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An Evaluation of the State of the Top-Priority and Socially Important Industries of Russian Regions: an Analysis Based on Digital Tax Calculator Data

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Abstract. The paper uses the data of digital tax burden calculator of Russia's Federal Tax Service to study the determinants of the total tax burden and average salary on the example of St. Petersburg for year 2020 with enterprises broken down by size and types of economic activity and with the focus on top-priority and socially important industries. Therefore, this study aims to provide a mathematical substantiation for the need to improve state support measures provided for top-priority or socially important types of activities in the region using taxation means and methods. The objectives set were achieved using simulation modeling. The dependent variables that characterize the state support of the top-priority and socially important types of activities are the rate of tax burden (excluding mineral tax and excise taxes) and the size of the average salary. Moreover, two analyses were conducted sequentially to achieve the objectives. The first was a two-way analysis of variance of the relationship between the average salary and the size of the organization or industry as well as the dependence of tax burden on the same factors. The second was a one-way analysis of the variance of the tax burden and average salary depending on different types of activities as well as the scale of the enterprise. The results of the one-way analysis were refined through regression methods based on dummy variables. It was observed that there were no considerable differences between the average salary and total tax burden in top-priority or socially important sectors compared to the other industries in the economy. The trend was the evidence of insufficient support provided by the state and the need to introduce additional preferences.

Keywords: Digital tax calculator; Priority industry; Socially important industry; Tax burden

1. Introduction

Sustainable development of territories is the problem with many aspects (Zaborovskaya, Kudryavtseva, and Zhogova, 2019), which depend on the conditions in various regions (Shestak, Shcheka, and Klochkov, 2020; Skripnuk, 2020), including their industry specifics (Gamidullaeva *et al.*, 2022; Rodionov, Konnikov, and Konnikova, 2018). Advancements in digital technologies (Victorova *et al.*, 2021; Rytova *et al.*, 2020) are observed to be significantly transforming the set of tools used for the sustainable development of regions (Kudryavtseva, Skhvediani, and Berawi, 2020). Meanwhile, the crises and global challenges (Borisov and Popova, 2022; Pinskaya, Steshenko, and Kermen,

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2021) are affecting the initial objective and method to achieve the development (Leksin and Porfiryev, 2017). This shows the need to determine the appropriate methods of improving the state policy aimed at the developing any given territory. An example of relevant policy implemented is the stimulation of the top-priority or socially important industries in a region through public-private partnerships (Berawi *et al.*, 2021). However, the measurement of the effectiveness of the support requires selecting relevant indicators and assessment criteria.

The success of regional socioeconomic development depends on a variety of factors. These include tax burden and average salary, which signal the economic capabilities of the territory and its population for implementing social projects and meeting social needs. It is generally believed that an increase in tax burden worsens the possibility of socioeconomic development while a higher average salary provides a positive influence.

In order to substantiate the stated position, the findings of modern publications concerning 1) tax burden as an indicator of state regulation and 2) average salary to represent the success of economic entities in a top-priority or socially important sector of the economy are briefly reviewed and summarized.

1) Scientific studies have been discussing various aspects of tax burden since the early 20th century. In the 1970s, scholars started to profoundly compare the tax burden in different countries. This was observed in the application of GDP (Karagianni, Pempetzoglou, and Saraidaris, 2012; Jedrzejowicz, Kiss, and Jirsakova, 2009) and different types of effective rates (Celikay, 2020; Shevlin, Shivakumar, and Urcan, 2019) as indicators. Meanwhile, the average effective rates are determined in taxing many factors such as capital, consumption, labor, and others (Wu, Wang, and Peng, 2024). The general idea is to determine the ratio of the calculated taxes to the taxation base and a specific methodology is devised to select the data for the numerator and denominator (Nicodeme, 2007; Carey and Rabesona, 2003). Similarly, the tax burned is also estimated for territories inside the country (Dang, Fang, and He, 2019).

