DYNAMICS OF INNOVATORS AND CONSERVATIVES
IN ECONOMIC DEVELOPMENT OF EUROPEAN UNION AND RUSSIA

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The purpose of the study *is to determine the influence of the effects of 'creative destruction' and 'combinatorial augmentation' on the emergence of innovators and innovative dynamics of the economy. An analysis of this effect is carried out in the European Union and Russia.*

Methodological basis of the study. *The neo-Schumpeterian theory of competition between innovators and conservatives, which is expressed in the manifestation of two effects of 'creative destruction' and 'combinatorial augmentation' is the methodological basis of the study. By 'creative destruction' is meant the distraction of agents from old Schumpeter combinations, the transformation of conservatives into innovators, and the effect of 'combinatorial augmentation' means the creation of a new labor resource for new combinations is the training of innovators. Using econometric models, taking into account statistical verification, based on empirical data, the laws of changing the shares and rates of distraction and resource creation are selected (the assessment is given by the labor resource) that affect the appearance of innovators. With the help of normative changes of the obtained empirical laws of diversion and resource creation, the possible influence of the effects of 'creative destruction' and 'combinatorial augmentation' on the dynamics of GDP in the European Union and Russia is established, based on the relationship between product dynamics and innovator dynamics for a specific time interval.*

Research result. *The Russian economy, unlike the European Union, demonstrates a conservative model of innovation dynamics and economic growth. Both the combinatorial effect and the creative destruction in Russia are weakly expressed, which is associated with the blocking of conditions for innovative development, for the European Union these effects are more influential. Thus, as the main conclusion, if the nature of resource diversion changes, the rate of economic growth can be increased on average, although expanding the training of innovators does not give an average growth rate for a given period of time both in Russia and in the European Union; types of activities.*

Key words: *innovations; innovators; conservatives; 'creative destruction'; 'combinatorial augmentation'; GDP dynamics; the rate of diversion and resource creation; a comparative analysis of the European Union and Russia.*

ДИНАМИКА ИННОВАТОРОВ И КОНСЕРВАТОРОВ В ЭКОНОМИЧЕСКОМ РАЗВИТИИ ЕВРОПЕЙСКОГО СОЮЗА И РОССИИ

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Целью исследования является определение влияния эффектов «созидательного разрушения» и «комбинаторного наращения» на появление новаторов и инновационную динамику экономики. Анализ такого влияния проводится по Европейскому союзу и России.

Методологическую основу исследования составляет неошумпетерианская теория конкуренции новаторов и консерваторов, которая выражается в проявлении двух эффектов «созидательного разрушения» и «комбинаторного наращения». Под «созидательным разрушением» понимается отвлечение агентов от старых шумпетеровских комбинаций, превращение консерваторов в новаторов, а под эффектом «комбинаторного наращения» понимается создание нового трудового ресурса под новые комбинации — подготовки новаторов. С использованием эконометрических моделей, с учётом статистической верификации на основе эмпирических данных подбираются законы изменения долей и скоростей отвлечения и создания ресурса (оценка даётся по трудовому ресурсу), влияющие на появление новаторов. С помощью нормативного изменения законов отвлечения и создания ресурса устанавливается возможное влияние эффектов «созидательного разрушения» и «комбинаторного наращения» на динамику ВВП в Европейском союзе и России, исходя из сформировавшейся связи динамики продукта и динамики новаторов для конкретного интервала времени.

Результат исследования. Российская экономика в отличие от Европейского союза демонстрирует консервативную модель инновационной динамики и экономического роста. Как комбинаторный эффект, так и созидательное разрушение в России слабо выражены, что связано с блокированием условий для инновационного развития, для Европейского союза эти эффекты влияют сильнее. Тем самым, **основной вывод** в том, что при изменении характера отвлечения ресурса можно в среднем повысить темп экономического роста, хотя расширение подготовки новаторов не даёт для данного периода времени как в России, так и в Европейском союзе увеличения среднего темпа роста, сильнее влияет отвлечение кадров из действующих видов деятельности.

Ключевые слова: инновации; новаторы; консерваторы; «созидательное разрушение»; «комбинаторное наращение»; динамика ВВП; скорость отвлечения и создания ресурса; сравнительный анализ Европейского союза и России.

