of social infrastructure are expressed by the number of university graduates per 10,000 residents and the number of hospital beds per 10,000 residents, respectively. As a proxy for the intensity of housing supply, floor space per capita is used. The effect of ecological risk is examined using the ecological-risk ranking of federal entities, produced by the Expert RA Rating Agency.

In addition to the above 11 variables, we also utilize the youth population rate to represent the age structure of the population,[2] and a time-trend variable to capture the long-term tendency in marriage rates as control variables. The names, definitions, descriptive statistics, and sources of the aforementioned dependent and independent variables are presented in **Table 2**.

If our predictions are supported, regression coefficients for the average January temperature, real GRP growth rate, number of firms and organizations, number of university graduates, number of hospital beds, and per capita floor space should be positive, while those for the share of the Slavic population, migration rate, share of firms and organizations in fiscal deficit, share of population under the poverty line, and ecological risk should be negative.

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of marriage decision-making and are employed to avoid endogeneity between the dependent and independent variables.

[2] The marriage rate is strongly affected by the age structure of the population. In Russia, however, detailed population statistics for each age group for each federal entity, are not published. In this paper, therefore, we use the youth population rate as a proxy for the age structure of the population.

4. Results

The estimation results are reported in **Table 3**. Models [1] to [8] report the estimates of individual independent variables or those of a pair of independent variables where the area of inquiry is similar. Model [9], meanwhile, shows the simultaneous estimation of all 11 variables. As shown in this table, the lagged endogenous variable is estimated to be positive at the 1% significance level in all nine models, clearly illustrating the strength of the path dependency and the autoregressive nature of marriage rates. The youth population rate has a negative coefficient at the 1% level, demonstrating its effectiveness in representing the age structure of the population. In contrast, the time-trend variable does not show a robust estimate.

In Models [1] to [8], the series of variables from average temperature in January to ecological risk are estimated with a 10% or higher significance level, with the exception of the share of firms and organizations in fiscal deficit and the share of population under the poverty line. Of the nine statistically significant variables, six—consisting the share of the Slavic population, the migration rate, the number of firms and organizations per 10,000 residents, the number of university graduates per 1,000 persons, floor space per capita, and the ecological risk—support our predictions. By contrast, three variables, namely average temperature in January, GRP growth rate, and the number of hospital beds per 10,000 residents, produced estimates that are at odds with our expectations. In Model [9], however, regression coefficients of the share of the Slavic population, number of hospital beds, and ecological risk are estimated to be insignificant. Consequently, we concluded that the four variables of migration inflow, employment and educational opportunities, and housing supply strongly support our predictions.[3]

It is highly likely that the factors that affect marriage differ greatly for each region. To investigate the possible impact of regional heterogeneity, we classified eight federal districts into four groups from the viewpoint of similarity of socio-economic characteristics and present the estimation results for each group in **Table 4**. As shown in this table, while our predictions hold true for regions comprising the

[3] As **Table 3** shows, the Arellano–Bond test for AR (2) indicates that the assumptions of the disturbance term are adequately satisfied for the system GMM estimation in Models [1] and [9]. On the other hand, the Sargan test rejects the null hypothesis that over identifying restrictions are valid in all models. The estimation results of the dynamic model, therefore, have some room for improvement in model specification.

North-Caucasian and Southern FD, they hardly apply to regions that are part of the Siberian and Far East FD. The pronounced regional heterogeneity proved in estimation results in **Table 4** implies that, in Russia, where the socio-economic development and ethnic composition vary greatly among regions, the design of policy measures that are effective throughout the country, is an extremely difficult task.

5. Conclusion

The empirical results in this paper strongly suggest that regional factors have substantial impact on marriage rates in Russia. This finding implies that a nationwide "one size fits all" policy approach may be inefficient in encouraging family formation. As Iwasaki and Kumo (2019) emphasized the need for differentiated policies to improve fertility rates, the federal and regional governments should implement effective and distinctive policies, while considering, in parallel, regional characteristics, to promote marriage and family formation.