Few studies were observed to have considered tax burden as a measure of possibilities of business in a region such as Latin America (Hallerberg, and Scartascini, 2017), Russia (Victorova *et al.*, 2020), and other countries (Celikay, 2020; Park, 2020; Jedrzejowicz, Kiss, and Jirsakova, 2009; Nicodeme, 2007). Only a few publications compared industry-specific taxation of different businesses (Rota-Graziosi, and Sawadogo, 2022; Carey and Tchilinguirian, 2000) while other studies frequently focused on discussing the factors of production rather than a specific industry (Karminskaya and Islamutdinov, 2021) or the situation of a specific company (Pan, Huang, and Jin, 2024; Berawi *et al.*, 2022). This leads to the conclusion that there is no comprehensive study on the problems related to tax burden.

2) Another indicator of the socioeconomic development of a region is the average salary size which has also been widely covered in many publications by economists. The review of relevant literature showed two areas considered quite problematic. Firstly, the analysis and assessment of the impact of average monthly salary on the socioeconomic development of a territory as a whole, and second, the effect on the development of top-priority or socially important types of activities in the territory.

The study by Karminskaya and Islamutdinov (2021) can be referred as an example of the first group of research. The scholars focused on econometric analysis of the impact of human capital, specifically in higher and vocational education, on the economic development of a region. The results showed that a higher average monthly salary was one of the key factors of the development. The concept has also been proposed to represent the competitiveness of a territory. For example, Shavandina *et al.* (2021) discussed the context

in RF municipalities while Wojtasiak-Terech and Majerowska (2019) analyzed the Polish case using taxonomic methods and suggested a composite competitive indicator for each province.

An example of the second group of research is Volkov *et al.* (2022) which proposes to increase the average salary indicator in the context of attracting young personnel in the agro-industrial complex of a region. Cantillo *et al.* (2022) also showed the effect of salary on the jobs selected based on manpower in the formal or informal sector of the economy in the Caribbean region of Columbia. The scholars concluded conclude that the attractiveness of a formal job depended directly on the pay raise in this sector to a level not less than the minimum wage in the region.

The average salary of formal employees was found to be part of the factors affecting the development of franchising in Brazilian towns (Melo *et al.*, 2021). This was confirmed through a simulation conducted using a multiple regression method to prove the connection between the analyzed indicators.

Junusbekov *et al.* (2020) made an important conclusion concerning the change in the form of labor remuneration in Kazakhstan using a statistical analysis to determine the data dynamics of average salary in all regions of the country. Chinese scholars, Liu *et al.* (2021), also provided a non-conventional and quite interesting observation in the process of discussing the problem of market diversification in regions with private foreign subsidiaries. The results showed that average salary was an influential but insignificant parameter on Tobin's Q.

The summary showed that several scientists have focused on indicators such as the size of tax burden and average salary to assess the impact of the state regulating function on the development of a region as a whole and concerning the top-priority or socially important industries. However, there was no comprehensive approach to apply these two indicators for assessment in contemporary studies. Therefore, the goal of this study was to analyze and evaluate the effect of the state policy on top-priority or socially important types of activities in a region using official digital resource data. It was also used to provide recommendations on the improvement of state support measures for the identified economic sectors using tax methods. Two hypotheses were formulated and the first was that tax burden and the average salary were influenced by the type of enterprise (its size) operating in the top-priority or socially important sectors of the region. The second was to confirm the impact on similar indicators of the industry specifics.

2. Methods

The study was conducted using tax burden calculator data obtained from the RF Federal Tax Service. This source is normally used to calculate the tax burden for organizations based on the percentage of the earnings and the average salary. The four measurements often used include the tax period, region in Russia, industry, and scale of activity. Therefore, the simulation was conducted using some factors characterizing the state support for top-priority or socially important types of activity as the dependent variables. These include tax burden, excluding those related to mineral and excise, and the level as well as the average salary and the size.