1. Introduction. The modern economy is characterized by high dynamism of innovative changes [1–2, 5, 16, 22], often seen as a condition for economic growth and victory in the competition not only of firms, but also of countries. However, each country has its own innovators, who appear in different ways, and whose quality is different, even if the number of innova-tors, suppose, is the same. This creates the basis for competitive outcomes, which are difficult to predict without taking into account this quality. However, in order to advance in understanding the nature and quality of novelty, the appearance of an innovator [3], it is necessary to imagine where the innovator comes from. It can appear either due to conversion from a conservative, or be

prepared immediately for new activities. These are the two main sources of the appearance of the innovator. In the first case, we are talking about the mechanism of the effect of 'creative destruction', in the second case, about the training of new personnel, for example, in the framework of the education system with the replenishment of the workforce by innovators [12].

By innovators in this study we will mean agents engaged in the creation of concepts, new knowledge, products, services, processes, methods and systems, as well as the management of relevant projects. According to the World Bank, researchers are defined in this way, under which the authors here, following the Schumetherian tradition, designate them as innovators. The given accounting definition of the World Bank of researchers is just covered by the definition of new combinations by J. Schumpter (Schumpeter, 2008), that is, they act as innovators. The aim of the study is to determine the degree of influence of the effect of 'creative destruction' and 'combinatorial augmentation' on the change in the structure of 'innovators-conservatives', which determines the prospects for the innovative type of economic growth. We believe that innovators are involved, one way or another, in new industries — in the functioning and creation of such industries. By conservatives we understand the difference between the total number of employees (from 15 to 74 years) and the number of researchers (innovators), believing that they determine the functioning of the so-called old industries, activities. The created labor force engaged in new activities is, according to our approach, those employed in new industries or activities that have 7–8 levels of education according to the International Standard Classification of Education (master's degree, doctoral studies). They constitute new innovators who embody the action of 'combinatorial augmentation.' The distraction of labor, embodying the principle of 'creative destruction', from old activities and industries in favor of new activities is considered by us according to Eurostat, as the number of workers who switched from activities with the lowest amount of intellectual costs to knowledge-intensive industries. n fact, we are studying the process of moving labor from existing activities to new activities and the process of creating new personnel purely for new activities — how these two processes relate to each other in different countries, in particular Russia and

the European Union. According to accounting, we designate researchers as innovators, as mentioned above, we consider the remaining agents as conservatives serving existing activities.

The main purpose and objective of the study are to analyze the process of the emergence of innovators and conservatives and, based on empirical information on Russia and the European Union, to give a macrostructural characterization of the emergence of innovators and the movement of labor in the economy from the perspective of the effect of 'creative destruction' and 'combinatorial augmentation'. The process of moving labor resources appears from the perspective of the Neo-Schumpeterian theory as a distraction of conservatives, turning into innovators and creating new innovators. Thus, the methodological basis of the research is the neo-Schumpeterian theory, which is expanded due to the effect of creating a new resource for new production.

Thus, we divide the labor resource of the economy (labor force) into two types are innovators and conservatives, considering their movement between activities are new and already functioning. This allows you to establish the strength of the influence of one or another process — the diversion of the resource from aging activities in favor of new ones and the creation of new personnel immediately for new activities. The research hypothesis can be viewed as an assumption that the effect of creative destruction turns out to be stronger in comparison with the effect of combinatorial build-up — the creation of new personnel. Although such a result will be individual for each country in the considered time interval, for which a comparative analysis of Russia and the European Union, as its main foreign economic partner, will be carried out.

Let us imagine the mentioned effects in two parameters are the shares of labor force distraction from previous combinations (turning a conservative into an innovator) and the creation of a new labor resource (innovators), as well as the rates of these two processes. Having received average estimates of the growth rate, provided that the law of resource diversion and the creation of new innovators has been changed, we will characterize the process of preparing innovators. This approach will be useful in its application for the implementation of macroeconomic planning and refinement of economic policy measures aimed at stimulating innovative development.

Neo-Schumpeterian competition, encompassing the behavior of innovators and conservatives, is generated by a process of 'creative destruction' and 'combinatorial augmentation' [14]. Empirical and model analysis of the influence of these effects on innovative and economic dynamics was carried out to a limited extent [1–2, 7, 14–15], since the necessary data were partially missing, and the approach itself was not applied in the formulation that is carried out in this article.

Technological changes encompass various types of activities, but an important feature is the emergence of an innovator moving to a new technology that generates innovations [8, 21]. The existing structure of innovations can be considered as a characteristic of the current state of the economy and the prospects for its development. At the same time, the process of diverting a resource from previous technological capabilities in favor of new technologies, and the process of creating a resource for new technologies are a structural characteristic of technological changes. Both processes can be described as the diversion of personnel employed in known activities in favor of new types, and the training of new personnel for new activities. In the first case, we are talking about 'creative destruction', when certain types of labor resources are diverted (the effect of 'creative destruction'), in the second case, 'combinatorial augmentation', when the labor resource must be created for new types of innovations, either completely new or obtained by combining well-known technologies, which is the content of the combinatorial effect considered here.

