Reflection of digital transformation on tax burden

Natalia Victorova1*, Natalia Pokrovskaia2, Yevgeniy Yevstigneev3
1 Peter the Great St.Petersburg Polytechnic University, Politechnicheskaya st., 29, St. Petersburg, 195251, Russia
2 Saint Petersburg State University, Universitetskaya nab., 7-9, St. Petersburg, 199034, Russia
3 Peter the Great St.Petersburg Polytechnic University, Politechnicheskaya st., 29, St. Petersburg, 195251, Russia

*Email: viktorova_ng@spbstu.ru

Abstract. The paper is aimed at discussing an important problem - the taxation mechanism which is not used sufficiently today to develop the digital economy in a given country. The tax regime is analyzed as a whole. In addition, indirect and direct taxation are looked into for two groups of countries: frontrunners and adopters. The countries were distributed into groups taking into account the data of Global Connectivity Index 2018. It is shown that the tax burden differs in the groups of countries that have different pace of digital transformation. Moreover, the tax burden in the frontrunner countries is higher than it is in the adopter countries. The adopters demonstrate a steady downward trend. In the adopter countries, the tax burden of direct income taxes imposed on business is lower than in the frontrunner countries, while the burden of indirect taxes is higher. In dynamics, the burden of indirect taxes grew in most countries of both groups. However, the largest increase in indirect taxes is typical for the adopters. Changes in the burden of direct taxes businesses have to pay in the adopter countries are less uniform. This may be caused by different approaches that are used to stimulate digital transformation: using tax instruments or providing direct government support. According to the study, the need for reforming profit taxation in Russia is substantiated in order to enhance the stimulating effects of digitalization. The assessment of the nexuses between digital transformation and individual taxation parameters is of great interest.

Keywords: digital economy, tax burden, indirect taxes, direct taxes.

1. Introduction

Historically, in most countries around the world taxes have been a key instrument of state regulation and budget replenishment. Currently, despite the observed global changes (in the economic policies of many countries), tax revenues still fulfill a fiscal function. Thanks to this function, the material base is formed, which is necessary for developing the state, financing defense and law enforcement expenses, and creating a social protection system for the population. In addition, the existing tax system has a significant impact on the functioning of the real sector of the economy, and also stimulates entrepreneurship [1].

Both of these tax functions are important when countries transit to digital relationships, on the one hand, to finance the digitization of government processes, and on the other hand, to develop and implement advanced technologies involved in this process. However, the question is: what happens to
the tax burden when technical and economic social paradigms are changing? Does it decrease or increase due to the transformation of objects and conditions of taxation, changes in the mentality of tax inspectors and taxpayers? Which countries (and in what way) are more susceptible to digital adjustment - those with a high or low tax burden? Which taxes are more likely to influence the ongoing changes - direct or indirect ones? These and other questions are now important in practice and in the theory of taxation, so approaches and guidelines should be developed. Some important issues of taxation will be considered in this article, taking into account the authors’ experience and vision.

2. Literature review
There are a lot of works devoted to the analysis of various problems directly or indirectly related to the state economy and taxes, such as: globalization of the business environment [2], change in the behavioral paradigm of taxpayers [3], differentiation of individuals' taxation on a territorial and other basis [4-6] and some others. There are also publications that propose tools for addressing these issues [7-10].

However, in the context of this study, we are more interested in the works devoted directly to tax burden issues, both on the micro and macro levels. For example, papers [11-12] discuss approaches to reducing the tax burden in specific tax situations. In works [13-14], the tax burden is analyzed for a particular sector of the state economy. In the first case, the study is about US households, in the second one - organizations of different sizes in Ethiopia. The problems of optimal taxation are highlighted in papers [15–16]. A comparative analysis of the tax burden redundancy in Russia and the USA was carried out in work [17]. Tools that ensure the stability of the tax system are described in the paper by Konnikov et al [18].