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Table 1. Theoretical prediction of the impacts of geographical and socioeconomic factors on marriage rates in Russian regions

Factor	Predicted impact on marriage rates
Climate hardship	-
Presence of a Slavic population	-
Migration inflow	-
Economic growth	+
Employment opportunity	+
Favorable local business conditions	+
Poverty risk	-
Educational opportunity	+
Quality of social infrastructure	+
Housing supply	+
Ecological risk	-

Note: The sign "+" denotes a positive correlation between a given factor and fertility, "-" for a negative correlation.

Table 2. Names, definitions, descriptive statistics, and sources of variables used in the empirical analysis

Variable group and name	Additional definition	Descriptive statistics					Source
		Mean	S.D.	Median	Max	Min	
Dependent variable							
Log of marriage rate	Number of marriages per 1,000 people	2.11	0.12	2.12	2.58	1.44	ROSSTAT (http://www.gks.ru/)
Independent variables							
Average temperature in January	In centigrade; lagged 3-year moving average	-11.72	7.68	-10.10	3.60	-36.70	ROSSTAT
Share of Slavic population	In % of total population; lagged 3-year moving average	76.88	25.39	88.98	98.10	0.50	Estimates made by the authors based on the 2002, 2010, and 2015 censuses of the Russian
Migration rate	Number of immigrants per 10,000 residents; lagged 3-year moving average	-11.07	66.78	-8.57	207.33	-501.90	ROSSTAT
GRP (Gross Regional Product) growth rate	Annual real growth rate (%); lagged 3-year moving average	4.49	3.53	4.43	19.97	-7.73	ROSSTAT
Log of the number of firms and organizations per 10,000 residents	Lagged 3-year moving average	5.48	0.40	5.45	6.96	4.05	ROSSTAT
Share of firms and organizations in fiscal deficit	In % of total firms and organizations; lagged 3-year moving average	34.87	7.47	34.10	60.77	17.70	ROSSTAT
Share of population under the poverty line	In % of total population; lagged 3-year moving average	18.87	8.22	17.10	78.73	6.90	ROSSTAT
Log of the number of graduates of higher education per 1,000 persons	Lagged 3-year moving average	2.24	1.01	2.19	5.60	-0.27	ROSSTAT
Log of the number of hospital beds per 10,000 residents	Lagged 3-year moving average	4.66	0.21	4.65	5.50	3.78	ROSSTAT
Log of floor space per capita	Basic unit is m2; lagged 3-year moving average	3.08	0.16	3.10	3.51	1.88	ROSSTAT
Ecological risk	Regional ranking (lowest ecological risk=1); lagged 3-year moving average	41.85	23.17	41.33	86.67	1.33	Expert RA Rating Agency (http://www.raexpert.ru/ratings/regions/)
Control variables							
Youth population rate	Persons below working age as a proportion of the total population (%)	17.60	3.99	16.60	34.80	12.10	ROSSTAT
Time trend	2005 = 0	5	3.16	5	10	0	Authors' calculation