Consider these processes in more detail, defining a methodology for further research on the influence of these two effects on the emergence of innovators. We are talking about the transformation of an innovator either through retraining, acquiring new knowledge (from a conservative), or due to training from a zero level (educational system). In the future, we show the results of these two processes for the European Union and Russia.

2. Research methodology. The effect of 'creative destruction' [18, p. 81] describes how the resource is borrowed (distracted) from old combinations in favor of new ones, that is, from conservatives to innovative agents. Old opportunities are shrinking, new ones are expanding. There is a process of crowding out the old with the new, however, new types of combinations can coexist with the old and even expand their ability to function. The new combination and innovators may not begin to dominate immediately, but over time, and may be defeated in the market, and then the old combinations will continue to make the main contribution to economic development. A model is also possible when the innovator immediately dominates, but eventually turns into a conservative, and a new innovator does not arise. The economy is returning to a conservative growth model. Thus, economic dynamics is possible with the decisive role of conservatives or with the decisive role of innovators who are the generators of new combinations (innovations). The process of the appearance of an innovator seems important from the point of view of studying not only the patterns and properties of innovative dynamics, but also its impact on economic development as a whole.

An innovator appears upon receipt of a resource that allows an agent to move from a conservative model of behavior oriented to a well-known product, technology, services, methods, etc. The innovator reproduces a new model of behavior, which involves the creation of new ideas, concepts, products, technologies, processes, methods. However, an innovator may by no means appear from among conservatives, but in the preparation of agents that re-enter the workforce and are focused on creating a new result. Similarly, 'new conservatives' may appear, which are agents oriented to stereotypical markets, products, and well-known technologies. Thus, the system of education and vocational guidance makes a significant contribution to changing the structure of the 'innovator-conservative'.

As can be seen from Figure 1, three main processes affect the innovative development, covering the change in the ratio of innovators and conservatives in the economy:

— training of new personnel for ongoing innovations (newly created resource), emerging 'new innovators';

— the transfer of old personnel (conservatives) from existing industries to new areas of activity with possible retraining, retraining (turning a conservative into an innovator);

— the transfer of personnel from new industries to old ones due to the fact that new com-
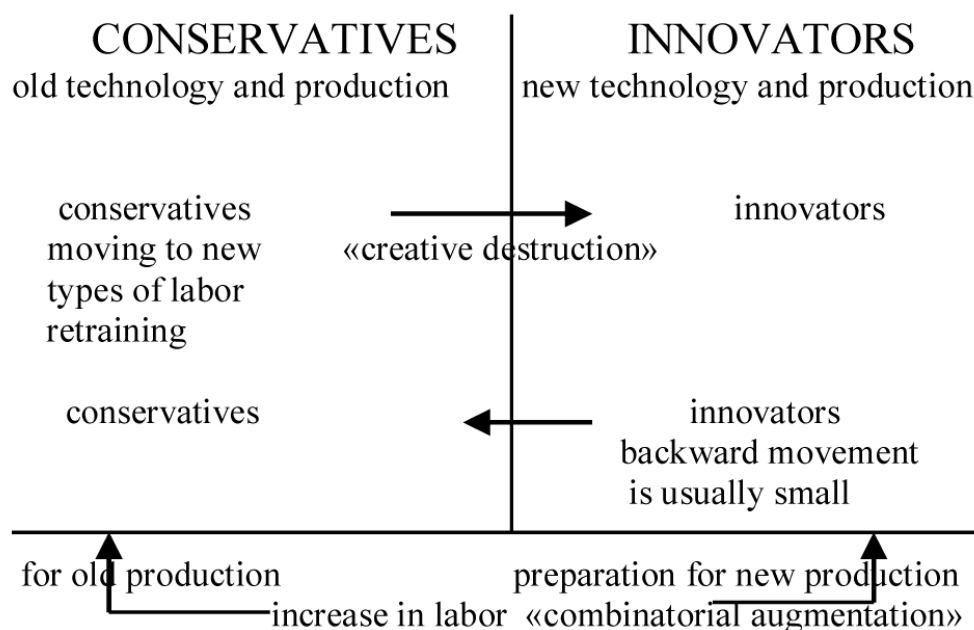
Fig. 1. Interaction of innovators and conservatives (compiled by the authors)

binations are exhausting their development, for example, due to lack of resources (lack of liquidity), unavailability of the market, etc. (turning an innovator into a conservative).

