

An impact of AI on the Russian labor market

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In recent decades, we have seen rapid development in the field of artificial intelligence (AI). And in recent years, this is largely due to the development of machine learning methods and the availability of huge amounts of data. Artificial intelligence, or machine learning, refers to algorithms that learn to perform tasks by identifying statistical patterns in data and not following instructions provided by humans. This technology has recently achieved superhuman performance in a wide range of economically valuable tasks. And it is fair to expect that this growth will only increase [7], but at the same time, people still do not know its scale and the final result. And yet, even the most negative outcome with the subordination of a person to superintelligence can be avoided.

It is assumed [16] that in this case we can create an AI based on new principles, the main one of which will be ambiguity in human preferences, which the AI should correspond to. In this case, AI would be modest, altruistic and aimed at achieving human goals, not its own. Returning to the present, it is fair to expect that AI algorithms, like any new technology, will transform the labor market. This means that we can expect changes in the relative requirements for professions [8], an increase in productivity and the overall standard of living. Understanding these implications is important for many purposes. For example, it allows government agencies to develop appropriate policies in the field of education and the labor market, and also helps individuals to make the right career choices.

It would be logical to assume that the introduction of such technologies will primarily endanger the existence of professions based on cyclic procedures and algorithms. This is true and can already be noticed for such professions as: salesman, driver or machinist (there is already an unmanned metro in different cities of the world), courier and warehouse logistics worker, bank employee accepting loan applications, call center operator. AI algorithms are also being actively implemented in medicine [14] to identify diagnoses, select patient treatment and develop medicines. The influence is noticeable both in business [15] and finance. A striking example: Sberbank. The overwhelming number of loan applications is handled by the AI algorithm. The credit histories of clients, income and cost levels are studied. In addition to the advantages in speed of execution and accuracy in comparison with a person, it is also possible to note the procedure of online financing.

Based on transaction information, the client's credit history and other data, the AI calculates when the client needs financing and offers him the necessary amount in advance. But with all this, the company currently does not have the issue of completely replacing a person with AI algorithms, since the AI algorithm will not be able to make a correct forecast for companies that have recently started their activities and is powerless to predict the future of projects of companies that have undergone the reorganization or merger procedure.

This transformation of the labor market can provide both a future without work [18] and an increase in labor productivity and people's work experience [10]. Thus, at the moment, according to the available studies, it can be stated that the existing data are not exhaustive. And there is still no systematic evidence of whether there has really been a significant increase in the adoption of AI algorithms, which is often claimed by the media. After all, you can find examples of how AI

technologies either replace workers or complement them, because AI algorithms, as a technological platform, are able to do both. Nevertheless, the speed of implementation of AI algorithms is uneven, and the number of jobs affected by AI depends on the level of availability of high-tech industries and branches of large companies in a particular location [5].

Research on the impact of AI algorithms, rather than automation in general, began to appear relatively recently and their number is constantly growing along with research in other areas of automation. This paper studies the introduction of artificial intelligence algorithms in Russia and their impact on the labor market. The idea is that the introduction of AI can be partially classified by the traces it leaves in firms, considering hiring employees specializing in activities related to AI algorithms, for example, machine translation or image recognition. To implement this idea, a data set on AI activity at the firm level was created, based on online job advertisements in HeadHunter containing detailed skill requirements for vacancies.

Considering data at the firm level is also useful for understanding how automation in general affects the production process and productivity [11]. According to French data, the introduction of robots at the firm level coincides with a decrease in the share of labor, an increase in added value and productivity, as well as a decrease in the share of production workers [2]. Overall employment is growing faster in firms implementing robots. This positive effect may be a consequence of the redistribution of production and labor in favor of firms that reduce their costs compared to their competitors. This redistribution explains the positive impact of robots at the firm level.

Thus, automation replaces the tasks previously performed by labor with capital, reducing the share of labor in value added and increasing the added value per employee in the process. While higher productivity due to automation, as a rule, increases the demand for labor, its displacement effect may outweigh this positive impact and may lead to an overall decrease in employment and wages [3].

Our work pretty much echoes another work by Acemoglu et al. [1], which examines the impact of AI algorithms at the level of firms in the United States from 2010 to 2018. It similarly states that firms whose task structure allows the use of AI algorithms have significantly increased the number of vacancies associated with them. It is also found that the impact of AI algorithms is associated with significant changes in the skill set of professions corresponding to vacancies, and that the introduction of AI has a real impact on the number of jobs not related to AI, allowing firms to replace some tasks previously performed by employees, making certain skills redundant, while creating demand for new skills. Of interest is the verification of these conclusions for Russian data.

The theoretical section describes an extension of the model used in the article by Acemoglu et al. [1], distinguishing firms by industry. It consists in the fact that the same AI algorithms will have different performance in different industries. The assumption about the dependence of the performance of algorithms on the industry in which they are implemented is quite intuitive.

Firstly, this is due to the different scales of application. The larger the scale of AI application, the more data and hardware performance requirements algorithms will impose and the harder it will be to improve their performance. For example, a chatbot created for a store or a chain of stores will, all other things being equal, have a greater potential performance compared to a chatbot for a large bank. The reason for this is precisely the scale of the application: in the bank, with its variety and complexity of the services provided, the complexity and variety of requests sent by customers to the chatbot will be much greater.

Secondly, the use of the same technology in different industries may differ in its specifics. For example, the technology of the biometric key is used by both smartphone manufacturers, as well as banks and military-industrial complexes. However, it is quite obvious that in the first case, the developers' efforts are aimed at maximum simplification (cheapening) of the algorithm, which is accompanied by a decrease in its accuracy. At the same time, the development of biometric key technology in banks or military complexes focuses exclusively on security, i.e. accuracy. Even if neural network technology is used in both cases, then at least the hyperparameters of such algorithms will differ, which means that the performance may be different.

Thirdly, various stochastic elements in the production process. Some industries face production shocks much less often than others, which allows them to collect less noisy data, which will also inevitably affect the operation of many algorithms.

Further, the article is organized as follows: section 1 presents a theoretical model that motivates our empirical strategy. Section 2 describes the data, and section 3 presents the empirical strategy itself. Section 4 presents the main results on the impact of AI on hiring at the firm level. The last section presents conclusions and conclusions. Empirical results and graphs are presented in the Appendix.