Table 3. System GMM dynamic estimation of marriage rate, 2005–2015

Dependent variable	Log of marriage rate								
Model	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Lagged dependent variable	0.49727 ***	0.48145 ***	0.50312 ***	0.45172 ***	0.44163 ***	0.44820 ***	0.48277 ***	0.50209 ***	0.23876 ***
	(0.1175)	(0.1074)	(0.1107)	(0.1215)	(0.1451)	(0.1248)	(0.1177)	(0.1118)	(0.0931)
Average temperature in January	-0.01317 ***								-0.00957 ***
	(0.0012)								(0.0011)
Share of Slavic population		-0.00573 **							-0.00226
		(0.0027)							(0.0019)
Migration rate		-0.00061 **							-0.00063 **
		(0.0003)							(0.0003)
GRP growth rate			-0.00234 **						-0.00225 **
			(0.0010)						(0.0010)
Log of the number of firms and organizations per 10,000 residents				0.14227 **					0.12376 **
				(0.0586)					(0.0630)
Share of firms and organizations in fiscal deficit				-0.00061					-0.00039
				(0.0010)					(0.0010)
Share of population under the poverty line					-0.00246				-0.00026
					(0.0019)				(0.0018)
Log of the number of graduates of higher education per 1,000 persons						0.09156 ***			0.16476 ***
						(0.0277)			(0.0500)
Log of the number of hospital beds per 10,000 residents						-0.32649 ***			-0.09154
						(0.1115)			(0.0890)
Log of floor space per capita							0.13848 ***		0.24668 **
							(0.0530)		(0.1255)
Ecological risk								-0.00186 *	-0.00080
								(0.0011)	(0.0005)
Youth population rate	-0.04247 ***	-0.04471 ***	-0.04151 ***	-0.04824 ***	-0.05749 ***	-0.03897 ***	-0.04400 ***	-0.04231 ***	-0.03998 ***
	(0.0162)	(0.0098)	(0.0162)	(0.0131)	(0.0156)	(0.0143)	(0.0168)	(0.0141)	(0.0135)
Time trend	-0.00251	0.00184	0.00039	0.00262	0.00886 *	-0.00914	0.00451	0.00049	-0.01178 *
	(0.0052)	(0.0037)	(0.0049)	(0.0041)	(0.0050)	(0.0066)	(0.0059)	(0.0050)	(0.0069)
Constant term	1.67206 ***	2.31123 ***	1.78941 ***	1.19267 **	2.09227 ***	3.20870 ***	2.27150 ***	1.87521 ***	1.09506 **
	(0.4821)	(0.4919)	(0.4811)	(0.5779)	(0.5499)	(0.4546)	(0.6082)	(0.4219)	(0.5282)
N	800	800	796	796	790	786	796	793	773
Arellano–Bond test [a]	0.573	5.051 ***	5.502 ***	5.036 ***	4.310 ***	4.500 ***	4.914 ***	5.087 ***	0.592
Sargan test [b]	580.630 ***	545.744 ***	506.503 ***	523.364 ***	522.098 ***	517.339 ***	519.192 ***	538.489 ***	560.688 ***
Wald test (χ^2) [c]	496.65 ***	532.33 ***	601.24 ***	840.34 ***	762.02 ***	547.48 ***	785.44 ***	1148.28 ***	929.89 ***

Notes:

[a] Autocorrelation test for AR(2). Null hypothesis: no autocorrelation.

[b] Test results that use estimates with normal standard errors. Null hypothesis: overidentifying restrictions are valid.

[c] Null hypothesis: all coefficients are zero.

Figures in parentheses beneath regression coefficients are robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors' estimation. See Table 2 for definitions and descriptive statistics of the variables used in the estimation.

Table 4. System GMM dynamic estimation of marriage rate by group of federal districts, 2005–2015