1. Tax period selection: The data covered up to the date of the study using those available for 2018, 2019, and 2020.
2. Region selection: The region selected is St. Petersburg which is a federal city in Russia. The preference for the region at the initial stage was due to the status as the home to enterprises engaging in a wide range of activities and producing socially significant products, works, and services. It was also selected due to the presence of legally

established priorities for the development of certain sectors of the economy considered significant for both the region and the country as a whole with a focus on the year 2020.

3. Industry selection: The activities classified as top-priority or socially important in the economic sectors of regions in Russia. Some have been listed in scientific literature but those identified in St. Petersburg legislation include the production of food, clothing, machinery, and equipment not otherwise classified, manufacture of other vehicles and equipment, erection of buildings, specialized construction works, information technology, employment and recruitment, as well as health care. The preference for socially important activities was due to their critical importance in providing basic human needs. Moreover, top-priority activities were selected for this study based on the St. Petersburg legislation and these include others not listed among socially important ones.
4. Scale of activity differentiation: The types of enterprises considered independently included micro-enterprise (revenue up to 30 million rubles), micro-enterprise (revenue from 30 to 120 million rubles), small business (revenue from 120 to 500 million rubles), small business (revenue from 500 to 800 million rubles), medium-sized enterprise (revenue from 800 to 2000 million rubles), and large enterprise (over 2000 million rubles). When the results were described, the scale of activity was characterized based on earnings. This indicator was used in the Tax Calculator Database and was also considered in the tax burden. Therefore, the differentiation of the business based on the size of revenue was specifically suitable for this study. After an observation with gaps had been excluded, a dataset of 63 observations was considered to be used.

The aim and hypotheses designed led to the conduct of this study based on three subsequent stages. The first was a two-factor dispersion analysis of the dependence of the average salary on the size of an organization and the industry, as well as the tax burden on the same factors. Meanwhile, the second was a one-factor dispersion analysis of the dependence of the tax burden and average salary on different types of activity as well as enterprise size. The third was focused on refining the one-way dispersion analysis results using regression methods and dummy categorical variables designed for each factor through the R language in the Rstudio integrated development environment.

3. Results and Discussion

The summary of the results for the two-factor dispersion analysis is presented in this section. Those related to average salary are presented in Figure 1 while those for total tax burden are in Figure 2.

```
> summary(aov(`Average salary, rubles a month`~Type+Industry,data=y))
             Df    Sum Sq   Mean Sq F value   Pr(>F)
Type          5 2.640e+10 5.280e+09  31.431 6.52e-14 ***
Industry     10 6.374e+09 6.374e+08   3.795  0.00085 ***
Residuals    47 7.895e+09 1.680e+08
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 1 Average salary response

```
> summary(aov( Total tax burden response (excluding mineral tax and excises) ~Type+Industry,data=y))
             Df  Sum Sq  Mean Sq F value   Pr(>F)
Type          5 0.00250 0.000500   1.199    0.324
Industry     10 0.03331 0.003331   7.987 2.41e-07 ***
Residuals    47 0.01960 0.000417
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 2 Tax burden response

The first model showed a significant difference in the average salary for the two factors under consideration based on Fisher's criterion but only found in the first factor for the second model. The two-way analysis of variance also confirmed the existence of a statistical difference in average wages and tax burden for the observed groups with different types of enterprises and activities. Moreover, significant differences were also identified in the average tax burden but only based on the type of activity.

One-way analysis of variance results for the tax burden related to the "type of activity" factor are presented in Figures 3 and 5. It was observed that the type of activity affected the average value of the cumulative load with a significance level of < 0.001. One-factor dispersion analysis results for the average salary on the “type of activity” factor are presented in Figures 4 and 6.

