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RESEARCH ARTICLE

Employment in Informal Sector of Russia: Unemployment and Other Socio-Economic Factors

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Abstract

In Russia in 2023, 18.3% of the employed were engaged in the informal sector. As in many other countries, the informal economy is important for the social and economic situation of the population.

This paper aims to identify the impact of specific key factors, such as unemployment rate, wages, poverty level, number of formal sector actors, proportion of the rural population, on the proportion of the informally employed.

The Two-Stage Least Squares Method estimates allow to conclude that wages and the number of formal sector actors had a negative effect on the proportion of the informally employed in Russia in 2009–2021, while the unemployment rate had a positive effect. The paper shows a lack of statistical significance of the impact of the proportion of the rural population on the proportion of the informally employed.

Keywords

informal sector, formal sector, the employed, labour demand, labour supply, poverty level, unemployment rate, number of formal sector actors, wages, proportion of rural population

JEL codes: E24, J21, O17

Introduction

The literature reveals various aspects of informal employment. K. Hart (Hart 1973) pioneered research of the informal sector. (Gimpel'son and Zudina 2011) produced a definition and scope of informal employment. (Glinskaya 2018) specified the reasons encouraging people to engage in informal employment (economic, legal, motivational,

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administrative). Many studies (Dubravskaya 2020; Karpushkina and Voronina 2019) link informal employment to a low level of socio-economic development of the region concerned.

The regional levels of income and unemployment are widely considered to be the key factors contributing to a high share of informal employment (Bojko 2021). This means that informal employment directly correlates with the unemployment rate and inversely, with the level of income. (Nefedova 2019) holds a similar view. However, this point is not entirely clear and requires further verification.

This paper aims to identify the impact of the unemployment rate, wages, number of formal sector actors and the proportion of rural population on the proportion of informal employment by using econometric models.

There are two main approaches to defining the informal sector.

The *production* approach focuses on the *activity pattern* of informal sector actors (or production units). Their distinction from the formal actors is based on their legal form, i.e. whether an entity is registered as a legal entity. If not, it is considered to be part of the informal sector. Whether or not an entity is engaged in illegal activity is not a priority. The advantage of this approach is that it allows to keep statistical records of informal sector actors and employment on a country-wide scale (see Annex 1) (Barsukova 2004). This approach is in line with the provisions of the 15th International Conference of Labour Statisticians[1]. It is this approach that this paper follows.

Another is the *legal* approach that associates informal employment and the informal sector with a lack of business and tax accounting in place. This can be considered in the context of *illegality*, a lack of registration, non-payment of social security contributions (Gimpel'son and Zudina 2011). Due to the difficulty of data collection, this approach is only appropriate in narrowly focused studies, without the possibility of aggregating the data on the country-wide scale (Barsukova 2004). Weeks (1975), Leonova and Shushunina (2011), Belikova et al. (2022) support the legal approach to research on informal employment and the informal sector.

There are a number of microdata-based studies to be found in literature of the factors that affect informal employment in Russia (Lehmann, Zaiceva 2013; Lukiyanova 2015; Kim et al. 2019). (Nureev and Akhmadeev 2021) point to the dependence of informal employment primarily on the level of income of the population, rather than the condition of the formal sector. (Karpushkina and Voronina 2019) showed a significant negative impact of the unemployment rate on informal employment. The results of these studies need further verification on the panel data using an instrumental variable. A possible relationship between informal employment and the number of entities (actors) in the formal sector and the proportion of rural population has been insufficiently studied.

The novelty of this study is the testing of the causality between informal employment and the unemployment rate, wages, the number of formal sector actors, and the proportion of the rural population. The analysis aims at removing the endogeneity of the unemployment rate in the models by using the poverty rate as an instrumental variable. This technique is not to be found in the literature with respect to these indicators. Its practical significance lies in a more detailed consideration of the problem of endogeneity and the way it can be addressed with respect to informal employment.

1 Fifteenth International Conference of Labour Statisticians (ICLS). https://www.ilo.org/public/libdoc/ilo/1993/93B09_65_engl.pdf [accessed: 24 September 2023].

Accounting for informal employment

A distinction is made between the *formal* and *informal* sectors of the economy in which the employed are engaged (Figure 1).

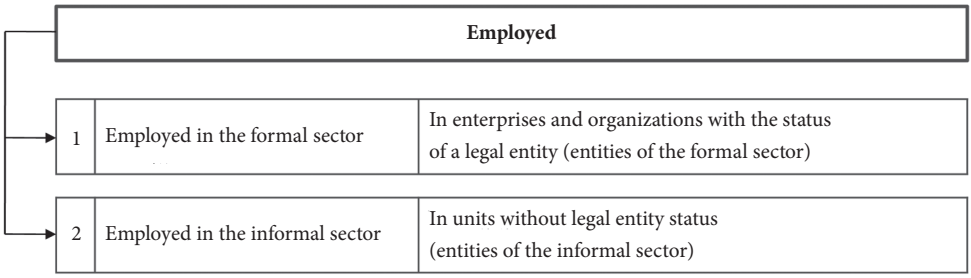

Figure 1. Typology of the employed by their engagement in the *formal* vs. *informal* sector of the economy. *Source:* compiled by the authors based on (Methodological provisions on statistics… 2003). *Note:* For the purposes of this analysis, formal sector actors, enterprises and organisations are treated as a single concept.

Statistics on informal employment is based on the data from the national labour force survey conducted by Rosstat. The *production approach* to defining informal employment is used. The categories of individuals considered to be informally employed are listed in Figure 2.

Materials and methods

This study follows the interpretation of Rosstat[2], which defines **informal sector workers** as "individuals who, during the survey period, were employed in a minimum of one of informal production units, irrespective of their employment status or whether that was their primary or secondary job"[3]. Absence of registration as a legal entity is used as a criterion for defining informal production units.

Data on the proportions of informal employment ($InfEmp_{i,t}$) by region is a dependent variable in the panel regression analysis.

The regressors are as follows:

1. *Unemployment rate* (according to the ILO guidelines) – $Unemp_{i,t}$, %. A high unemployment rate could encourage individuals to take alternative informal jobs instead of those in the formal sector. However, a different situation is also possible. During a crisis with its unemployment, there is a lower demand for labour, such as housekeepers, nurses, drivers etc. In that case, the proportion of the informally employed could

2 Methodological provisions on statistics. 7. Methodological provisions for measuring employment in the informal sector of the economy / Federal State Statistics Service. URL: https://rosstat.gov.ru/bgd/free/b99_10/isswww.exe/stg/d030/i030150r.htm [Accessed on 26.09.2024].