Dependent variable	Log of marriage rate				
Target districts	Whole federation	North-Caucasian and Southern Districts	Central and North West Districts	Volga and Ural Districts	Siberian and Far East Districts
Model	Reference [a]	[1]	[2]	[3]	[4]
Lagged dependent variable	0.23876 ***	0.32336 ***	-0.17987 ***	0.07228	0.24273 **
	(0.0931)	(0.0576)	(0.0539)	(0.0547)	(0.1222)
Average temperature in January	-0.00957 ***	-0.02261 ***	-0.01026 ***	-0.01423 ***	-0.00908 ***
	(0.0011)	(0.0047)	(0.0021)	(0.0027)	(0.0016)
Share of Slavic population	-0.00226	-0.00276	0.00143	0.01014 *	-0.01493 **
	(0.0019)	(0.0069)	(0.0028)	(0.0055)	(0.0068)
Migration rate	-0.00063 **	-0.00093 ***	0.00021	-0.00034	-0.00031
	(0.0003)	(0.0001)	(0.0003)	(0.0004)	(0.0002)
GRP growth rate	-0.00225 **	0.00526 *	0.00125	-0.00389 ***	-0.00152
	(0.0010)	(0.0032)	(0.0015)	(0.0011)	(0.0020)
Log of the number of firms and organizations per 10,000 residents	0.12376 **	0.14703 *	0.34930 ***	0.50788 ***	-0.08862
	(0.0630)	(0.0814)	(0.1274)	(0.1029)	(0.0647)
Share of firms and organizations in fiscal deficit	-0.00039	0.00577 ***	0.00500 ***	-0.00235	0.00056
	(0.0010)	(0.0019)	(0.0019)	(0.0019)	(0.0019)
Share of population under the poverty line	-0.00026	-0.00299	-0.00240	-0.00240	-0.00202
	(0.0018)	(0.0018)	(0.0024)	(0.0029)	(0.0022)
Log of the number of graduates of higher education per 1,000 persons	0.16476 ***	0.35022 **	0.12784	0.01023	0.08150
	(0.0500)	(0.1474)	(0.0879)	(0.0613)	(0.0639)
Log of the number of hospital beds per 10,000 residents	-0.09154	0.12647	0.20865 *	-0.31062 *	-0.12634
	(0.0890)	(0.1477)	(0.1112)	(0.1785)	(0.1591)
Log of floor space per capita	0.24668 **	0.20746 **	-0.44940 *	0.29281	0.19398
	(0.1255)	(0.1031)	(0.2298)	(0.4466)	(0.2685)
Ecological risk	-0.00080	-0.00286 ***	0.00172 ***	-0.00107	-0.00290 ***
	(0.0005)	(0.0007)	(0.0006)	(0.0009)	(0.0011)
Youth population rate	-0.03998 ***	-0.01276	-0.10931 ***	-0.04729 ***	-0.05597 ***
	(0.0135)	(0.0162)	(0.0280)	(0.0104)	(0.0101)
Time trend	-0.01178 *	-0.02110 ***	0.03082 ***	-0.02452 **	0.00446
	(0.0069)	(0.0058)	(0.0112)	(0.0116)	(0.0097)
Constant term	1.09506 **	-0.96950	1.76392	-0.12984	4.24889 ***
	(0.5282)	(0.6907)	(1.3890)	(1.7330)	(1.2866)
N	773	120	280	180	193
Arellano–Bond test [a]	0.592	-2.447 **	-1.842 *	-3.320 ***	1.918 *
Sargan test [b]	560.688 ***	100.220 ***	212.239 ***	160.030 ***	130.422 ***
Wald test (χ^2) [c]	929.89 ***	23681.05 ***	181.38 ***	3417.85 ***	560.29 ***

Notes:

[a] Autocorrelation test for AR(2). Null hypothesis: no autocorrelation.

