# Tax burden and shadow economy growth in Russian regions

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**ABSTRACT**

The study is devoted to verification the hypothesis that a higher tax burden does not necessarily lead to the growth in the shadow economy in Russian regions. The cross-regional comparative analysis was undertaken to measure the influence of the tax burden on the shadow economy. The analysis used Rosstat workforce surveys data about the number of informal workers nationwide and by sector from 2007 to 2019. Stochastic factor analysis was used to examine the relationship between the share of informal workers and such factors as the tax burden, GRP per capita, advanced production technologies, innovation activities of organizations, industrial sectors' and social sectors' contribution to GRP. To determine the strength of the relationship between the factors and the resultant indicator, a correlation and cluster analysis were conducted. It has shown that there is an inverse correlation between the tax burden and informal employment. Regions with a lower tax burden tend to have higher rates of informal employment (in 2019, the correlation coefficient was –0.4274). A similar inverse correlation is observed for the level of informal employment and the macro-economic indicators – GRP per capita, innovation, and the contribution of industrial sectors to GRP. There is a direct correlation between informal employment and the contribution of social sectors to GRP. These findings shed light on the key factors conducive to the growth in the shadow economy: what matters most is the economic and innovation lag in the development of certain regions. The results of this research can be useful for policy-makers seeking to address the problem of the shadow economy in regions.

**KEY WORDS**

tax burden, shadow economy, regional economy, informal employment, correlation analysis, innovation

**JEL** H21; O17; R21

# Влияние налоговой нагрузки на рост теневой экономики в российских регионах

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**АННОТАЦИЯ**

Исследование посвящено проверке гипотезы о том, что повышение налоговой нагрузки не обязательно приводит к росту теневой экономики в регионах России. Для измерения влияния налоговой нагрузки на теневую экономику проведен межрегиональный сравнительный анализ. В анализе использовались данные о численности неформальных работников по стране и по секторам полученные на основе выборочных обследований организаций, индивидуальных предпринимателей, домохозяйств и населения по вопросам занятости,

проведенных Росстатом с 2007 по 2019 г. Стохастический факторный анализ использовался для изучения взаимосвязи между долей работников неформального сектора и такими факторами, как налоговая нагрузка, ВРП на душу населения, передовые производственные технологии, инновационная деятельность организаций, вклад промышленного и социального сектора в ВРП. Для определения силы связи между факторами и результирующим показателем был проведен корреляционный и кластерный анализ. В результате исследования была выявлена обратная корреляционная зависимость между величиной неформальной занятости и уровнем налоговой нагрузки. В регионах с низким уровнем налоговой нагрузки обычно наблюдаются значительные масштабы неформальной занятости: коэффициент корреляции в 2019 г. составил –0,4274. Так же обратная корреляционная зависимость была выявлена между величиной неформальной занятости и такими макроэкономическими показателями, как величина валового регионального продукта на душу населения, уровень развития инновационных процессов в регионе, доля отраслей промышленности в валовом региональном продукте. Прямая корреляционная зависимость наблюдается между уровнем неформальной занятости и долей социальных отраслей в валовом региональном продукте. Полученные результаты позволили выявить факторы, благоприятствующие росту теневой экономики. Среди них на первый план выходит отставание регионов в экономическом и инновационном развитии. Полученные результаты могут быть использованы органами государственной власти для разработки региональной экономической политики, направленной на сокращение масштабов теневой экономики.

**КЛЮЧЕВЫЕ СЛОВА**

налоговая нагрузка, теневая экономика, региональная экономика, неформальная занятость, корреляционный анализ, инновации

## 1. Introduction

Openness and transparency are the two pillars of modern economy. The development of ICTs has led to the dissemination of a greater amount and a higher quality of information that economic agents have access to. Economic agents, in their turn, strive to spread positive information about themselves and share their successful practices to attract more clients. At the same time, negative information about economic malpractices or cases of breach of contract spreads fast enough among the participants of the market. Thus, economic transparency becomes a cornerstone of business success. Transparency and disclosure are needed in the interactions between businesses and financial institutions, for instance, to conclude or extend a loan agreement, to purchase an insurance coverage, to get a lease, or to attract investors.

Despite the above-described trends, some economic agents choose to participate in the informal economy and thus cut their costs by avoiding taxes, underpaying their staff, bypassing utility bills and so on.

Entrepreneurs in developing countries where the economic infrastructure often leaves much to be desired and social institutions are unable to meet the needs of the market economy often choose to operate in the shadows in the hope of making profit or at least staying afloat. In other words, in developing countries institutional conditions tend to drive businesses into the shadow economy while in developed countries many businesses are better off in the formal sector. There are substantial differences between the countries in the size of the shadow economy [1].

Apart from the cross-country variations in the degree of informality, there are also interregional differences which institutional differences alone cannot explain, since the territory of a country is an integral economic system subject to the same legal regulations.

It is commonly believed that the main cause of the shadow economy is high taxes, which push businesses to move part of their activities into the shadow in order to pay less in taxes and other obligatory payments. To test this view, in this

study I intend to measure the influence of the tax burden on the shadow economy in Russian regions. Regarding the fact that tax burden is not the only factor influencing the beha-vioural strategies of economic entities, the analysis also includes other factors.

Thus, the hypothesis to be tested is that a high tax burden does not always cause an increase in the shadow economy.

The level of the shadow economy should be lower in regions where the institutional conditions are closer to those of developed countries. These conditions include the following: a high level of economic growth measured through gross regional product (GRP) per capita; active use of innovative technologies; a high level of the tax burden which provides regional governments with sufficient funds for the provision of public goods.