3 Such simplified accounting is legitimate due to a very low proportion of individuals who "combine" work in the informal and formal sectors, which is just 6.1% of the total informally employed in Russia by the end of 2022.

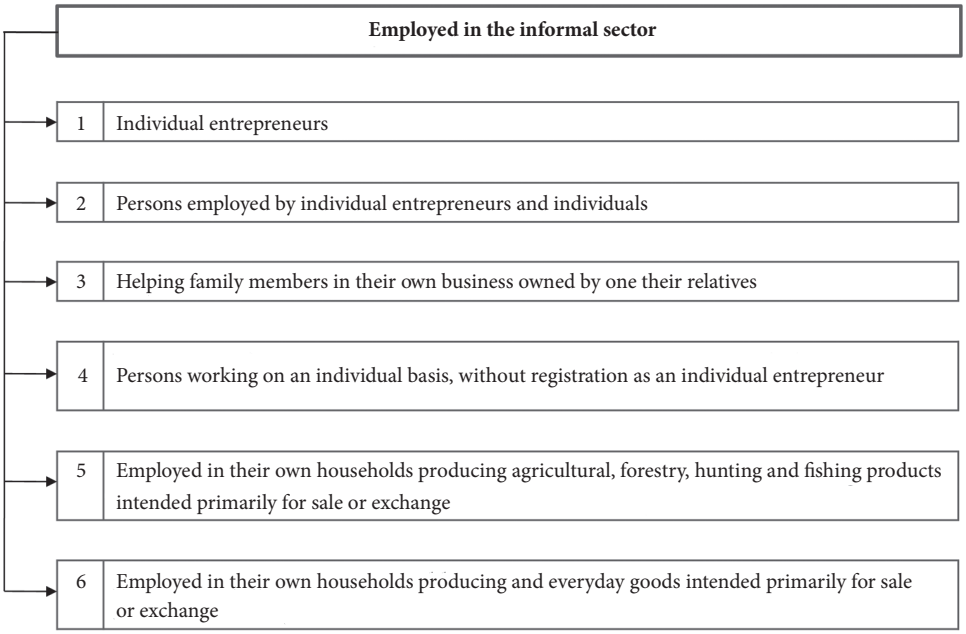

Figure 2. Structure of *informal* employment. *Source*: compiled by the authors based on Order of the Federal State Statistics Service No. 445 of 30 June 2017 "On approval of the basic methodological and organisational provisions for conducting a sample labour force survey".

decline as the unemployment rate increases. The econometric modelling shows which of these effects is more pronounced in Russia.

2. *Average monthly accrued wages of employees across entities in the entire economy in 2009 prices, Wage*$_{i,t}$, rubles. This regressor takes into account the price effect in the form of the labour price. For example, individuals can find it attractive to work in organisations legal entities where wages are usually higher than in the informal economy (Uzyakova 2022).
3. *Number of enterprises / organisations (according to state registration data) per 1,000 population*, *Org*$_{i,t}$, units. This is the same as the number of formal sector actors, in contrast to the informal sector. A high value of this regressor would show a high employment potential, based on availability of many job vacancies, and could have a positive impact on individuals' decision to seek employment in the formal sector. Conversely, a lack of jobs could force people into the informal sector (Sanghi et al. 2019).
4. *Proportion of rural population in the total population as of 1*st *January, AgriPopul*$_{i,t}$, %. As a rule, this regressor correlates positively with the regional level of unemployment and poverty. However, the question remains open as to how a high proportion of rural population can influence the proportion of the informally employed. The effective demand for hired labour in the informal sector is higher in urban than in rural areas. However, cities have more legal entities, which expands the potential for formal employment.

This regressor may be endogenous due to bi-directional causality. It may not be the case that high unemployment leads to a lower proportion of informal employment. Rather, it is the opposite, that a low proportion of informal employment causes high unemployment.

Endogeneity can also be caused by omission of significant variables. Measurement errors can be another reason for endogeneity of the regressor.

To eliminate endogeneity due to bi-directional causality, a tool is needed that correlates with the unemployment rate (i.e., is relevant), but not with the proportion of the informally employed (i.e., is exogenous). We use the *poverty rate* as such a tool, i.e., a proportion of the population with monetary incomes below the poverty line (subsistence minimum) in the total population ($Poverty_{i,t}$, %).

The poverty rate should correlate positively to the unemployment rate. An increase in the latter, in turn, should lead to an increased proportion of the informally employed. Individuals who lose their jobs could subsequently move into the informal sector.

We apply the two-stage least squares method (2SLS).

First-Stage Regression. We estimate the regression of $\ln Unemp_{i,t}$ on the tool ($\ln Poverty_{i,t}$) and on the logarithms of all exogenous variables to obtain the predicted values of the unemployment rate:

$$\ln \widehat{Unemp}_{i,t} = \hat{\alpha}_0 + \hat{\alpha}1 \ln Poverty_{i,t} + \hat{\alpha}_2 \ln Wage_{i,t} + \hat{\alpha}_3 \ln Org_{i,t} + \hat{\alpha}_4 \ln AgriPopul_{i,t}. \quad (1)$$

Second-Stage Regression. We regress $\ln InfEmp_{i,t}$ on $\ln \widehat{Unemp}_{i,t}$ and the logarithms of all exogenous variables:

$$\ln \widehat{InfEmp}_{i,t} = \hat{\beta}_0 + \hat{\beta}_1 \ln \widehat{Unemp}_{i,t} + \hat{\beta}_2 \ln Wage_{i,t} + \hat{\beta}_3 \ln Org_{i,t} + \hat{\beta}_4 \ln AgriPopul_{i,t}. \quad (2)$$

There is a problem of potential endogeneity of the remaining regressors, but no appropriate tools have been found to address it.

Annex 2 explains the variables with their mean values and standard deviations.

More than 1,000 observations in 78 Russian federal constituents from 2009 through 2021 were used to model the factors[4]. Observations for 2022 and 2023 were not included in the regression analysis due to a lack of regional statistical data on individual regressors at the time of writing.

To compare results, modelling was also conducted on the panel data with fixed-effects estimators[5].

Data description

According to Rosstat data, in Russia in 2023 the proportion of the informally employed was 18.63%, and the number of such workers was about 13.4 million. For comparison, in Germany in 2021, informal employment was at 3.8%, in France, 4.4%, in Italy, 11.2%,

4 Due to the lack of necessary data, the Republic of Crimea, the federal cities, and the recently incorporated Russian federal constituents were excluded from the regional sample.