Some interesting results are obtained in other scientific studies. Thus, Dang et al [19] proved in their paper the existence of a direct link between the economic policy the country pursues and the tax burden. Liu et al [20] analyzed the impact of corruption in the government bodies on the size of the tax burden and its structure. Kakaulina et al [21], based on the concept of the Laffer curve, examined the relationship between three factors: economic development, the presence of the shadow component, and the size of the tax burden. The study shows that underestimation of the illegal sector of the economy negatively affects tax revenues. As a result of the analysis of the tax burden in EU countries, another scientist (Bâzgan) [22] concluded that the value of this indicator has the opposite effect on economic growth and the country’s budget balance. Paper [23] proves that with a high level of tax burden and state social expenditures per capita, the mortality rates at middle age are lower.

As the result of literature review, a conclusion can be made on a diverse range of issues, a never-ending discussion concerning indicator of the tax burden, which seems to be historically formed. However, taking into account the realities of digitalization of social relations, our scientific interest is somewhat different from the common beliefs. This research study is aimed at finding out about what influence the transformations taking place in different countries have on the heaviness of taxation.

In order to achieve the goal of the research, the groups of countries characterized by similar processes of digital transformation have to be identified, the total tax burden in these countries must be analyzed, the same as the importance of direct and indirect taxes paid by companies. The processes of digital transformation in Russia are of particular interest to the authors, therefore, it is also proposed to come up with recommendations for the development of taxation in Russia, which contributes to its accelerated digital development, based on the analysis of the relationship between digital transformation and the tax burden.

3. Methods

3.1. Digital Transformation Assessment
The first stage of the research methodology is to determine the indicators of the countries’ digital development.
There are several rankings measuring digitalization of countries. In particular, the World Bank used the 2014 and 2016 data to form the Digital Adoption Index (DAI), which includes three sub-indices. Each sub-index is formed on a subjective basis - for business, people, government - and evaluates the technologies necessary for their development in the digital era. The index reflects the increasing productivity and accelerating general growth for business, expanding opportunities and improving wellbeing of the population, increase in the effectiveness and accountability of services provided for the government. The index is compiled for more than 180 countries of the world.

The European Commission calculates the Digital Economy and Society Index (DESI) for the countries of the European Union. It is a comprehensive index that summarizes digital indicators for European countries and tracks the evolution of EU member countries in the field of digital competitiveness. The index has been calculated since 2013 and is regularly updated. The main obstacle to the wide use of this index for cross-country comparisons is its focus on the countries of the European Union with only fragmented addition of other countries’ examples.

In the authors’ opinion, the Global Connectivity Index (GCI) developed by the company Huawei is most consistent with the purpose of the study, that is, assessment of tax transformation. The GCI Index was created to analyze a wide range of indicators for information and communication technology infrastructure and digital transformation. The index is aimed at forming a fairly complete map of the global digital economy. For the first time, the index was compiled according to 2014 data for 79 countries, which together account for 95% of the global GDP. The advantage of assessing changes in the position of an individual country in the ranking is the high stability of the number of countries included in the index. The GCI evaluates the digital transformation from basic communication levels to advanced technologies in 5 areas: broadband communication, data centers, cloud services, Big Data and the Internet of Things; the index is calculated by 40 indicators. According to the results of the calculated index, three groups of countries are distinguished: frontrunners, adopters and starters. Starters are countries with less than 35 points. In the 2018 ranking, this group includes 40 out of 97 countries. The group of adopters includes countries with more than 35 but less than 56 points. In 2018, there are 37 countries in this group. The smallest group - frontrunners - includes 20 countries with more than 56 points. Despite the fact that the index characterizes the transformation, the affiliation of countries to groups is quite stable and hardly varies by years in the ranking.

To achieve the goal of the study, the differences were analyzed in the tax burden of the countries included in the groups of frontrunners and adopters according to the 2018 ranking. The group of frontrunners includes the USA (78 points), Singapore (75), Sweden (73), Switzerland (71), the UK (70), Finland (68), Denmark (68), the Netherlands (67), Norway (65), Japan (65), the Republic of Korea (64), Australia (64), Luxembourg (63), Germany (63), New Zealand (62), Ireland (62), Canada (62), Belgium (61), France (61), Austria (60). The group of adopters includes countries with more than 35 but less than 56 points. In 2018, there are 37 countries in this group. The smallest group - frontrunners - includes 20 countries with more than 56 points. Despite the fact that the index characterizes the transformation, the affiliation of countries to groups is quite stable and hardly varies by years in the ranking.