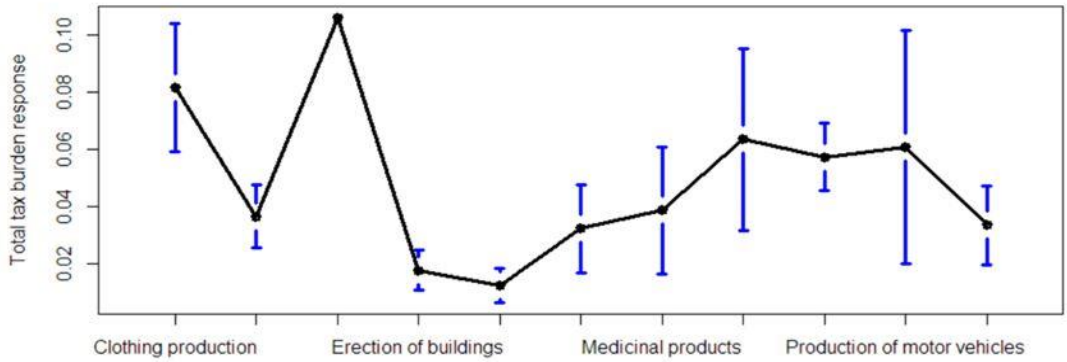

Figure 3 Assessed marginal means for tax burden based on industry

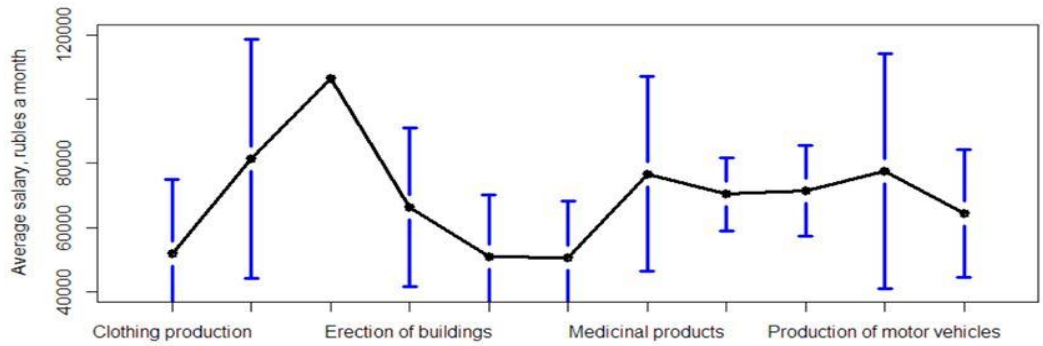

Figure 4 Assessed marginal averages for average salary based on industry

```
> M01<-aov(`Total tax burden response (excluding mineral tax and excises)`~Industry,data=y)
> summary(M01)
            Df  Sum Sq  Mean Sq F value   Pr(>F)
Industry    10 0.03236 0.003236     7.3 4.44e-07 ***
Residuals   52 0.02306 0.000443
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 5 Criteria for intergroup effects of tax burden based on industry