5 This model is preferable due to the need to consider individual effects by Russia's regions. The latter feature a great diversity of natural, social and economic conditions. Random-effects models and pooled regression are inferior at accounting for such individual effects. (Dubravskaya 2021), a paper on a similar topic, also uses the fixed-effects model.

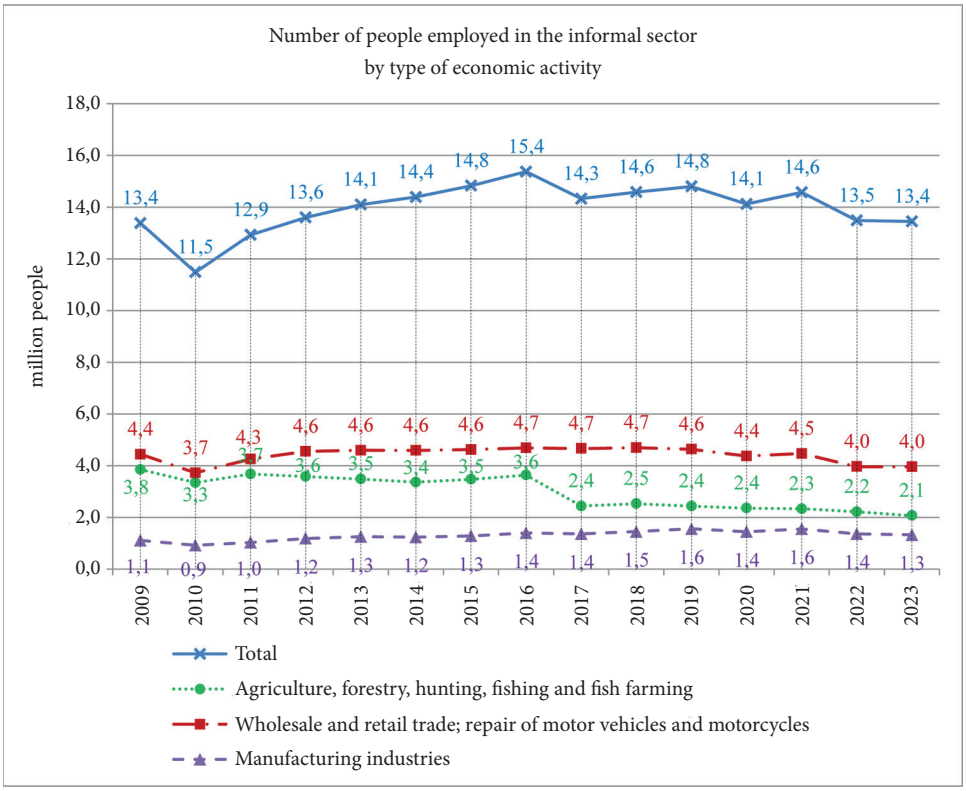

Figure 3. Number of the informally employed, by economic activity in Russia in 2009-2023, million. *Source:* compiled by the authors on the basis of data for 2009-2013 from the statistical compendia "Ekonomicheskaya aktivnost' naseleniya Rossii" [Economic Activity of the Population of Russia] for 2010, 2012, 2014, as well as on the basis of data for 2014-2023 from the statistical compendia "Rabochaya sila, zanyatost' i bezrabotitsa v Rossii" [Labour Force, Employment and Unemployment in Russia] for 2016, 2018, 2020, 2022, 2024 / Federal State Statistics Service. URL: https://rosstat.gov.ru/folder/210/document/13211 (accessed: 07 October 2024). *Notes:* 1. Before 2017, Rosstat conducted the survey for persons 15-72 years old, and as from January 2017, for persons aged 15 years and older. 2. Since 2017, only those who produce mainly for sale have been counted as the informally employed. Before 2017, the informally employed number included both those who produce mainly for sale and those who sell their surplus products* (*Labor Force, Employment and Unemployment in Russia (based on the results of Sample Labor Force Surveys) (2024) Stat. collection / Rosstat. Moscow, 2024. p. 92. URL: https://rosstat.gov.ru/storage/mediabank/Rab_sila_2024.pdf (accessed: 26 September 2024.)

in Australia, 26.1%, in Turkey, 29.9%[6]. Although the number of the informally employed in Russia decreased in absolute terms in 2017, 2022, 2023, this was not an improvement in the labour market situation. The trend was related to an overall unfavourable economic situation in Russia, especially in 2022, due to sanctions imposed against Russia. In 2010 and 2017[7], the number of the informally employed decreased as the country recovered from the economic crises of 2008-2009 and 2015-2016, correspondingly, with a higher demand from the formal economy, while in 2020, due to the impact of the COVID-19 pandemic (Kunitsyna and Dzhioev 2023). In our view, the number of people employed in the informal sector declined in 2022 due to the partial mobilisation, increased demand for labour in the formal sector and a significant reduction in migration growth.

In a crisis, the demand for goods and services other than essentials decreases. Usually, the informal sector is a source of non-essentials. As a result, the number of the informally employed decreases. In difficult economic circumstances, the formal sector features a higher resilience, as it is able to keep more jobs or, in extreme cases, to transfer workers to part-time or hidden employment.

Starting from 2018, the proportion of the informally employed in agriculture has stabilised in the range of 50-52%. In previous years, this figure was higher (Figure 4). In 2023, the proportion of the informally employed in agriculture, forestry, hunting, fishing and fish farming reached 51.4% and the number, 2.1 million.

Due to restrictions during the COVID-19 pandemic, individuals were losing their jobs across the informal economy, which led to a decline in the proportion of the informally employed. The lower proportion of the informally employed in 2017 was caused by a higher demand for labour in the formal sector. Also to be considered is the change in the methodology used by Rosstat to account for the employed (see the notes to Figure 4).

In our view, the labour market will continue to be characterised by low unemployment and high demand for labour in the formal sector in the near future.

It is important to consider the problem of informal sector employment not only at the national level but also at the regional level.

The highest proportions of the informally employed in 2023 were observed in the constituents of the North Caucasus Federal District (Fig. 5). Agriculture is key for these regional economies. The dominance of small-scale farming is usually associated with a high proportion of the informally employed.

In 2023, the Arkhangelsk Oblast (18.3%), the Bryansk Oblast (18.5%), the Sakha Republic (18.8%) and the Novgorod Oblast (19.1%) were close to the national average (18.3%). The Udmurt Republic (17.2%), the Republic of Mordovia (17.5%) and the Tver Oblast (17.9%) were slightly below the Russian average.