It may be supposed that the low level of informality is more characteristic of the regions whose economies are dominated by industry and where a significant part of the value added is generated by social sectors. This situation can be explained by the fact that the industrial sectors are usually dominated by large-scale enterprises and for larger companies it is harder to engage in informal activities. As for the social sector, it is usually dominated by state-owned and municipal organizations, which are also less prone to operate in the informal economy. In this study, a cross-regional comparative analysis of the shadow economies in Russian regions will shed light on the conditions that are conducive to the growth in the shadow economy and the conditions that, on the contrary, impede it.

## 2. Research on the shadow economy and the influence of the tax burden on the shadow economy

There are numerous studies on the shadow economy and its size in different countries. These studies are usually based on statistical observations, drawing on the data from the systems of national accounts. They apply a range of direct and indirect methods to calculate the size of shadow economies on the national level.

It is much more difficult, however, to obtain the necessary statistical data to measure the shadow economy in regions since some of the indicators used by the national statistical services are calculated only for the whole country. This happens because regions are not closed economic systems and it is not always possible to accurately measure the interregional redistribution of financial and commodity flows or workforce.

Moreover, governments generally rely on the national-level data for their economic decision-making, which is why much fewer methodologies were developed to measure regional shadow economies.

Putniņš [2] applied direct methods to estimate the size of the shadow economy on the regional level: he studied the shadow economies in the Baltic countries by analyzing unreported business income (profits), 'envelope wages', and proportion of revenue spent on payments 'to get things done' (bribery). Albu [3] studied the informal sector in the regions of Romania by analyzing the structure of households' income.

Some studies use indirect methods of measurement based on the indicators reflecting separate aspects of informal economic activities. For example, Ardizzi et al. [4] examined the value of cash transactions in Italian provinces, assuming that the preference for cash transactions is indicative of informal economic activities. Heath & Jones [5] applied the so-called physical input method and compared observable electricity consumption with the industrial output in the USA to reveal the volume of underground economic activity.

Numerous modeling methods are based on mathematical models which can be used to simulate the development of economic processes and calculate the indicators characterizing different phenomena related to the shadow economy. For example, Mummert & Schneider [6] applied the MIMIC procedure to measure the shadow economy in the federal states of Germany. Sokolovskaya et al. [7] applied the MYMIC and DYMIMIC-models to estimate the shadow economy in Ukraine.

Substantial knowledge has been accumulated concerning the factors that influence the shadow economy in regions. For instance, a high tax burden is often seen as the main incentive for businesses to move into the shadows (see, for example, Sutina et al. [8]). According to Scheglov & Fedonina [9], as long as taxpayers have to pay higher taxes, there will always be shadow economy. Krivorotov et al. [10] and Vylkova & Pozov [11] also subscribe to the view that a high tax burden leads to an increase in the shadow economy.

Studies by Russian scholars focus on regional disparities and the differences in the sectoral structure of regional economies. For instance, Lizina [12] highlights the significance of the high level of unemployment and uneven distribution of GRP. Aleshnikova & Burtseva [13] demonstrate the key role played by the economic sectoral structure in the interregional variations of the size of the shadow economy.

Kireenko et al. [14] have shown the heterogeneous impact of the shadow economy on the social sphere and living standards in Russian regions: they associate the negative impacts of the shadow economy with the lower ratio of hospital beds to population and the lower number of places in pre-school institutions as well as shorter lifespans. The positive impacts are associated with the larger difference between per capita consumption and per capita income and the smaller difference between the number of bank deposits and per capita income.

A separate group of studies discuss the impact of the shadow economy on innovation in Russian regions. The shadow economy is seen as a factor impeding innovation in manufacturing [15; 16]. Kondratieva [17] and Tereshchenko [18] express similar views about the impact of the shadow economy on innovation.

Informal employment has only recently become the focus of scholarly attention – the earliest studies in this area go back to the mid-twentieth century. A large-scale field study of informal employment in Accra, the capital of Ghana, was conducted by British social anthropologist Keith Hart [21], who showed a high degree of informality in the local labour market. He also examined the gender and age distribution of workers in informal employment. Gershuny [22] defined informal employment as activities which fell outside formal employment and unpaid work in the home (household economy).

Bangasser [23] measured the size of the informal sector and the role of the International Labour Organization in crea-ting jobs in developing countries. An interesting study of the effects of taxation on the employment structure was conducted by Slonimczyk [24], who found that after the income tax rate was lowered in 2001 in Russia, the rate of informal employment declined. He argues that informal and formal labour markets are closely integrated. Nureev et al. [25] consider informal employment as an element of the shadow economy. Other studies of informal employment and its size were conducted by Bernabé [26], Williams [27], Meldolesi [28], Jutting at al. [29], Krylova et al. [30].

Informal employment can be indicative of the size of the shadow economy and reflect the economic processes in regions. John Maynard Keynes [31] studied the stability of economic systems by using employment-related indicators. He evaluated effective demand that occurs in the point of equilibrium between aggregate demand and aggregate supply and is characterized by the absence of economic crises. To this end, he used the functional dependence between output and employment described by formula (1):

$$Z = \varphi(N), \tag{1}$$

where $Z$ is the aggregate supply; $N$ is the aggregate employment [31, p. 59].

Thus, there is a substantial body of research on the connection between the shadow economy and other economic and social phenomena. Most researchers subscribe to the view that tax burden is the key factor that leads to the growth in the shadow economy. In its turn, the shadow economy has negative consequences for the living standards and the quality of life and it also has an adverse impact on innovation.

## 3. Methodology

Measurements of the size of the shadow economy in specific regions usually rely on different statistical indicators. The most representative indicators used by the national statistical service (Rosstat) in Russia are as follows:

1) adjustment of gross value added for economic transactions that are not observed through direct statistical methods;

2) the share of informal workers in the economy.

The first indicator is compiled by using Rosstat experts' estimations of the gross value added that was not included in the official reports of surveyed organizations but was estimated with the help of other economic indicators. This indicator characterizes the contribution of the informal economy to GDP on the national level. No regional breakdown is provided.