Figure 1 shows the effects of 'creative destruction' and 'combinatorial augmentation'. One and the same agent, depending on what initial potential in the field of innovation it has and access to which resource it has, may be at some time interval for conservatives, then, when these conditions change, become an innovator, but over time again become a conservative. Such changes occur permanently, and it is precisely this dynamics associated with the switching of the agent's behavior model that, in our opinion, is a rather strong characteristic of innovative development, which will be demonstrated below on the example of Russia.

The country's transition from a conservative to an innovative development model, or vice versa, can affect the pace of economic dynamics. Moreover, not only 'creative destruction', but also 'combinatorial augmentation' as a process in which a resource, including labor, is not distracted from previous combinations, but is re-created, including due to the combination

of known technological capabilities, or without such a combination — it is an important characteristic of development. Therefore, by combining the two main modes, we can evaluate the model of innovative dynamics. The creation of a new resource (types of labor) can be considered as a new combination in itself.

Development occurs with various interactions of factors, and the creation of a new resource can be considered, in our opinion, as the content of the 'combinatorial augmentation' effect, since this is a development mode without distracting the resource from old combinations. The interaction of new and old combinations, innovators and conservatives occurs as part of their consumption of resources. In this regard, by analyzing the number of people employed in the old type of activity — conservatives, and in new types of activity — innovators, one can study the process of labor movement due to the diversion of personnel and the creation of new personnel. These two processes will mean creative destruction in case of distraction and combinatorial augmentation in case of creation of new personnel.

Suppose that the number of innovative agents[1] (Ln) that appears at a certain point in

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1 Agents innovators and conservatives are identified in the introduction. Statistics make it possible to take into account the presence of such agents both in the European Union and in Russia, which makes this study possible.

time t represents the amount of distraction from conservatives (lsn) plus the value of newly created new (ln) employees, minus those innovators (lns), who became conservatives[2]. Then $Ln = lsn + ln - lns$. The total number of innovators will be equal to the sum of the appearing current number of innovators and their initial value. Let us denote the value $\alpha = lsn/Ls$ is the share of labor force diversion from conservatives in favor of innovators, where Ls is the number of conservatives, $\mu = ln/Ln$ is the proportion of the total number of innovators of newly trained agent-innovators. The number of innovators at the current time will consist of the number of abstract conservatives who have become innovators (the effect of 'creative destruction') and the number of newly created innovators, that is $Ln = \alpha Ls + \mu Ln$, whence $Ln = \alpha Ls / (1 - \mu)$.

The fraction of the resource distraction from old combinations (conservatives) and the share of the newly created new resource, which are variable per unit time, are the rates of distraction and resource creation are $V\alpha = d\alpha/dt$, $V\mu = d\mu/dt$.

Having empirical data to determine the values of α, μ it is not difficult to obtain a connection between the changes of innovators and conservatives in the economy. The process of diverting a resource and creating a new resource is subject to its own law, which must be verified. Influencing the process of resource diversion and the creation of a new resource, that is, determining the mode of turning conservatives into innovators and preparing innovators, it is possible to influence innovative dynamics and economic development with different tools. The rates of distraction and resource creation (in this case, labor) are also relevant parameters that determine the mode of innovative dynamics in the economy.

The effect of 'creative destruction' is determined by the relative share of resource distraction and the rate of distraction (α, $V\alpha$), the effect of 'combinatorial augmentation' in this case to create a new resource — innovators and the rate of this process (μ, $V\mu$). Typically, in economics, the number of conservatives far exceeds the number of innovators. In this regard, the share of

resource diversion will be significantly less than the share of creating a new resource, although in absolute terms the number of conservatives turning into innovators can exceed the number of newly created innovators. This circumstance leads to the need to distinguish between assessing the two effects of 'creative destruction' and 'combinatorial augmentation' in relative shares and in the absolute value of the resource being diverted and created.

With the superiority of the process of diversion of the resource over the process of creation, determined by the proportion of distraction and creation of a new resource, we will assume that the effect of 'creative destruction' prevails. Otherwise — the effect of 'combinatorial augmentation'. An additional characteristic of these effects is the ratio of the rates of distraction and resource creation, since it determines the properties of the dynamics of these effects. When $V\alpha > V\mu$ his means strengthening the regime of 'creative destruction' in the development of the economic system, since resource diversion from old combinations is faster. When $V\alpha < V\mu$ he regime of 'combinatorial growth' is strengthened, a new resource is created faster than the resource is distracted from the existing combinations. This can weaken the effect of 'creative destruction' if it prevails (for $\alpha > \mu$). If the share of resource diversion is lower than the share of resource creation ($\alpha < \mu$, but $V\alpha > V\mu$), then the 'combinatorial augmentation' mode is weakened.