The lowest proportions of the informally employed in Russia were observed in the Chukotka Autonomous Okrug (2.7%), Moscow (4.9%), St. Petersburg (6.2%), Murmansk Oblast (7.3%), Nenets Autonomous Okrug (5.4%), and Khanty-Mansi Autonomous Okrug – Yugra (9.0%). These are industrial regions where agriculture does not play a major role (Fig. 5).

6 ILO Data Explorer: Proportion of informal employment in total employment by sex and sector (%). https://www.ilo.org/shinyapps/bulkexplorer20/?lang=en&id=SDG_0831_SEX_ECO_RT_A [Accessed on 29 September 2023].

7 The conclusions in (Kunitsyna and Dzhioev 2023) (p. 443) do not agree with the Rosstat data, according to which in Russia in 2017 there was a decrease, rather than an increase, in the specific weight and number of the informally employed.

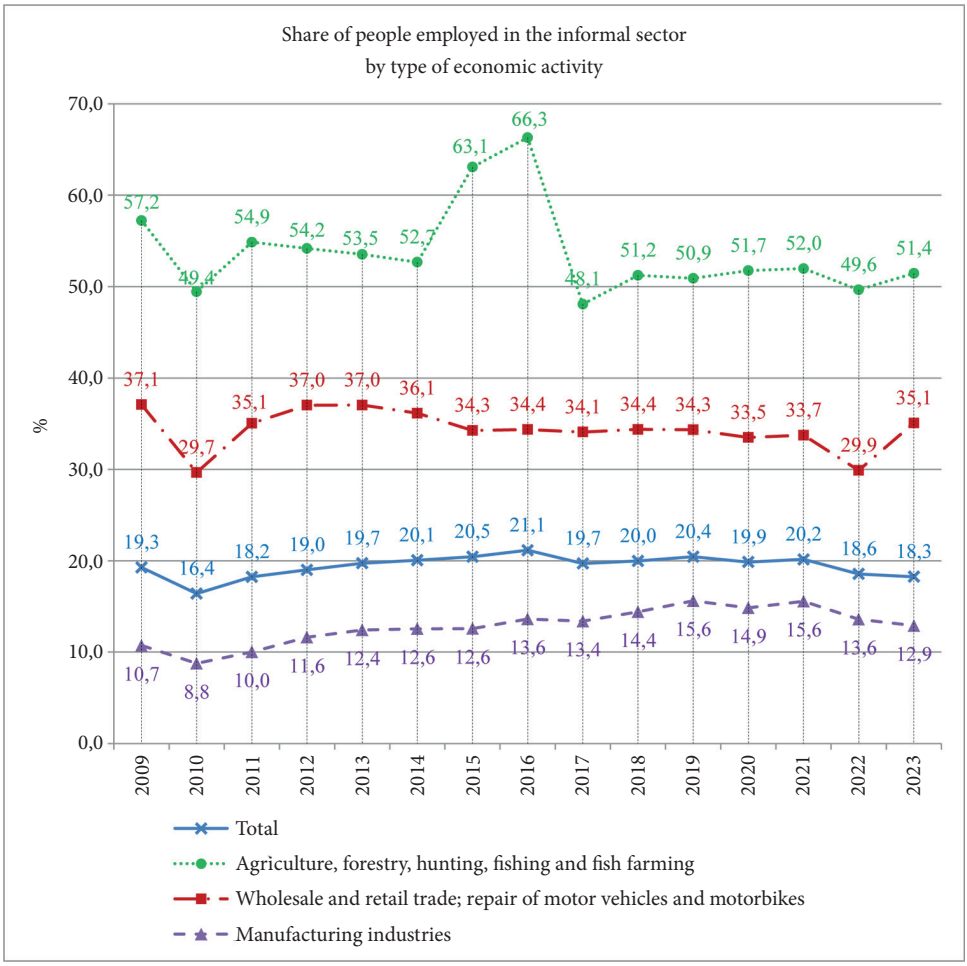

Figure 4. Proportion of the informally employed, by economic activity in Russia in 2009-2023, % of the total employed population by economic activity. *Source:* compiled and calculated by the authors based on the 2009-2013 data from the statistical compendia "Ekonomicheskaya aktivnost' naseleniya Rossii" [Economic activity of the population of Russia] for 2010, 2012, 2014 and the 2014-2023 data from the statistical compendia "Rabochaya sila, zanyatost' i bezrabotitsa v Rossii" [Labour force, employment and unemployment in Russia] / Federal State Statistics Service. URL: https://rosstat.gov.ru/folder/210/document/13211 (accessed: 07 October 2024). *Notes:* 1. Before 2017, Rosstat conducted the survey for persons 15-72 years old, as from January 2017, for persons aged 15 years and older. 2. Since 2017, only those who produce mainly for sale are counted as the informally employed. Before 2017, the informally employed number included both those who produce mainly for sale and those who sell their surplus products* (*Labor force, employment and unemployment in Russia (based on the results of Sample Labor Force Surveys) (2024) Stat. collection / Rosstat. Moscow, 2024. p. 92. URL: https://rosstat.gov.ru/storage/mediabank/Rab_sila_2024.pdf (accessed: 26 September 2024).

Figure 5. Proportion of the informally employed aged 15 years and older by Russian regions in 2023, % of the total employed population. *Source:* compiled by the authors based on the 2023 data from the statistical compendium "Rabochaya sila, zanyatost' i bezrabotitsa v Rossii" [Labour force, employment and unemployment in Russia] for 2024 / Federal State Statistics Service. URL: https://rosstat.gov.ru/folder/210/document/13211 (accessed: 29 September 2024). *Note:* The new territories of the Russian Federation [incorporated] after the 2022 referendum are indicated by hatching; they were not included in the analysis due to lack of data.

Prior to econometric modelling, it is necessary to determine the correlation coefficients between the variables. A strong correlation is characteristic between the *average monthly accrued wages* and *average monthly cash income of the population* ($r_{corr.}$ = 0,85) (Table 1). The Belsley-Kuh-Welsch test confirms the absence of multicollinearity between the variables, providing that the *average monthly cash income of the population* (*Income*) is excluded.

Notable correlation is inherent in the pairs of variables "*Share of rural population – Number of enterprises and organisations*" ($r_{corr.}$ = -0.54); "*Share of employed in the informal sector – Unemployment rate*" ($r_{corr.}$ = 0.53); "*Share of rural population – Unemployment rate*" (r_{corr} = 0.53); "*Share of employed in the informal sector – Average monthly cash income per capita*" ($r_{corr.}$ = -0.51); "*Share of employed in the informal sector – Number of enterprises and organisations*" ($r_{corr.}$ = -0.51) (Table 1).