There are studies, however, that use indirect measurement methods to estimate gross value added (GVA) of the informal sector. For instance, Kakaulina [19] calculated the size of the shadow economy in the Far East of Russia by using the national-level statistical data on the shadow economy in different sectors and transferring the same proportions of the formal and informal economies to the regional-level structure. Nevzorova et al. [20] developed and applied a methodology of spatial data analysis based on the use of Global Moran's I and the size of the non-observed economy in Russian regions. Their assumption was that the non-observed economy retains its sectoral proportions on the regional and national levels.

The second indicator – the share of informal workers – is calculated by Rosstat by using employment-related sample surveys of organizations, entrepreneurs, households and population. This indicator shows the part of the workforce that was employed in the given period at least in one of the production units of the informal economy. Such labour activities can be classified as informal.

In this study, the main indicator characterizing the size of the shadow economy is informal employment. It should be noted that this indicator is not quite common in the studies of the shadow economy (the few studies that use it include [21; 23; 24]).

Informal employment was chosen as the key indicator for this study because it reflects people's willingness to work in the informal sector. Obviously, informal employment does not give us a full picture of the shadow economy since these statistics do not take into account people involved in criminal or illegal activities. Nevertheless, the share of informal workers reflects the proportion and dynamics of the formal and informal economies. Although the share of informal labour is not equal to the size of the shadow economy, it is highly likely that interregional variations in the level of informal employment will correspond to those in the shadow economy. In regions with higher informal employment, the shadow economy can be expected to be larger.

The period that was selected for the analysis of informal unemployment dynamics was from 2007 to 2019, that is, the most recent decade when the structure of the Russian economy was already well-established.

The analysis covered the number of informal workers nationwide and by sector and encompassed all 85 regions of Russia (until 2015 there were 83 regions, that is, excluding the Republic of Crimea and the city of Sevastopol). It should be noted that Rosstat conducts its sample surveys of the workforce in Russian regions once in two years, which is why the data for the given period are provided not for every year but with 2-year intervals.

There is sufficient evidence showing that the key factor that determines the size of the shadow economy is the tax burden. Therefore, analysis of the tax burden in Russian regions was conducted by using the following formula (2):

$$TB_j = \frac{TR_j}{GRP_j} \times 100, \qquad (2)$$

where $TB_j$ is the tax burden in Russian regions, in % of GRP; $TR_j$ is the tax revenue collected in a specific region; $GRP_j$ is the gross regional product of this region.

In order to gain a better understanding of the factors contributing to the growth of the shadow economy in Russian regions, stochastic factor analysis was used to ex-

amine the relationship between the share of informal workers and such factors as the tax burden, GRP per capita, advanced production technologies, innovation activities of organizations, industrial sectors' and social sectors' contribution to GRP. To determine the strength of the relationship between the factors and the resultant indicator, a correlation analysis was conducted to find the linear correlation coefficient.

Afterwards, a cluster analysis was conducted: regions were divided into quartiles depending on their levels of tax burden. For each cluster, correlation analysis was conducted to measure the strength of the relationship between the tax burden and informal employment.

## 4. Results

### 4.1. Analysis of informal employment

The analysis has brought to light a general increase in the number of informal workers, which demonstrated a wavelike fluctuation pattern. As Figure 1 illustrates, the total number of informal workers in the given period grew by 15%.

During the economic crisis of 2008–2009 and the period of stagnation in 2014–2016, the number of informal workers was rising. As the economy started to pick up and there was a growth in output accompanied by increasing demand for labour, there was a fall in informal employment.

A large share in the structure of informal labour in Russia is accounted by trade: 31.1% in 2019. There was, however, a slight drop in comparison with 2007, when trade accounted for 34.1%. In the given period, the share of agriculture in the structure of informal employment also shrank from 32.2% to 16.4%. The reduction in the share of the above-mentioned sectors led to a considerable increase in the shares of other sectors: construction (from 9.0 to 10.7%); manufacturing (from 7.9% to 10.5%); and transport from (6.6% to 10.4%). The shares of other sectors are insignificant.

Figure 2 illustrates the shares of workers in the informal economies of the Russian regions with the highest and lowest rates of informal employment.
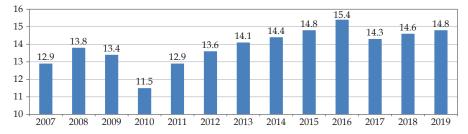


***Figure 1.*** **Dynamics of the number of informal workers in Russia in 2007–2019, mln people**
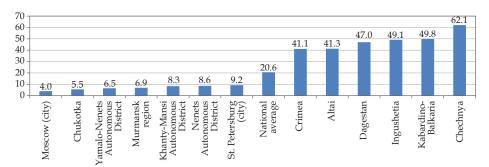Compiled by the author by using Rosstat data (http://www.rosstat.gov.ru)



***Figure 2.*** **The share of workers in the informal economy in Russian regions in 2019, in % of the total number of employees**
Compiled by the author by using the data from: Workforce, Employment and Unemployment in Russia (Based on the Results of Labour Force Surveys). 2020: Statistical Yearbook/Rosstat. Moscow, 2020. P. 162–163.

Capital cities (Moscow, St. Petersburg) and oil-producing regions have the lowest degrees of informality. The highest informal employment is characteristic of the republics in the North Caucasus, and in Chechnya it even exceeds formal employment.

### 4.2. Analysis of the tax burden

The analysis covers all Russian regions for the period of 2007–2019. The regions were ranked in the descending order from the highest to lowest tax burden (Table 1).

Regions with the highest tax burden are located in the north of Western Siberia and specialize in oil and gas extraction. These regions generate considerable added value and their oil and gas enterprises pay the most in taxes. Regions with the lowest tax burden are in the North Caucasus. The economies of these regions are dominated by small enterprises, which cannot pay much in taxes.