3.2. Tax burden assessment
The list of the countries, which were selected at the first stage of the methodology, sets the limits for the data source of the second stage of analysis. The authors could not limit themselves to very detailed data on the tax systems of the European Union or the OECD, but chose the data on the Government Finance Statistics of the International Monetary Fund (IMF). The following indicators were included in the analysis: (1) the total tax burden, calculated as taxes and obligatory payments of the social insurance system, paid to the state consolidated budget and state extra-budgetary funds, in relation to GDP, (2) the burden of direct taxes on corporate profits, calculated as revenues from taxes on income,
profits and capital gains of a business (indicator “taxes on income, profits, & capital gains: corporations”) in relation to GDP; (3) the burden of indirect taxes, calculated as revenues from taxes on goods and services (indicator “taxes on goods & services”) in relation to GDP. The analysis was based on 2017 data (the tax burden for China, Mexico and the Philippines is calculated for 2016 according to the latest data available at the time of analysis). The dynamics of these indicators over five years were also considered (in 2017 compared to 2012).

The IMF government financial statistics database does not contain tax burden data for the following countries from the group of adopters: Argentina, Bahrain, Kuwait, Malaysia, Oman, Saudi Arabia, Uruguay. Thus, 20 countries of the group of frontrunners and 30 countries of the group of adopters are included in the final sample. The IMF’s database on state financial statistics provides incomplete data for some countries; these cases are considered individually when the results are discussed.

3.3. Research Hypotheses
At the final stage of the research methodology, the hypotheses are formulated. Based on the authors' assumptions about the nexus between the tax burden and digital development, the following research hypotheses were formulated:

Hypothesis 1: groups of countries that differ by the pace of digital transformation, have differences in the tax burden. Thus, the authors suggest that taxation reflects digitalization processes.

Hypothesis 2: due to the need for state targeted stimulation of digitalization, including direct financial support of top priority areas, the tax burden for the adopters will be higher than for the frontrunners.

Hypothesis 3: since tax instruments are widely used in stimulating digital transformation, the tax burden of direct taxes on corporate profits will be lower for the adopters than for the frontrunners; and the burden of indirect taxes - on the contrary, will be higher so that enough financial resources can be formed by the country.

4. Results and Discussion
The results of descriptive statistics of the total tax burden in 2017 showed some differences between the analyzed groups of countries (Table 1). Due to incomplete data of the IMF database on state financial statistics, the analysis did not include the burden of direct taxes on corporate profits and the burden of indirect taxes in Canada (frontrunners), the Philippines (adopters), the burden of direct taxes on corporate profits in Chile (adopters).

**Table 1.** Descriptive statistics of the tax burden depending on the processes of digital transformation by groups of countries in 2017

| Indicator                      | Total tax burden | Tax burden of direct taxes on corporate profits | Tax burden of indirect taxes |
|--------------------------------|------------------|-----------------------------------------------|-----------------------------|
|                                | F               | A                | F               | A                | F               | A                |
| Group of countries             |                 |                  |                 |                  |                 |                  |
| Mean value, in %               | 26.95           | 20.67            | 3.57            | 2.79             | 9.95            | 11.89            |
| Standard error, in %           | 1.65            | 0.86             | 0.25            | 0.21             | 0.72            | 0.64             |
| Median, in %                   | 27.29           | 20.70            | 3.07            | 2.43             | 10.61           | 11.67            |
| Standard deviation, in %       | 7.39            | 4.71             | 1.07            | 1.13             | 3.15            | 3.43             |
| Sample variance, in %          | 54.68           | 22.22            | 1.15            | 1.29             | 9.92            | 11.79            |
| Kurtosis                       | 1.63            | -0.83            | -0.92           | -0.23            | -0.73           | 0.21             |
| Asymmetry                      | 0.97            | 0.04             | 0.44            | 0.65             | -0.50           | -0.6             |
| Interval, in %                 | 31.28           | 17.53            | 3.74            | 4.37             | 10.45           | 15.36            |
| Minimum, in %                  | 14.83           | 11.71            | 1.73            | 0.98             | 4.08            | 4.03             |
| Maximum, in %                  | 46.10           | 29.23            | 5.47            | 5.35             | 14.52           | 19.39            |
Thus, the first hypothesis was proven conclusively: there are differences in the tax burden between the groups of countries with different levels of digital transformation. Moreover, these differences are also inherent in the burden of direct taxes on corporate profits, and indirect taxes.