Table 1. Correlation matrix of variables

	ln*fEmp*	*Unemp*	*AgriPopul*	*Income*	*Wage*	*Poverty*	*Org*
ln*fEmp*	1.00	0.53	0.72	-0.51	-0.45	0.36	-0.51
Unemp		1.00	0.53	-0.28	-0.19	0.46	-0.31
AgriPopul			1.00	-0.44	-0.39	0.43	-0.54
Income				1.00	0.85	-0.43	0.34
Wage					1.00	-0.23	0.24
Poverty						1.00	-0.21
Org							1.00

Source: compiled by the authors using the Gretl software package. *Notes:* 1. For variable designations in tabular form see Annex 2. 2. 2.5% significance points (two-sided) = 0.06 for 1,014 observations.

Results

Table 2 presents the coefficients of the regressors (both significant and insignificant) for the six models.

The fundamental equation of the model is as follows:

$$\ln InfEmp_{i,t} = \underset{(1,73)}{6,17}^{***} + \underset{(0,10)}{0,25} \times \ln Unemp_{i,t}^{**} - \underset{(0,16)}{0,37} \times \ln Wage_{i,t}^{***} - \\ - \underset{(0,08)}{0,22} \times \ln Org_{i,t}^{***} + \underset{(0,14)}{0,22} \times \ln AgriPopul_{i,t}. \quad (3)$$

Table 2. Estimates of panel models of dependence of the logarithm of the proportion of the informally employed ($\ln InfEmp_{i,t}$) on socio-economic factors in Russia in 2009-2021

Regressors	**Models**					
	2SLS(1); IP = *lnPoverty*$_{i,t}$; reg. = *lnUnemp*$_{i,t}$	**2SLS(2); IP = *lnPoverty*$_{i,t}$; reg. = *lnUnemp*$_{i,t}$; *lnIncome*$_{i,t}$**	**2SLS(3); IP = *lnAgriPopul*$_{i,t}$; reg. = *lnWage*$_{i,t}$**	**FE (1)**	**FE (2)**	**FE (3)**
$\ln Unemp_{i,t}$	0.25**	0.18**	0.13*		-0.10	-0.06
	(0.10)	(0.09)	(0.08)		(0.06)	(0.06)
$\ln Unemp_{i,t-1}$				-0.11**		-0.08**
				(0.04)		(0.03)
$\ln Wage_{i,t}$	-0.37**	-0.38**	-1.03***		0.17	0.19
	(0.16)	(0.16)	(0.37)		(0.11)	(0.14)
$\ln Wage_{i,t-1}$				0.19**		0.06
				(0.09)		(0.10)
$\ln Poverty_{i,t}$			0.02		0.01	0.12**
			(0.11)		(0.10)	(0.06)

Regressors	Models					
	2SLS(1); IP = $lnPoverty_{i,t}$; reg. = $lnUnemp_{i,t}$	2SLS(2); IP = $lnPoverty_{i,t}$; reg. = $lnUnemp_{i,t}$; $lnIncome_{i,t}$	2SLS(3); IP = $lnAgriPopul_{i,t}$; reg. = $lnWage_{i,t}$	FE (1)	FE (2)	FE (3)
ln$Poverty_{i,t-1}$				-0.13		-0.19**
				(0.11)		(0.09)
ln$Org_{i,t}$	-0.22***	-0.24***	-0.23**		-0.01	0.24
	(0.08)	(0.08)	(0.11)		(0.08)	(0.15)
ln$Org_{i,t-1}$				0.03		-0.18
				(0.09)		(0.16)
ln$AgriPopul_{i,t}$	0.22	0.24*			0.09	0.28
	(0.14)	(0.14)			(0.35)	(0.30)
ln$AgriPopul_{i,t-1}$				-0.09		-0.39
				(0.40)		(0.55)
const	6.17***	6.38***	13.5***	1.99	1.23	0.23
	(1.73)	(1.86)	(3.57)	(1.63)	(1.36)	(1.63)
Number of observations (n)	1011	1011	1011	933	1011	933
Corrected R^2	0.55	0.55	0.45	0.10	0.05	0.11
LSDV-R^2				0.89	0.88	0.89
Log likelihood	-5386.8		-5276.4	571.9	574.2	577.7
p-value from the Hausman test (H_0: LSM estimates are valid)	0.04	0.81	1.3×10^{-6}			
F-statistics on the results of the weak tool test	468.5	292.7	275.7			

Source: compiled by the authors. *Notes:* 1. FE – models with fixed-effects estimation* (*To account for individual effects of Russian regions, we used fixed-effects models. The Hausman test is also in their favour when compared to random-effects models. The linear restriction test indicates the superiority of fixed-effects models over pooled regression). 2. LSM – least squares method. 2SLS – two-stage least squares method. 3. IP – instrumental variable. 4. Regr. – regressor. 5. Standard coefficient errors are given in parentheses. 6. Asterisks indicate coefficient significance levels: * – at the 10% level; ** – at the 5% level; *** – at the 1% level.

Let us explain the choice of the 2SLS(1) model. The Hausman test confirms the appropriateness of the 2SLS(1) and 2SLS(3) models at the 5% significance level, as opposed to 2SLS(2). The 2SLS(1) model is preferable, with a higher corrected R^2 value (0.55) than in 2SLS(3) (Table 2).

In the 2SLS(1) model, the *F*-statistic for the weak tool test[8] is 468.5, which is greater than 10. Thus, we can conclude that the tool is relevant.

The 2SLS estimate of the unemployment rate in the 2SLS(1) model was significantly larger in absolute value than the estimates in FE (2) and FE (3) models (Table 2). This implies that measurement errors were likely the predominant cause of the endogeneity of the unemployment rate. In the presence of measurement errors, the coefficient estimates for this regressor are biased towards zero. 2SLS eliminated this problem, and the coefficient estimate is larger. This suggests the superiority of 2SLS over the fixed-effects estimation models (FE (1), FE (2) and FE (3)).

Other things being equal, a 1% increase in the average monthly accrued wages of employees across organisations decreases the proportion of the informally employed by an average of 0.4 percentage points (p.p.). This relationship seems quite logical: an increase in wages makes working in organisations more attractive for both their existing employees and those informally employed.

An increase in the unemployment rate by 1 p.p. contributes to an increase in the proportion of the informally employed by an average of 0.3 p.p. An increase in the unemployment rate can indicate difficulty in finding a job in the formal sector, which can encourage people to take jobs in the informal sector instead.