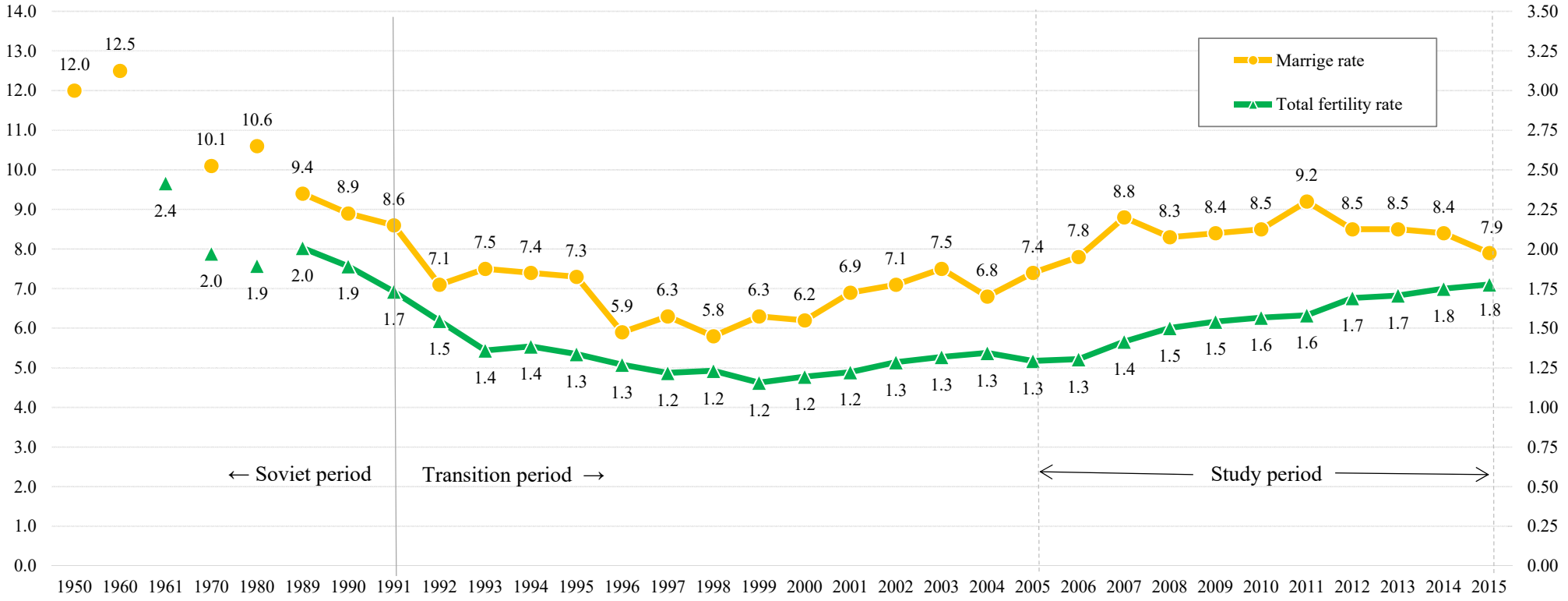
[b] Test results that use estimates with normal standard errors. Null hypothesis: overidentifying restrictions are valid.

[c] Null hypothesis: all coefficients are zero.

Figures in parentheses beneath regression coefficients are robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors' estimation. See Table 2 for definitions and descriptive statistics of the variables used in the estimation.

Figure 1. Long-term trend of marriage rate and total fertility rate in Russia, 1950–2015



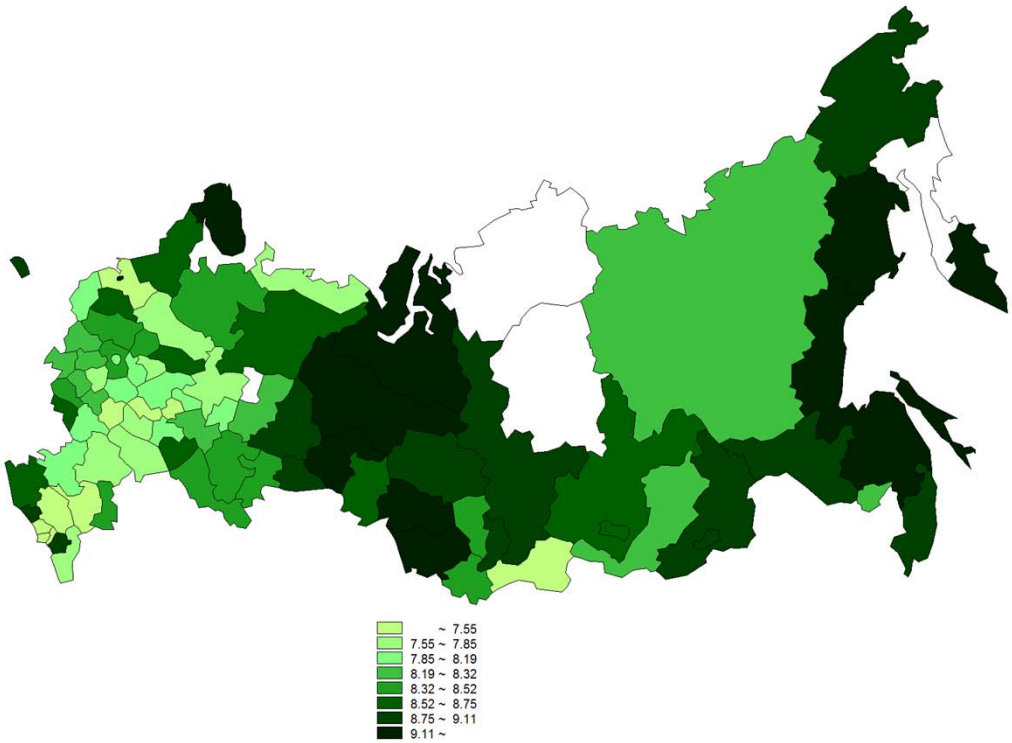
Source: Authors' illustration based on the data available at the Rosstat website (https://www.fedstat.ru/indicator/)