Table 1

**Tax burden in Russian regions in 2007–2019, % of GRP**

| Region | 2007 | 2009 | 2012 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|---|
| National average | 24.9 | 19.6 | 24.5 | 23.4 | 23.4 | 23.2 | 24.0 |
| Khanty-Mansi Autonomous District | 53.7 | 45.9 | 62.2 | 62.6 | 63.0 | 63.4 | 74.2 |
| Yamalo-Nenets Autonomous District | 48.5 | 40.7 | 50.2 | 45.9 | 43.8 | 46.5 | 51.6 |
| Orenburg region | 27.6 | 22.0 | 29.0 | 26.0 | 29.9 | 31.9 | 36.7 |
| Tomsk region | 26.9 | 24.8 | 35.0 | 33.1 | 32.6 | 33.5 | 36.4 |
| Kaliningrad region | 23.1 | 21.9 | 29.0 | 30.5 | 25.1 | 28.8 | 35.1 |
| Samara region | 26.1 | 25.3 | 30.2 | 27.8 | 24.4 | 30.8 | 34.5 |
| Nenets Autonomous District | 35.3 | 18.0 | 36.4 | 30.4 | 26.6 | 28.2 | 34.4 |
| Komi Republic | 32.2 | 23.0 | 24.4 | 24.9 | 28.8 | 31.1 | 34.0 |
| Ryazan region | 25.3 | 23.8 | 27.0 | 32.3 | 24.5 | 30.8 | 33.3 |
| Udmurt Republic | 32.6 | 26.3 | 30.1 | 29.4 | 26.6 | 30.5 | 31.7 |
| Republic of Tatarstan | 24.0 | 18.4 | 23.2 | 22.3 | 23.2 | 27.3 | 30.0 |
| Astrakhan region | 24.0 | 17.0 | 22.3 | 17.2 | 21.2 | 27.3 | 29.5 |
| Irkutsk region | 15.4 | 13.2 | 19.8 | 17.8 | 19.8 | 26.8 | 29.2 |
| Leningrad region | 20.2 | 19.3 | 20.3 | 24.8 | 27.1 | 33.5 | 28.7 |
| Perm region | 24.7 | 21.4 | 25.1 | 25.3 | 22.2 | 26.8 | 28.4 |
| Tyumen region | 10.9 | 12.1 | 16.2 | 12.3 | 18.4 | 22.0 | 26.9 |
| Krasnoyarsk region | 20.0 | 14.0 | 22.7 | 23.3 | 21.2 | 24.9 | 26.4 |
| City of St. Petersburg | 25.9 | 20.8 | 19.9 | 22.7 | 22.1 | 28.7 | 25.5 |
| Yaroslavl region | 24.1 | 21.9 | 26.9 | 27.8 | 23.9 | 27.8 | 25.2 |
| Sakhalin region | 13.2 | 16.6 | 12.7 | 14.2 | 31.8 | 18.6 | 24.5 |
| Omsk region | 20.7 | 18.0 | 25.0 | 23.0 | 19.9 | 27.4 | 24.3 |
| Kaluga region | 21.7 | 15.5 | 22.4 | 19.8 | 20.4 | 22.1 | 24.0 |
| Saratov region | 21.9 | 18.7 | 20.7 | 20.5 | 19.9 | 25.1 | 21.7 |
| Respublic of Bashkortostan | 24.1 | 21.8 | 18.8 | 20.3 | 20.2 | 23.9 | 21.6 |
| Moscow region | 21.4 | 20.9 | 21.7 | 21.4 | 20.2 | 22.0 | 21.1 |
| Ulyanovsk region | 18.0 | 13.8 | 14.9 | 14.8 | 16.9 | 22.2 | 20.8 |
| Sakha Republic (Yakutia) | 16.5 | 15.3 | 14.2 | 12.9 | 20.6 | 18.6 | 20.4 |
| City of Moscow | 29.9 | 19.8 | 20.3 | 17.9 | 18.4 | 19.6 | 19.5 |
| Khabarovsk region | 19.8 | 17.5 | 20.1 | 11.3 | 16.2 | 19.1 | 17.9 |
| Nizhny Novgorod region | 20.8 | 17.9 | 19.5 | 18.2 | 18.1 | 21.9 | 17.8 |
| Volgograd region | 20.1 | 18.0 | 16.7 | 17.1 | 16.1 | 20.7 | 17.3 |
| Republic of Adygea | 11.2 | 10.6 | 11.5 | 12.0 | 12.8 | 16.9 | 17.0 |
| Kostroma region | 16.4 | 15.3 | 14.0 | 14.0 | 12.9 | 15.0 | 17.0 |
| Chukotka Autonomous District | 12.3 | 20.7 | 20.5 | 14.6 | 24.2 | 17.1 | 16.4 |
| Arkhangelsk region | 9.0 | 7.9 | 12.5 | 13.6 | 15.8 | 14.8 | 16.3 |
| Republic of Crimea | – | – | – | – | 15.1 | 19.9 | 15.9 |