The increase in the number of enterprises / organisations leads to a decrease in the proportion of the informally employed by 0.2 p.p. This speaks to the attractiveness of working in organisations legal entities, and some of the workers could leave the informal sector for formal jobs. However, there are barriers to finding employment in enterprises / organisations (due to lack of necessary qualifications and knowledge) (Ohnsorge and Yu 2022). As is shown in the section "*Discussion of results*", the prevailing part of the informally employed have secondary general or basic general education. It can be concluded that the transition of applicants to organisations legal entities is possible providing they have appropriate knowledge and skills.

Discussion of results

Estimates of the scale of informal employment are debatable. They can vary greatly depending on their accounting methodology, for example, on whether the latter is based on household consumption for own needs and for sale on the market as opposed to hidden employment in enterprises (where workers do not receive labour contracts) (Uzyakova 2022).

The activities of informal actors can be linked to the shadow economy. One of the methods of tax evasion by employers is using the services of the self-employed. Although those are labour relations requiring employers to pay social contributions, some informal actors prefer not to register in order to avoid government control.

We are discussing employment across the entire informal economy, but sectoral specifics are also possible. During crises, informal employment in agriculture increases. This is due

8 In this case, it is the same as the *F*-statistic for the equation insignificance test.

to the fact that some people migrate to rural areas. In order to secure food and increase their incomes, household farms are likely to expand their activities.

According to the estimates given in (Bojko 2021; Vinogradova 2022), in recent years (2020-2023) the proportion of the informally employed in the Russian economy was decreasing. This is linked to economic difficulties, with a decline in demand for their labour (and the goods they sell or services they provide) and to the resulting "shrinking" of opportunities for self-employment. Labour supply in the Russian economy has been decreasing, which is confirmed by the evolution of the unemployment rate: in 2020, it was at 5.8%, whereas in 2022 and 2023, at 4.0% and 3.2%[9], respectively. The results of this study coincide with the findings in (Uzyakova 2022) on the procyclical dynamics of informal employment.

(Uzyakova 2022) links a high share of informal employment with a significant share of low-skilled workers. This is also consistent with the findings in (Gimpel'son and Kapelyushnikov 2013). Population groups under study have a heterogeneous qualitative structure. Thus, according to Rosstat, in Russia in 2023, workers who are university graduates accounted for only 19.1% of the total employed in the informal sector (against 35.4% of the total employed in the entire economy)[10; 11]. At the same time, 33.0% of the total employed in the informal sector have secondary general or basic general education (compared to 18.9% of the total employed in the entire economy).[12; 13]

(Uzyakova 2022) notes that as the number of jobs in enterprises / organisations grows, informal employment may decline. The models proposed in this paper reflect this effect, although they do not account for the size of enterprises / organisations, with their associated ability to create a certain number of jobs.

The proportion of the rural population, too, has no significant impact on the evolution of the proportion of the informally employed. At first glance, this seems puzzling, since the informally employed in the rural areas in Russia in 2023 accounted for 21.8% of the total employed *rural population,* according to our calculations based on Rosstat data[14]. The corresponding figure for the *urban population* is almost 1.7 times lower, at 13.0%[15]. However, there are only six regions in Russia where the rural population prevails over the urban population. These include the Republic of Altai (the proportion of rural population in 2023 was 69.3%), the Republic of Chechnya (60.9%), the Republic of Karachay-Cherkess (58.6%), the Republic of Dagestan (54.8%), the Republic of Kalmykia (53.0%) and the Republic of Adygea (51.2%). These leave other Russia's regions behind in terms of in-

9 Federal'naya sluzhba gosudarstvennoy statistiki. Trudovyye resursy, zanyatost' i bezrabotitsa. [Federal State Statistics Service. Labour resources, employment and unemployment.] URL: https://rosstat.gov.ru/labour_force (accessed: 05 March 2024).

10 *Aged 15 years and older.

11 According to the statistical compendium "Rabochaya sila, zanyatost' i bezrabotitsa v Rossii za 2022 god". Federal'naya sluzhba gosudarstvennoy statistiki. [Labour force, employment and unemployment in Russia for 2022 / Federal State Statistics Service.] URL: https://rosstat.gov.ru/folder/210/document/13211 (accessed: 01 October 2023).

12 *Aged 15 years and older.

13 According to the statistical compendium "Rabochaya sila, zanyatost' i bezrabotitsa v Rossii za 2022 god". Federal'naya sluzhba gosudarstvennoy statistiki. [Labour force, employment and unemployment in Russia for 2022 / Federal State Statistics Service.] URL: https://rosstat.gov.ru/folder/210/document/13211 (accessed: 01 October 2023).

14 Ibid.

15 Ibid.

formal employment, too. This "leadership" and insignificance of the above-mentioned regressor can be explained by socio-cultural factors not taken into account in the econometric modelling.

The dispersion of the proportion of the informally employed at only 54.6% can be explained by the model, which indicates the presence of other unaccounted-for factors. These may include: the quality of institutions regulating the labour market; the level of labour market mobility; socio-cultural characteristics of regions, etc. For these factors, statistical data are missing that would be sufficient to build the time series for 2009-2021; or there are no indicators available to fully characterise these factors. The significant proportion of the informally employed can be linked to the low quality of the business environment, dissatisfaction of entrepreneurs with the available public services (OECD 2021).

Conclusion

This paper evaluates a possible impact of socio-economic factors on the proportion of the informally employed in Russia in 2009-2021. The significant regressors, which indicate the statistical significance of the impact on the dependent variable, include average monthly wages and the number of enterprises / organisations (a negative impact), as well as the unemployment rate (a positive impact).

The results obtained seem quite logical and do not contradict the theoretical assumptions.

Higher wages in the formal sector make working in organisations more attractive. As a consequence, workers can become better anchored in the formal sector and informal workers can take jobs there too.

In general, an increase in the unemployment rate can indicate difficulties in finding formal employment, which may cause people to take informal jobs. Declining and low unemployment rates indicate a high demand for labour, substantially exceeding its supply.

Growth in the number of enterprises / organisations may come along with a decrease in the proportion of the informally employed. This can indicate the attractiveness of working in organisations legal entities, and some of the workers may leave the informal sector for a formal job.

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Annex 1

International experiences in measuring the informal economy and informal employment

About 70 countries have measured the informal economy or informal employment at least once over the last ten years (In-depth review ... 2022).