Figure 2. Dynamics of marriage rate in Russian Federation and federal districts, 2005–2015

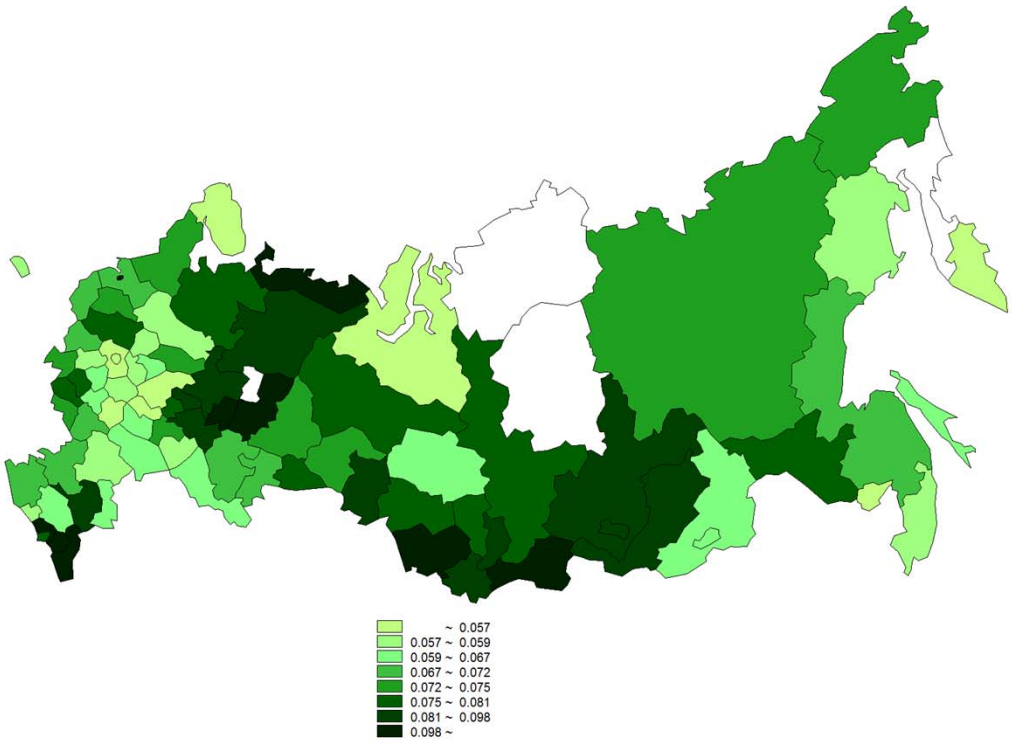
Source: Authors' illustration based on the data available at the Rosstat website (https://www.fedstat.ru/indicator/)

Figure 3. Period average and coefficient of variation of marriage rate in Russian federal entities, 2005–201

(a) Period average



(b) Coefficient of variation



Note: Data for regions in white is missing.
Source: Authors' illustration based on the data available at the Rosstat website (https://www.fedstat.ru/indicator/)