However, the total tax burden is on average lower for the adopters than for the frontrunners. At the same time, the tax burden is less variable for the adopters, which may mean that the trends similar in the current tax policy. The tax burden for a sample of countries is shown in Fig. 1.

![Fig. 1. The total tax burden for the frontrunners and adopters in 2017, in%.

The results of the study do not support the second hypothesis: the tax burden turned out to be lower for the adopters, not for the frontrunners.

In order to investigate the revealed correlations in the dynamics, we analyzed the growth of the total tax burden, the burden of direct taxes on corporate profits and the burden of indirect taxes for the groups of countries in 2017 in comparison with 2012. The results are presented in Table 2. Due to the incomplete data of the IMF database on the state financial statistics, the analysis does not include the following: dynamics of the indirect tax burden in Colombia, Serbia and Chile (adopters); dynamics of the burden of direct taxes on corporate profits in Serbia (adopters).

| Table 2. Distribution of changes in the tax burden depending on the digital transformation by groups of countries in 2017 compared to 2012 |
|---------------------------------------------------------------|
| Indicator | Total tax burden | Burden of direct taxes on corporate profits | Burden of indirect taxes |
| Groups of countries | F | A | F | A | F | A |
| Number of observations (countries), pcs. | 20 | 29 | 19 | 28 | 19 | 26 |
| Number of countries where the burden increased, pcs. | 17 | 16 | 10 | 19 | 16 | 16 |
| Number of countries where the burden reduced, pcs. | 3 | 13 | 9 | 9 | 3 | 10 |
The analysis of tax burden changes over 5 years since 2012 shows less homogeneous results in the groups than in the values considered for 2017. The total tax burden has a more clear downward trend in the adopter countries. This is expressed both in the share of countries in which the burden decreased, and in the magnitude of this decline. The biggest reduction in tax burden is observed in the following adopter countries - the United Arab Emirates (-48%), Peru (-23%), Kazakhstan (-14%), Romania (-14%), the Russian Federation (-14%). For the frontrunner countries, the largest reductions in the total tax burden are observed in Ireland (-19%) and Norway (-11%).

Thus, the tax burden is lower in the adopter countries compared to the frontrunners, while the tax burden in these countries decreased more significantly over the 5 years that were analyzed.

The third hypothesis was generally proven: the burden of direct corporate taxes is lower in the adopter countries compared to the frontrunners (the average value for the group in 2017 is 3.6% and 2.8% of GDP, respectively), and the burden of indirect taxes, on the contrary, is higher in the adopter countries compared to the frontrunners (the average value for the group in 2017 is 9.9% and 11.9% of GDP, respectively).

However, the dynamic analysis of the individual taxes burden does not provide very clear results. The burden of indirect taxes grew in most countries of both groups, but the largest increase in indirect taxes is typical for the adopters (Mexico - 91%, Greece - 81%, Hungary - 64%). The share of countries in which the indirect tax burden decreased is also greater in the group of adopters, but the absolute value of this decrease is higher in the group of frontrunners.

With a larger share of countries where the burden of direct taxes on corporate profits grew, the group of adopters is characterized by more polar changes comparing to the group of frontrunners (Table 3).