End of Table 1

| Region | 2007 | 2009 | 2012 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|---|
| Chelyabinsk region | 16.8 | 10.4 | 15.3 | 15.0 | 14.9 | 15.8 | 15.9 |
| Chuvash Republic | 18.3 | 15.6 | 15.0 | 15.5 | 14.4 | 15.8 | 15.8 |
| Vladimir region | 18.3 | 17.6 | 16.4 | 15.8 | 15.9 | 17.1 | 15.8 |
| Krasnodar region | 18.0 | 15.4 | 13.6 | 12.4 | 13.3 | 15.2 | 15.4 |
| Tver region | 17.3 | 16.3 | 16.9 | 16.0 | 15.9 | 16.1 | 15.4 |
| Sverdlovsk region | 18.2 | 14.4 | 14.8 | 13.9 | 13.4 | 14.7 | 15.1 |
| Stavropol region | 17.3 | 15.6 | 14.8 | 14.5 | 11.3 | 14.7 | 15.0 |
| Smolensk region | 18.4 | 15.1 | 14.1 | 15.2 | 17.4 | 15.6 | 14.6 |
| Altai region | 12.1 | 11.2 | 13.9 | 13.4 | 13.0 | 15.5 | 14.4 |
| Republic of Altai | 25.9 | 13.9 | 14.3 | 14.1 | 14.2 | 14.4 | 14.3 |
| Kamchatka region | 17.4 | 13.8 | 16.2 | 16.0 | 15.4 | 15.6 | 14.2 |
| Rostov region | 15.6 | 14.9 | 15.8 | 15.6 | 14.2 | 15.2 | 14.0 |
| Novosibirsk region | 21.1 | 19.6 | 17.4 | 16.3 | 13.9 | 15.1 | 14.0 |
| Mari El Republic | 16.4 | 14.4 | 12.2 | 11.6 | 10.6 | 15.4 | 14.0 |
| Vologda region | 19.7 | 13.1 | 12.4 | 11.6 | 11.7 | 13.9 | 13.9 |
| Kirov region | 16.2 | 14.7 | 16.1 | 16.0 | 14.8 | 14.6 | 13.6 |
| Republic of Mordovia | 20.9 | 13.3 | 15.9 | 15.5 | 18.0 | 18.7 | 13.6 |
| Bryansk region | 16.0 | 18.6 | 18.9 | 15.2 | 12.6 | 14.4 | 13.6 |
| Kursk region | 16.3 | 12.4 | 14.7 | 14.7 | 13.7 | 14.6 | 13.5 |
| Ivanovo region | 16.0 | 15.4 | 17.1 | 15.9 | 13.7 | 15.6 | 13.4 |
| Kurgan region | 14.4 | 11.2 | 13.4 | 11.8 | 12.3 | 14.4 | 13.3 |
| City of Sevastopol | – | – | – | – | 19.4 | 19.7 | 13.2 |
| Republic of Karelia | 12.3 | 10.7 | 14.0 | 11.3 | 11.3 | 10.5 | 13.2 |
| Belgorod region | 17.3 | 10.7 | 12.1 | 10.9 | 10.1 | 11.6 | 13.0 |
| Voronezh region | 14.5 | 11.9 | 11.4 | 11.7 | 9.8 | 11.3 | 12.8 |
| Tula region | 14.4 | 12.8 | 12.6 | 13.1 | 11.9 | 11.5 | 12.7 |
| Republic of Buryatia | 14.7 | 14.9 | 13.0 | 11.9 | 13.3 | 13.6 | 12.7 |
| Kemerovo region | 18.6 | 13.2 | 14.1 | 12.7 | 12.7 | 14.5 | 12.4 |
| Primorye region | 16.2 | 12.7 | 12.7 | 12.9 | 11.9 | 13.0 | 12.4 |
| Zabaikalye region | 14.2 | 13.8 | 12.2 | 12.0 | 13.0 | 11.5 | 12.2 |
| Pskov region | 14.8 | 13.6 | 13.6 | 13.8 | 11.8 | 12.5 | 12.2 |
| Penza region | 15.4 | 14.6 | 13.4 | 12.7 | 10.9 | 14.0 | 12.2 |
| Novgorod region | 13.0 | 14.3 | 12.8 | 12.2 | 9.6 | 10.4 | 11.8 |
| Jewish Autonomous Region | 10.5 | 10.0 | 9.4 | 12.8 | 9.9 | 11.4 | 11.5 |
| Lipetsk region | 13.0 | 9.4 | 8.3 | 8.9 | 10.3 | 8.7 | 10.4 |
| Murmansk region | 19.5 | 17.0 | 16.1 | 16.2 | 15.6 | 17.7 | 10.4 |
| Orel region | 15.7 | 14.5 | 13.1 | 11.8 | 10.0 | 11.8 | 10.2 |
| Republic of Kalmykia | 28.3 | 16.3 | 15.9 | 10.6 | 7.9 | 11.4 | 10.1 |
| Karachay-Cherkess Republic | 11.2 | 8.7 | 9.5 | 10.6 | 11.4 | 13.7 | 9.8 |
| Republic of Tyva | 9.7 | 9.8 | 8.6 | 9.2 | 9.7 | 10.2 | 9.3 |
| Tambov region | 11.8 | 10.4 | 8.7 | 8.3 | 9.4 | 9.7 | 9.0 |
| Republic of Khakassia | 12.4 | 11.4 | 10.1 | 8.2 | 10.0 | 10.8 | 9.0 |
| Kabardino-Balkarian Republic | 11.7 | 11.6 | 8.3 | 9.0 | 12.8 | 9.4 | 8.8 |
| Magadan region | 17.1 | 14.5 | 16.7 | 11.2 | 13.0 | 8.6 | 8.7 |
| Republic of North Ossetia-Alania | 14.6 | 9.2 | 8.5 | 8.7 | 8.8 | 13.8 | 8.6 |
| Chechen Republic | 21.3 | 15.9 | 10.2 | 9.9 | 8.2 | 7.5 | 6.9 |
| Republic of Ingushetia | 5.6 | 7.5 | 6.9 | 6.3 | 7.3 | 7.7 | 6.7 |
| Republic of Dagestan | 6.7 | 5.5 | 5.7 | 5.3 | 4.8 | 5.6 | 6.3 |
| Amur region | 14.1 | 15.7 | 13.9 | 15.6 | 14.1 | 8.5 | 4.8 |

The table is compiled by the author by using the data from Rosstat (http://www.rosstat.gov.ru) and the Federal Tax Service (http://www.nalog.ru)

### 4.3. Analysis of the tax burden and informal employment

Comparison of the levels of tax burden and informal employment in Russian regions has shown a moderate inverse correlation between these indicators. Regions with a low tax burden usually have higher rates of informal employment and vice versa, regions where a large part of the generated added value is transferred to the budget via taxes have a low level of informality.