```
> M02<-aov(`Average salary, rubles a month`~Industry,data=y)
> summary(M02)
            Df    Sum Sq   Mean Sq F value Pr(>F)
Industry    10 9.326e+09 932632513   1.547   0.15
Residuals   52 3.134e+10 602734028
```

Figure 6 Criteria for intergroup effects of average salary based on industry

The results of a one-way analysis of variance for the tax burden on the "enterprise scale" factor are presented in Figures 7 and 9. It was observed that the statistical hypothesis about the difference in the average response value depending on the analyzed factor.

The results of the one-factor dispersion analysis for tax burden on the “type of activity” factor are presented in Figures 8 and 10. It was discovered there were no statistically significant differences in the average value of the tax burden.

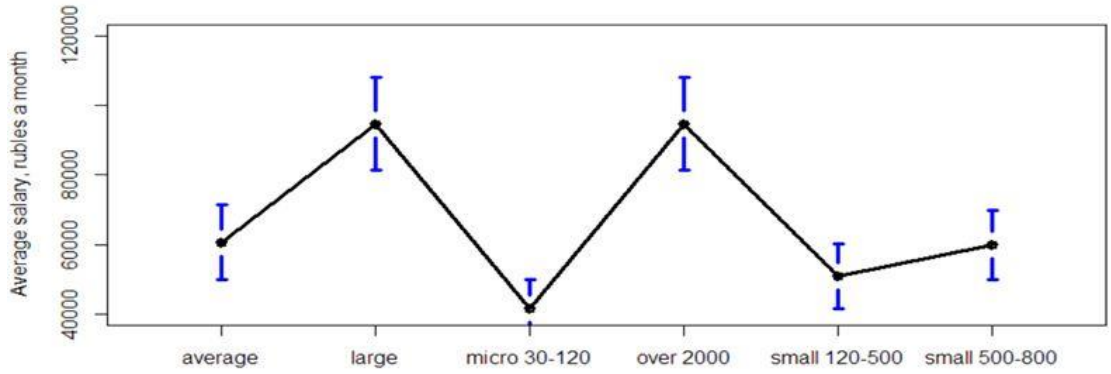

Figure 7 Assessed marginal averages of average salary based on enterprise size

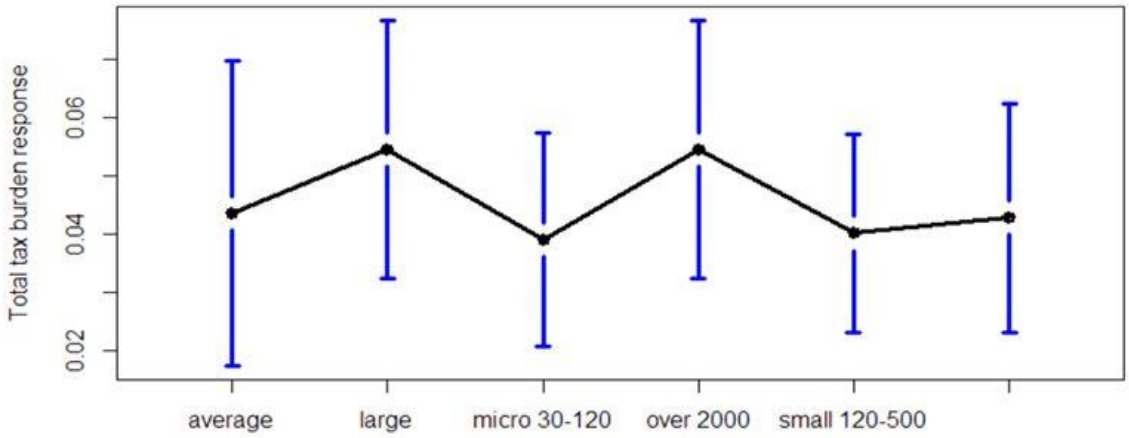

Figure 8 Assessed marginal averages of tax burden based on enterprise size

```
> MO3<-aov(`Average salary, rubles a month`~Type,data=y)
> summary(MO3)
             Df    Sum Sq   Mean Sq F value   Pr(>F)
Type          5 2.640e+10 5.280e+09   21.09 7.14e-12 ***
Residuals    57 1.427e+10 2.503e+08
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 9 Criteria for intergroup effects for average salary based on the scale of activity

```
> MO4<-aov(`Total tax burden response (excluding mineral tax and excises)`~Type,data=y)
> summary(MO4)
             Df  Sum Sq   Mean Sq F value Pr(>F)
Type          5 0.00250 0.0005002   0.539  0.746
Residuals    57 0.05292 0.0009284
```

Figure 10 Criteria for intergroup effects for tax burden based on the scale of activity

The summary of the results obtained from a one-way analysis of variance is presented in the following Table 1. The presence of the factor effect was represented by yes while the absence was stated as no.