The *Eurostat Tabular Approach on Exhaustiveness* is designed to analyse the informal economy in the EU, with informal activities including categories such as underground producers, producers not required to register, and reporting errors.

Countries in Eastern Europe, the Caucasus and Central Asia, and South-Eastern Europe most often use the *Eurostat Tabular Approach*. Latin American countries use 2008 SNA[16] and the OECD Guidelines to measure informal economy. The International Labour Organisation (ILO) publishes annual reviews of the measurement of informal employment based on the following three sources (In-depth review ... 2022; OECD et al. 2002):

(1) Review of labour force survey questionnaires from 148 countries, as part of the revision of the International Standard Classification of Status in Employment (ICSE-93)[17];

(2) Criteria evaluation of the set of 112 microdata indicators used for the ILOSTAT harmonised series on the informal economy and informal employment[18];

16 System of National Accounts 2008 (2008 SNA). The 2008 SNA methodology distinguishes between market production; own use; non-market production and use of the full set of household accounts, similar to the Eurostat Tabular Approach.

17 Department of Economic and Social Affairs, Statistics Division. International Classification of Status in Employment 93 (ICSE-93). URL: https://unstats.un.org/unsd/classifications/Family/Detail/222 [Accessed on 12.06.2023].

18 ILOSTAT. Statistics on the informal economy. URL: https://ilostat.ilo.org/topics/informality/ [Accessed on 12.06.2023].

(3) Questionnaires for collecting information on a set of criteria for evaluating informal employment and informal economy.

Innovations on statistical classifications of the employed and characteristics of the labour relationships identified by the 20th International Conference of Labour Statisticians are summarised in (Lajkam et al. 2018).

Identification of informal employment is based on the data of the national labour force survey or similar household surveys. Employers' social security contributions are included in the identification of informal employment.

Annex 2

Table A1. Description of variables used in the paper for 78 constituents of the Russian Federation for 2009-2021

№	Designation	Definition	Unit	Average value	Standard deviation
		Dependent variable			
1	$InfEmp_{i,t}$	Informal employment as a percentage of total employment	%	23.2	9.2
		Regressors			
1	$Unemp_{i,t}$	Unemployment rate (according to ILO guidelines)	%	7.3	4.9
2	$Wage_{i,t}$	Average monthly accrued wages of employees across organisations in the entire economy by constituents of the Russian Federation	rubles	19,094	8,131
3	$Org_{i,t}$	Number of enterprises / organisations (at the end of the year) per 1,000 population	%	23.8	8.1
4	$AgriPopul_{i,t}$	Rural population as a percentage of total population as of 1st January	%	31.1	12.2
		Tools			
1	$Poverty_{i,t}$	Poverty rate – number of people with monetary incomes below the poverty line (subsistence minimum)	%	14.8	4.9
2	$Income_{i,t}$	Average monthly cash income per capita	rubles	14,210	5,356
	u_i	Individual effects of regions			
	$\varepsilon_{i,t}$	Accidental errors			

Source: compiled by the authors. *Notes*: 1. All values are given at 2009 prices. 2. Subscripts mean: in region *i* in year *t*. 3. Enterprises / organisations ($Org_{i,t}$) are accounted for according to state registration data.

Annex 3

Table A2. Ranking of economic activities by contribution to the total number of the informally employed in Russia in 2023 (2022 data are given for comparison), %

№	Type of economic activity	2022	2023
1	Wholesale and retail trade; repair of motor vehicles and motorbikes	29.4	29.4
2	Agriculture, forestry, hunting, fishing and fish farming	16.4	15.4
3	Transportation and storage	10.8	10.8
4	Construction	10.1	10.0
5	Manufacturing industries	10.1	9.9
6	Provision of other services	9.0	9.6
7	Hospitality and catering	4.0	4.2
8	Professional, scientific and technical activities; administrative activities and related ancillary services	4.0	3.9
9	Health and social services	1.5	1.9
10	Education	1.4	1.5
11	Information and communication	0.9	0.9
12	Culture, sports, leisure and entertainment	0.9	0.9
13	Real estate operations	0.6	0.8
14	Financial and insurance	0.3	0.3
15	Mining	0.2	0.2
16	Water supply, wastewater disposal, waste collection and disposal, pollution elimination	0.2	0.2
17	Provision of electricity, gas or steam; air conditioning	0.2	0.1
18	Other economic activities	0.1	0.1
	Total number of the informally employed	100.0	100.0

Source: compiled by the authors based on 2022 and 2023 data from the statistical compendium "Rabochaya sila, zanyatost' i bezrabotitsa v Rossii" / Federal'naya sluzhba gosudarstvennoy statistiki [Labour force, employment and unemployment in Russia] for 2024 / Federal State Statistics Service. URL: https://rosstat.gov.ru/folder/210/document/13211 (accessed: 07 October 2024).

Thus, the proportions of the informally employed in the regions are closely related, among other things, to their sectoral structure[19]. Where the latter is dominated by economic activities with stricter government regulation (including registration as legal entities), such regions have a lower proportion of the informally employed. Such types of economic activities include, in particular, mining, financial and insurance, health care and social services, education, information and communication, provision of electricity, gas or steam, air conditioning, and, in some degree, manufacturing, etc.

19 This thesis is corroborated in (Gimpel'son and Zudina 2014).

Annex 4

Table A3. Number of the informally employed by primary employment in 2022 and 2023

№	Categories of the informally employed by primary employment	Category employment, million		Category employment as a percentage of the total informally employed, %	
		2022	2023	2022	2023
1	Employed by individuals, individual entrepreneurs, farmers	7.9	7.8	58.5	58.2
2	Entrepreneurial activity without creation of a legal entity	3.9	4.1	28.9	30.6
3	Own household production of agricultural, forestry, hunting and fishing products for sale or exchange	0.9	0.8	6.7	6.0
	Total informally employed	13.5	13.4	100.0	100.0

Source: compiled by the authors on the basis of data for 2022 and 2023 from the statistical bulletin "Obsledovaniye rabochey sily" za 2023 god / Federal'naya sluzhba gosudarstvennoy statistiki [Labour Force Survey for 2023 / Federal State Statistics Service.] URL: https://rosstat.gov.ru/compendium/document/13265 (accessed: 07 October 2024).

In Russia in 2023, 7.8 million were employed by individuals, individual entrepreneurs or farmers, or 58.2% of the total informally employed.