Figure 3 compares the tax burden and informal employment in the Russian regions with the lowest and highest levels of tax burden in 2019.

Most of the Russian regions with the lowest tax burden are located in the North Caucasus and in the south (including the majority of national republics). These are the regions whose economies are dominated by such sectors as agriculture and trade, that is, the sectors where enterprises pay the lowest in tax. These are also the regions with high degrees of informality, which is also characteristic of the abovementioned sectors.

On the other hand, the regions that have major industrial taxpayers have lower levels of informal employment, which can be explained by the fact that large companies do not normally support informal employment.

These data disprove the opinion that a high tax burden drives companies to move into the shadows. Russian regions with a low tax burden also have higher informal employment while in regions with a high tax burden informal employment is, on the contrary, smaller.

In the case of the latter, an extra incentive for companies to formalize could be the desire to gain access to better institutional conditions for doing business. In other words, a higher tax burden creates higher tax revenues, which are used by regional governments to create a more favourable business environment. In regions where tax funds are scarce, governments simply cannot afford to invest enough in the economic infrastructure. As a result, businesses try to compensate for the deficient infrastructure by shifting their activities to the informal sector and thus gaining cost advantage by avoiding taxes.

Not all regions demonstrate a strong relationship between the tax burden and informal employment in the given period. As Table 2 illustrates (see below), in 2007–2019, the average correlation coefficient between the given indicators was –0.3736, which points to a modest correlation.



*Figure 3.* **Tax burden and the share of informal workers in Russian regions in 2019**

Compiled by the author by using the data from Rosstat (http://www.rosstat.gov.ru) and from the Federal Tax Service of Russia (http://www.nalog.ru)

### 4.4. Correlation analysis

As a result of cluster analysis, the Russian regions were divided into four quartiles. The first quartile comprises the regions whose tax burden in 2019 did not exceed 12.4% of GRP. These regions display a strong relationship between the tax burden and informal employment (–0.5214 in 2019). Regions of the fourth quartile had a tax burden of 24.3% or higher; they had a noticeably strong correlation between the indicators in question (–0.4152 in 2019). In the third and fourth clusters, the correlation was moderate. The first and second quartiles included regions with the highest level of informal employment while those with the lowest informal employment were in the third and fourth quartiles. Regions of the first and fourth quartiles were less sensitive to the changes in informal employment caused by the changing tax burden than regions of the second quartile. The coefficient of the correlation of the dynamics in these indicators in 2007–2019 was below 0.5 for the first quartile, which signifies stable informal employment rates in the regions with the lowest tax burden.

To demonstrate the extent of the shadow economy's dependence on other factor unrelated to the tax burden, a correlation analysis was conducted to study the relationship between informal employment and other macro-economic indicators influencing economic and social processes in regions (Table 2).

The correlation analysis detected an inverse correlation between GRP per capita and informal employment. Figure 4 shows the data for the regions with the highest and lowest GRP per capita.

The regions with the highest GRP are mostly those with the highest tax burden and, on the contrary, the regions with the lowest GRP tend to have the lowest tax burden. The reasons why these lists overlap are also similar: regions with higher taxes are usually those whose economies are dominated by the sectors with high labour productivity; enterprises in such sectors usually pay more in taxes but they are also more productive because they can afford to use high-tech solutions and benefit from better institutional conditions, created through increased public spending, with funds for the latter coming mainly from tax collections. In regions with few high productivity jobs, legal employment is replaced by informal employment, including the jobs which do not require higher-level professional qualifications.

The correlation between GRP per capita and informal employment in Russian regions is moderate: in 2019 the correlation coefficient was –0.4208. After the regions were clustered according to their

Table 2

**Coefficients of the correlation between the share of informal workers and economic indicators of Russian regions in 2007–2019**

| Indicator | 2007 | 2009 | 2012 | 2013 | 2015 | 2017 | 2019 | Mean value |
|---|---|---|---|---|---|---|---|---|
| Tax burden | –0.3010 | –0.3066 | –0.3907 | –0.3375 | –0.3778 | –0.4744 | –0.4274 | –0.3736 |
| GRP per capita | –0.4505 | –0.3879 | –0.4325 | –0.3931 | –0.4399 | –0.4246 | –0.4208 | –0.4213 |
| Use of advanced production technologies | –0.2077 | –0.3481 | –0.4585 | –0.3941 | –0.4663 | –0.5188 | –0.4837 | –0.4110 |
| Innovation | –0.0647 | –0.2378 | –0.2948 | –0.1188 | –0.3443 | –0.3557 | –0.4067 | –0.2604 |
| Contribution of the industrial sectors to GRP | –0.4652 | –0.5719 | –0.4826 | –0.4610 | –0.5355 | –0.5388 | –0.5198 | –0.5107 |
| Contribution of the social sectors in GRP | 0.3157 | 0.4665 | 0.4426 | 0.4571 | 0.5820 | 0.6320 | 0.5890 | 0.4978 |

The table was compiled by the author by using the data from Rosstat (http://www.rosstat.gov.ru) and the Federal Tax Service (http://www.nalog.ru)

GRP per capita, a rise in the strength of the correlation was detected for the first quartile, which includes regions with low labour productivity. In this group there is a strong inverse correlation: in 2019 the correlation coefficient was –0.7401. In the other quartiles the correlation relationship was weak or moderate. It should be noted that the majority of regions with high informality are in the first quartile; most regions with low informality are in the fourth quartile.
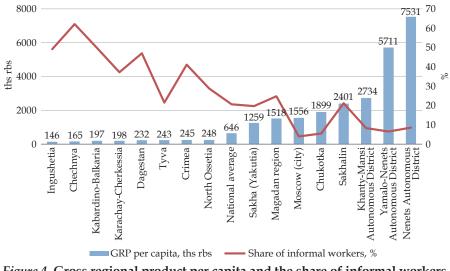
Regions in the first quartile also demonstrate a strong relationship between the dynamics of the given indicators in 2007–2019: the growth in per capita GRP lead to a proportionate fall in informal employment. Similarly, a decline in GRP correlated with an increase in informal employment. In the other clusters, such relationship was observed much less often, which means that low labour productivity, the use of low-tech equipment and the prevalence of small businesses, which are more prone to employ workers informally, are the conditions that contribute to the growth of the shadow economy. On the contrary, an increase in labour productivity in regions with larger shadow economies helps reduce the level of informality.