Table 1 Results of one-way analyses of variance

Factor	Response	
	Average Salary	Tax burden
Scale of activity (Type)	Yes/yes	No/no
Type of activity (Industry)	No/no	Yes/yes

The hypotheses were further analyzed to solve the problems of nonparametric analysis of variance using the Kruskal-Walli's test and the results were presented in the table through the "/" sign. The consistency observed in the results as well as the assumptions on the normal law of response distribution according to the Shapiro-Wilk test for the first, second, and fourth models were used to confirm the conclusions provided.

The table showed that the average salary value was predetermined by the scale of the enterprise while the tax burden for top priority or socially significant areas of activity depended on the specific type of activity. However, there were no significant differences in wages based on the type of activity and in total tax burden based on the type of enterprise. This showed the provision of insufficient state support primarily required by small and medium-sized enterprises.

The third stage focused on using regression analysis and dummy variables to investigate the changes in average response level in line with the level of the factors for the two scenarios. The results showed significant differences in the average response values depending on the scale of the enterprise as well as in tax burden based on the type of activity. This was due to the fact that the variance and regression analyses were special cases of a linear stochastic model. Moreover, the values generated for the dummy variables represented the contrast of each factor level with the base. It was also observed that the variables were only in the unit values in the generated encoding scheme. Therefore, the coefficients in the regression model were used to show the main effect of the corresponding level on the base. The results obtained from the multiple linear regression model of the dependence of average wages on the scale of the enterprise are summarized in the following Figure 11.

```
> RM1<-lm(`Average salary, rubles a month`~Type,data=y)
> summary(RM1)

Call:
lm(formula = `Average salary, rubles a month` ~ Type, data = y)

Residuals:
   Min     1Q Median     3Q    Max
-29217 -11546  -1741  11840  29918

Coefficients:
                  Estimate Std. Error t value Pr(>|t|)
(Intercept)        60567.3     4770.5  12.696  < 2e-16 ***
Typelarge          34194.7     6913.1   4.946 7.03e-06 ***
Typemicro 30-120  -19106.4     6746.5  -2.832  0.00638 **
Typeover 2000      34200.7     6913.1   4.947 7.01e-06 ***
Typesmall 120-500  -9730.9     6746.5  -1.442  0.15467
Typesmall 500-800   -714.3     6913.1  -0.103  0.91807
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 15820 on 57 degrees of freedom
Multiple R-squared:  0.6491,    Adjusted R-squared:  0.6184
F-statistic: 21.09 on 5 and 57 DF,  p-value: 7.135e-12

> shapiro.test(resid(RM1))

        Shapiro-Wilk normality test

data:  resid(RM1)
W = 0.96792, p-value = 0.09912
```

Figure 11 Summary of the response of the average wage based on the scale of the enterprise

The "Average" enterprise type was used as the base level through alphabetical ordering. Therefore, the average salary level for the enterprise was recorded to be 60,567

rubles while those considered to be large had 34,195 rubles. This showed that the average was 94,760 rubles and the lowest level was observed among microenterprises. The results further showed that four out of the six coefficients in the model were significantly different from zero. Moreover, the good quality of the model was supported by the value of the coefficient of determination, the Fisher's criterion, as well as confirmation of the normal distribution of residuals according to the Shapiro test.