**Table 3.** The groups of countries with the largest changes in the burden of direct taxes on corporate profits (2017 compared to 2012)

| Group of countries | Frontrunners | Adopters |
|--------------------|--------------|----------|
| Share of countries where the burden increased | 85% 55% 53% 68% 84% 62% | Share of countries where the burden decreased | 15% 45% 47% 32% 16% 38% |
| Number of countries where the burden reduced by over 10%, pcs. | 3 4 1 10 11 12 | Number of countries where the burden reduced by over 10%, pcs. | 2 5 1 4 3 7 |
| Number of countries where the burden has increased by over 10%, pcs. | 15 20 17 14 2 7 | Number of countries where the burden changed insignificantly (by less than 10%), pcs. | 15% 45% 47% 32% 16% 27% |
| The biggest growth of tax burden in the group, % | 18 37 21 39 56 91 | The biggest reduction of tax burden in the group, % | -19 -48 -18 -52 -50 -41 |

**Source:** calculated by authors.

**Note:** F – frontrunners, A – adopters.
Countries in which the burden increased by over 10%

| Country            | Percentage |
|--------------------|------------|
| Japan              | 21%        |
| Mexico             | 39%        |
| Russian Federation | 15%        |
| Kazakhstan         | 15%        |
| Ukraine            | 15%        |
| Greece             | 13%        |
| Thailand           | 12%        |
| Spain              | 12%        |
| Slovakia           | 11%        |
| Croatia            | 11%        |
| Chile              | 10%        |

Countries in which the burden reduced by over 10%

| Country                  | Percentage |
|--------------------------|------------|
| Ireland                  | -18%       |
| People's Republic of China | -12%     |
| Peru                     | -19%       |
| Romania                  | -22%       |
| United Arab Emirates     | -52%       |

Source: calculated by authors

We assume that such polar changes in the burden of direct taxes on corporate profits are associated with different national approaches to the ratio of the fiscal and regulatory functions of tax on corporate profits. It is likely that reducing the tax burden on corporate profits involves stimulating digital transformation using tax methods, and increasing the burden has fiscal objectives of providing further direct government support to digitalization processes.

As for the prospects of Russia, it should be recognized that an increase in the rate of value added tax (the key indirect tax in Russia) in 2019 from 18% to 20%, corresponds to the practice of increasing the burden of indirect taxes in most adopter countries. Moreover, the fiscal effect of these measures may provide the basis for reducing the burden of the corporate profits tax. The specific directions of changing the procedure for collecting corporate profits tax in Russia, which can create incentives for a more dynamic digital transformation, taking into account the best practices of the frontrunners and adopters, must be studied in addition.

As part of the discussion of the research results, it is important to note that our methodology involved the use of the tax burden indicators, which were widely accepted in previous works [11–16]. The tax burden was estimated as the ratio of individual taxes or their totality to the selected effective indicator. However, we should consider the existence of indirect costs for taxpayer associated with the calculation and settlement of tax payments, and for the state – those associated with administration. We believe that such indicators should also be taken into account when determining the level of taxation in a given country.

5. Conclusions

The study proved that the change in technical and economic social paradigms finds its way in taxation. An analysis of the tax burden by groups of countries characterized by similar processes of digital transformation (groups of frontrunners and adopters) allowed us to make the following conclusions:

1. There are differences in the tax burden between the groups of countries;
2. The tax burden of the frontrunner countries is higher than the tax burden of the adopter countries;
3. The tax burden of the adopters dynamically decreases with smaller changes in the tax burden of the frontrunners;
4. The tax burden of direct taxes on corporate profits in the adopter countries is lower than in the frontrunner countries;
5. The tax burden of indirect taxes in adopter countries is higher than in frontrunner countries;
6. The burden of indirect taxes grew in most countries belonging to both groups. However, the largest increase in indirect taxes is typical for the adopter countries;
7. The dynamic changes in the burden of direct corporate taxes in the adopter countries are quite polar: either the burden reduces (which may be typical when the digital transformation is stimulated by tax methods) or grows (probably due to the fiscal goals for further direct government support of the digitalization processes).

The directions of further research may be a detailed analysis of the reasons for the change in the burden of direct taxes on corporate profits in adopter countries, and an assessment of the nexuses between digital transformation and individual indicators of the national tax systems.
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