### 4.5. Analysis of the impact of innovation

Most of the research shows that informality holds back innovation (see, for example, [15–18]). The inverse relationship is also true: innovation is a factor constraining the expansion of shadow economic activities and employment. Thus, it makes sense to use as a point of departure the assumption that active innovation takes economic relations to a new level where the costs of illegal economic activities exceed their benefits.

Drawing on his extensive fieldwork, Hernando de Soto described this phenomenon as the "cost of illegality". This cost becomes more tangible for organizations implementing innovations. The most significant difference between the owner of an informal business and his or her colleague in the formal sector is the enormous costs the former has to pay to avoid getting caught.

Shadow business suffers from the lack of capital not only because it has very little access to loans but also because the use of certain equipment makes this business more conspicuous. These businesses cannot openly advertise their goods and services and they tend to rely heavily on reputation and word of mouth. To avoid penalties, these businesses have to spend



***Figure 4.*** **Gross regional product per capita and the share of informal workers in Russian regions in 2019**

Compiled by the author by using Rosstat data (http://www.rosstat.gov.ru)

a lot on bribes – the surveyed representatives of shadow enterprises stated that they spend from 10% to 15% of their gross profits on bribes and commissions while legal entrepreneurs spend on the same purpose 1% or even less. Shadow business is tied to low-technology and low productivity manufacturing. Moreover, an informal entrepreneur is an inconvenient contractual partner: their customers have to pay VAT but cannot subtract the expenditures on intermediate goods purchased from informal suppliers [32, p. 159–164].

Factor analysis of the relationship between informal employment and innovation was based on such indicators as the number of advanced technologies used per capita and the level of innovation activities of organizations.

In regions where the number of advanced technologies is small (they are shown in the left part of Figure 5), informal employment is higher than in regions where new technologies are actively implemented (shown in the right part of Figure 5). The correlation analysis has revealed a moderate inverse correlation between these indicators. A significant strength of the correlation was observed in 2017, when the correlation coefficient was –0.5188.

The level of innovation is calculated in percentage as a ratio of the number of organizations engaging in innovation to the total number of organizations. Innovation activity of organizations is inversely related to the level of informal employment. The strength of this relationship, however, is lower than of the relationship between informal employment and advanced production technologies. The highest correlation coefficient value was in 2019 –0.4067 (Figure 6).

The regions were clustered according to their tech intensity and innovation activity levels. However, for individual clusters the strength of the relationship between the shadow economy and innovation did not exceed the strength shown by the correlation analysis for the whole sample of Russian regions.

### 4.6. Analysis of the impact of the regions' economic structure

The structure of the regional economy is considered as one of the factors affecting the size of the shadow economy. The hypothesis is that in regions whose economies are dominated by industrial enterprises, the shadow economy should be lower since industrial enterprises are usually large-scale businesses and for them it is harder to engage in informal activities.
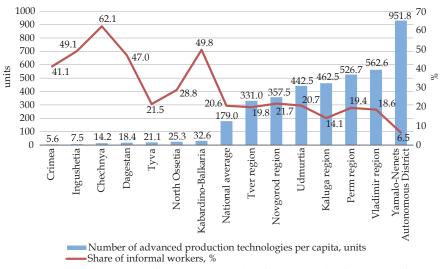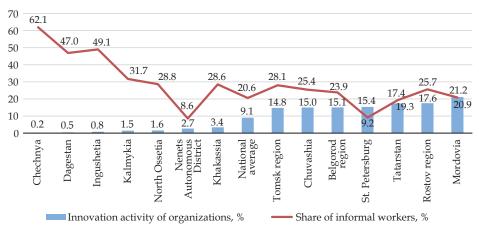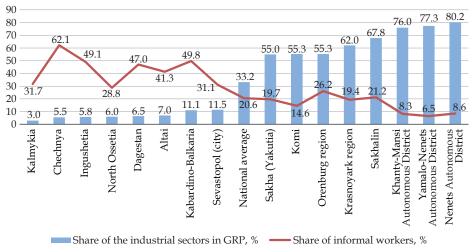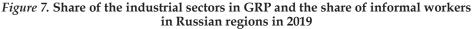


*Figure 5.* **The number of advanced production technologies per capita and the share of workers in the informal sector in Russian regions in 2019**

Compiled by the author by using Rosstat data (http://www.rosstat.gov.ru)

Figure 7 shows the regions with the smallest and largest share of industrial sectors in their GRPs. I found a noticeable inverse correlation between informal employment and the share of industrial sectors in Russian regions (in 2019, the correlation coefficient was –0.5198). In the southern regions and regions of the North Caucasus, low industrial output correlates with high informality while in regions where industries are thriving and in regions specializing on mineral extraction, the level of informal employment is comparatively low.

Clustering of regions by the share of industrial sectors has revealed the strongest inverse relationship between informal employment and the share of industry in the first quartile, which includes the regions with the lowest manufacturing output (the correlation coefficient in 2019 was –0.5748), and in the fourth quartile, regions with the highest output (the correlation coefficient, –0.5783). The majority of regions with the highest levels of informal employment belong to the first quartile.