The summary of the tax burden response to the type of activity is presented in Figure 12. The results showed that clothing production was adopted as the base level and the tax burden was 8%. Therefore, the lowest was found in food production with 0.08 + 0.07 = 0.15 which was approximately 15%. The quality of the model was also confirmed by the value of the corresponding metrics and the results of the tests conducted on the hypotheses based on the normal distribution of residuals according to the Shapiro test.

```
Call:
lm(formula = `Total tax burden response (excluding mineral tax and excises)` ~
    Industry, data = y)

Residuals:
      Min        1Q    Median        3Q       Max
-0.046400 -0.011533  0.001000  0.008075  0.052933

Coefficients:
                                                Estimate Std. Error t value Pr(>|t|)
(Intercept)                                     0.081750   0.007445  10.981 3.72e-15 ***
IndustryConstruction of engineering structures -0.045383   0.011372  -3.991 0.000207 ***
Industrydrinks production                       0.024350   0.022334   1.090 0.280620
IndustryErection of buildings                  -0.064117   0.011372  -5.638 7.13e-07 ***
IndustryFood production                        -0.069433   0.011372  -6.106 1.31e-07 ***
IndustryLand and pipeline transport activities -0.049533   0.011372  -4.356 6.25e-05 ***
IndustryMedicinal products                     -0.043150   0.011372  -3.794 0.000388 ***
IndustryOther vehicles and equipment           -0.018283   0.011372  -1.608 0.113941
IndustryProduction of machinery and equipment  -0.024350   0.011372  -2.141 0.036961 *
IndustryProduction of motor vehicles           -0.020950   0.011372  -1.842 0.071141 .
IndustrySpecialized construction works         -0.048350   0.011372  -4.252 8.84e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.02106 on 52 degrees of freedom
Multiple R-squared:  0.584,     Adjusted R-squared:  0.504
F-statistic:   7.3 on 10 and 52 DF,  p-value: 4.438e-07


        Shapiro-Wilk normality test

data:  resid(RM4)
W = 0.97028, p-value = 0.131
```

Figure 12 Summary of the response to the tax burden based on the type of activity

An increase in average salaries based on the scale of business was substantiated by the financial capabilities of enterprises. This showed that the earnings from sales of products, services, and works as well as the type of activity could increase the financial potential of an enterprise in covering all expenses necessary for statutory activity, including wages. Moreover, official salaries tended to grow when insurance premiums were designed for the types of activities considered important for the state. For example, the IT field has an insurance premium rate incentive of 7.6% compared to the usual 30% for other categories of payers. The reduction in the insurance premium burden was also observed to have converted all wages into official turnover.

The lack of significant differences between the salary and total tax burden of top-priority or socially important economic sectors compared to the other sectors shows that the support being provided by the state is insufficient and additional tax preferences should be introduced. It is specifically proposed that the rate of insurance premiums be reduced and the income tax paid by employees be reimbursed, in line with the method applied for enterprises in the IT sector. The changes are expected to affect all the IT companies in every region of the country. Therefore, the list of top-priority or socially important types of economic activity is required to be selected carefully.

The effectiveness of using only tax instruments as support for the sector by the state compared to other forms of incentives is considered debatable. For example, Iranian scientists (Ghazinoory and Hashemi, 2020) proved that direct government financing of high-tech firms, specifically those related to small and medium-sized businesses, was more effective than tax incentives. Meanwhile, Chinese scholars (Wang, Yuan, and Xu, 2022) also analyzed the impact of government subsidies and preferential tax policies on mobile phone recycling activities and concluded that tax incentives led to an increase in production and profits. The variation in these results shows the need for a more in-depth on the impact of both tax and other government support instruments on the development of top-priority or socially significant sectors of the economy in the region.

4. Conclusions

In conclusion, the hypotheses formulated were only confirmed partially and this was observed from the first hypothesis which was true only for the average salary in the region which was affected by the size of the enterprise. The second hypothesis was also confirmed for only one of the analyzed indicators which was observed from the dependence of tax burden on industry specifics. However, the limitations of the study included the lack of special tax regimes for IT companies, the specifics of St. Petersburg as a region of Russia, and the regional structure of the country as a whole. The digital calculator of tax burden provided the data used in formulating well-reasoned recommendations on the improvement of state support measures for the top-priority or socially important types of activities. Moreover, tax methods were used based on the assessment and analysis of the effects of the state policy on the development of the selected economic sectors. Future study on St. Petersburg can be continued in the context of longer time horizons. It is also recommended that a similar study be extrapolated to other Russian regions and territorial entities of different countries. Furthermore, the methodological approach described in this study can be applied to other Russian regions and territories of foreign states. The purpose of these individual scientific studies is to provide detailed substantiation and concretization of proposals for tax innovations in top-priority or socially important sectors of a territorial entity.

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