Annex 5

Average number of hours worked per week per person informally employed in Russia in 2009-2023, hours

Compared to the entire economy or the trade or manufacturing sectors, it is clear that the number of hours worked by the informally employed in agriculture, forestry, hunting, fishing and fish farming was growing in 2017-2023 (29.4 hours in 2023 against 27.6 hours per week in 2017). Having said this, due to seasonality of labour, the same indicator is lower in agriculture (especially in crop production) than in trade industry (39.1 hours) or manufacturing (35.7 hours), where employment is more stable year-round (Figure A1).

Annex 6

Natural growth of the number of individual entrepreneurs and household farms in Russia in 2012-2023, thousand units

See Figure A2.

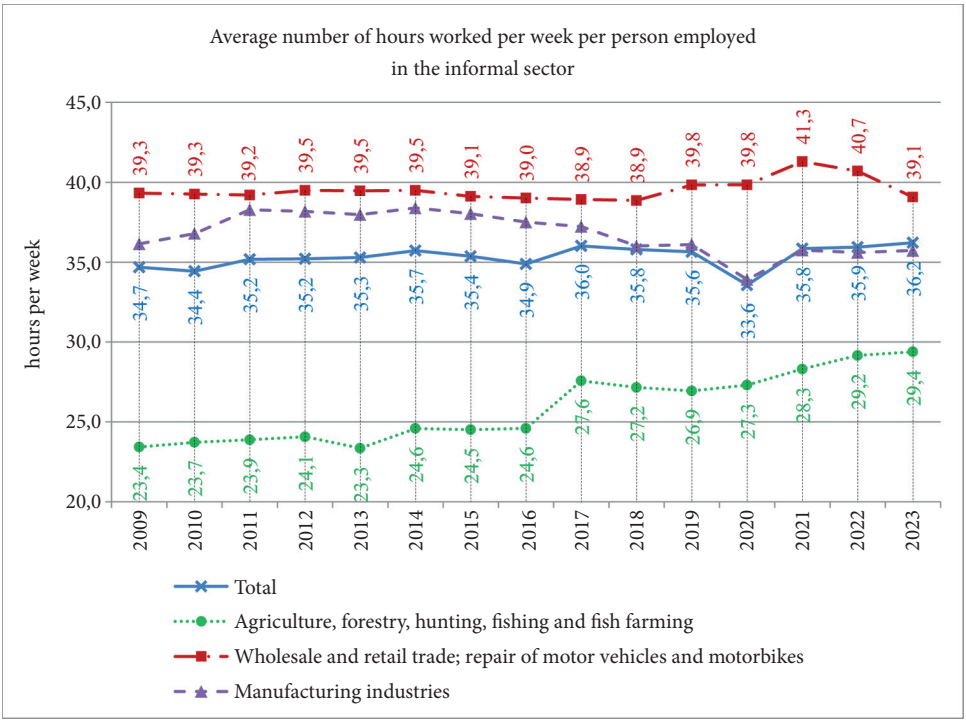

Figure A1. Average working hours per week per person informally employed. *Source:* Compiled by the authors based on 2009-2015 data from the statistical bulletins "Obsledovaniye naseleniya po problemam zanyatosti" [Population Survey on Employment] for 2009-2015, as well as the 2016-2023 data from the statistical bulletins "Obsledovaniye rabochey sily" / Federal'naya sluzhba gosudarstvennoy statistiki za 2016-2023 [Labour Force Survey for 2016-2023 / Federal State Statistics Service.] URL: https://rosstat.gov.ru/compendium/document/13265 (accessed: 07 October 2024).

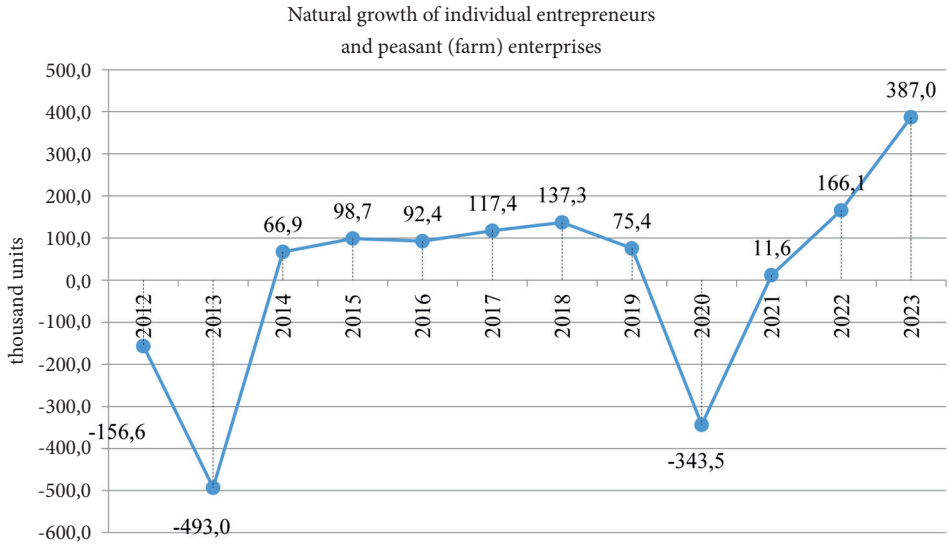

Figure A2. Natural growth of the number of individual entrepreneurs and household farms. *Source:* Compiled by the authors based on materials of the Federal Tax Service. Statistika po gosudarstvennoy registratsii YuL i IP v tselom po Rossiyskoy Federatsii. Svedeniya o rabote po gosudarstvennoy registratsii individual'nykh predprinimateley i krest'yanskikh (fermerskikh) khozyaystv [Statistics on state registration of legal entities and individual entrepreneurs in the entire Russian Federation. Information on state registration of individual entrepreneurs and household farms]. URL: https://www.nalog.gov.ru/rn77/related_activities/statistics_and_analytics/regstats/ (accessed: 02 October 2024). *Notes:* 1. Natural growth of the number of individual entrepreneurs and household farms is the difference between the number of registered individual entrepreneurs and household farms and the number of individual entrepreneurs and household farms that discontinued operation, per year. 2. Data for 2009-2011 are not available.

Supplementary material 1

Raw data for variables used in the models

Data for loading into Gretl or another econometric package.
Link: https://doi.org/10.3897/popecon.8.e114046.suppl1

Supplementary material 2

Estimates of Fixed Effects models

Estimates of Panel Data Regression models in the Gretl package.
Link: https://doi.org/10.3897/popecon.8.e114046.suppl2

Supplementary material 3

Estimates based on Two-Step Least Squares Method

Estimates based on Two-Step Least Squares Method in the Gretl package.
Link: https://doi.org/10.3897/popecon.8.e114046.suppl3

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