If we compare the dynamics in the given indicators in 2007–2019, we will



**Figure 6. Innovation and the share of informal workers in Russian regions in 2019**
Compiled by the author by using Rosstat data (http://www.rosstat.gov.ru)



*Figure 7.* **Share of the industrial sectors in GRP and the share of informal workers in Russian regions in 2019**
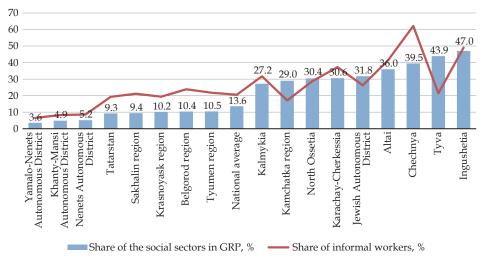Compiled by the author by using Rosstat data (http://www.rosstat.gov.ru)

see that the majority of Russian regions displayed an inverse correlation between industrial output and informal employment. An increase in the contribution of the industrial sectors to GRP was accompanied by a decline in the share of informal workers. When the share of industry in GDP shrank, informal employment started to rise. Based on the above, it can be concluded that a bigger share of industrial sectors in a regional economy contributes to the shrinking of the shadow economy.
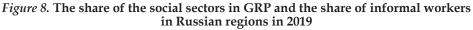
According to the initial hypothesis, the prevalence of social sectors in a regional economy, on the contrary, should correlate with a larger shadow economy. The social sectors are understood here as non-industrial types of activity such as healthcare, education, social services, social welfare, culture, sport, leisure and entertainment, and public administration. Organizations in these spheres are usually publicly or municipally owned, which reduces the chances that they will engage in informal labor relationships.

Figure 8 shows the Russian regions with the smallest and largest contributions of the social sectors to GRP. The correlation analysis has brought to light the direct relationship between the size of the social sectors and informal employment:

the larger is the contribution of the social sectors to GRP, the larger is the share of informal workers in the region's employment structure (in 2019, the correlation coefficient was 0.5890).

Clustering of regions by the share of the social sectors has revealed the strongest relationship between the given indicators in the first quartile – regions with the smallest share of the social sectors (in 2019 the correlation coefficient was 0.5605) – and in the fourth quartile where the share of the social sectors was the largest (the correlation coefficient, 0.4409).

In my view, the connection between higher informality and the prevalence of the social sectors in these regions is not straightforward: organizations in the social sphere as such do not contribute to informal employment, what matters is the low productivity of labour and the small share of industrial production. A considerable share of the value added generated in the social sectors signifies that the industrial production in these regions is poorly developed. Most of the value added consists of the wages of state-paid workers and civil servants and not of the profits of enterprises or wages of their staff, as is typical of economically developed regions.



*Figure 8.* **The share of the social sectors in GRP and the share of informal workers in Russian regions in 2019**
Compiled by the author by using Rosstat data (http://www.rosstat.gov.ru)

Lagging regions tend to have bloated shadow economies since their inadequate economic infrastructure provides little incentive for businesses to move out of the shadow. In these conditions, organizations and entrepreneurs cannot gain full advantage of formality and they are trying to reduce or eliminate some of the costs associated with formal sector operations.

### 4.7. Characteristics of the regions with higher informality

There is a set of characteristics that go hand in hand with higher informality and thus form what can be referred to as the "profile" of a Russian regional shadow economy. These characteristics include the following:

- a low tax burden;
- GRP per capita several times below the national average;
- the number of advanced production technologies per capita significantly lower than in other regions;
- local organizations less willing to innovate than in other regions;
- insignificant industrial output;
- large share of the social sectors in the structure of GRP.

These characteristics apply to regions with high informal employment: Chechnya, Ingushetia and Dagestan, Ivanovo region and Stavropol region. In regions with low levels of informal employment (Tatarstan, the Yamalo-Nenets Autonomous District, Leningrad region), the situation is the opposite. In these regions the indicators are higher or lower than the national average (Figure 9).

In many regions, the change in the level of informal employment correlates with changes in the economic indicators. Figure 9 shows the regions where in 2007–2019 informal employment was falling: the Jewish Autonomous Region, Republic of Tyva, Republic of Adygea, and Ryazan region. In this period, the tax burden in these regions grew, innovation processes intensified, the contribution of the industrial sectors to GRP rose while that of the social sectors declined. The regions with the growing rates of informal employment (North Ossetia, Stavropol region, Chechnya, Chelyabinsk region) saw the opposite economic trends.



***Figure 9.*** **The share of informal workers in Russian regions in 2007–2019, in percentage of the total number of employees**
Compiled by the author by using Rosstat data (http://www.rosstat.gov.ru)

## 5. Conclusions

Most of the hypotheses regarding the impact of different factors on the shadow economy formulated at the beginning of the article have been confirmed. The only hypothesis that was refuted was the supposition that a low shadow economy should be characteristic of the regions where a considerable part of the value added is generated by the social sectors.

In contrast to the commonly held opinion that a higher tax burden correlates with a bloated shadow economy, in Russia, regions with a higher tax burden have more favourable institutional conditions, which stimulate economic development and make companies willing to pay more in taxes. As the tax revenues begin to increase, the regional governments start spending more on the infrastructure which only formal businesses can benefit from.

Apart from the tax burden, other factors influencing the shadow economy include the level of innovation activity in regions. Organizations that actively implement innovative technologies, buy high-tech equipment and so on and whose sources of funding include borrowed capital are less inclined to engage in shadow activities. Businesses that are less willing to formalize are usually those that use outdated equipment. This means that another factor contributing to informality is low labour productivity measured as GRP per capita. Low labour productivity is associated with the use of obsolete technologies and old equipment.

The structure of regional economy also influences the level of informal employment: as a rule, informality is more widely spread in regions with a less developed industrial base because it is more difficult for large industrial enterprises to employ workers informally. A significant share of the social sectors in the structure of GRP points to the region's lagging economic development and, as a result, the high level of informal employment.

These research findings can be used by government agencies for analysis of regional economies and for the development of regional economic policies aimed at encouraging formalization and reducing the shadow economy.

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