Thus, there are two modes of 'creative destruction' and 'combinatorial augmentation'. One is determined by the ratio of processes of distraction and resource creation, that is, by the parameters α, μ. The second is incremental mode is estimated by the ratio of the rates of distraction and resource creation (Table 1). These modes characterize the model of innovation dynamics prevailing in the economy and, in a broader sense, economic growth.

If the absolute value of the distracted and retrained personnel (turning conservatives into innovators) exceeds the value of newly prepared innovators, then according to this criterion, when

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2 The reverse movement can not be taken into account not only because this process is usually not so significant, but also because the total value of Ln and Ls changes, and the model is limited by the movement towards innovative behavior, that is, the transformation of conservatives into innovators. The reverse movement is taken into account in the general indicators Ln and Ls, if some of the innovators have become conservatives. For quantitative assessments, this approach is justified from our point of view, especially in terms of studying the process of the emergence of innovators and their impact on innovative and economic dynamics.

Table 1

**The effect of 'creative destruction' and 'combinatorial augmentation'
in the relative share of distraction and resource creation and rates
(compiled by the authors)**

Mode	1st mode	2nd mode	Feature
Creative destruction	$\alpha > \mu$	$V\alpha > V\mu$	Due to the old combination
		$V\alpha < V\mu$	Striving for combinatorial augmentation (switch development mode)
Combinatorial augmentation	$\alpha < \mu$	$V\mu > V\alpha$	Due to the new combination — creating a resource for it
		$V\mu < V\alpha$	The desire for creative destruction (switch mode)

the rate of distraction exceeds the rate of creation of frames, the effect of creative destruction prevails, otherwise the ratio of rates also affects the effect of creative destruction, but weakening.

It seems important to note that the assessment of the absolute value of the resources being diverted and created is highly distorted, since the comparison of effects is possible by their influence in their distribution area, since the process of distraction and resource creation is generally unrelated and have their own distribution zone. Consequently, their comparative assessment may be adequate in scale within their scope, although in terms of resource size, the absolute number of innovators that have arisen due to distraction and retraining or are newly trained may be of analytical value. Subsequently, in an empirical analysis of the effects, we will characterize the aforementioned effects both in relative share and rates and in the absolute value of the distracted and created resource in the form of the number of innovators arising from conservatives and newly prepared.

If the amount of resource distraction exceeds creation, but the rate of distraction is less than the rate of creation, then the combinatorial effect is gaining momentum, while creative destruction retains its determining influence. If the distraction of the resource is less than the creation, but the rate of creation is less than the rate of distraction, then with the decisive role of the combinatorial effect, there is a tendency to strengthen the effect of 'creative destruction' and weaken the effect of 'combinatorial augmentation', when it prevails.

The laws of changes in the parameters α, μ, as well as $V\alpha$, $V\mu$ for each economy are individual. An important institutional task arises of changing the regime of innovative development, which can be reduced to changing the form of such a law, which is expressed in the amount of distracted personnel, affecting the transformation of conservatives into innovators and the training of innovators. These conditions also affect economic growth, an increase in gross domestic product. In the future, through the development of measures to modify these institutional parameters, it is possible to influence the structural quality of economic growth and its pace.

The effects of 'creative destruction' and 'combinatorial augmentation' are present in the economy at the same time, and some of them may dominate. This prevails over time and can change, and this result depends on many conditions and factors.

The mode of economic development, as well as the pace of this development will be determined by the ratio of the laws of change of α and μ. The difference in the values of distraction and the creation of a new resource for a new combination will characterize the development being carried out due to old or new combinations. Dynamics in the form of resource creation and diversion rates will also form a certain mode of economic development.

Further, applying the approach to assessing the movement of labor resources presented in this section, we will study the effect of the effects of 'creative destruction' and 'combinatorial augmentation' on it for Russia and the European Union. We calculate the parameters α and μ, evaluating the rate of change. Having obtained econometric models of the relationship between

GDP and the number of innovative agents, we determine the effect of changes in the laws α and μ on the change in GDP over the time interval 2001–2018. The calculations were made in 2010 prices. The laws of dynamics of the parameters $\alpha(t)$ and $\mu(t)$ changed arbitrarily, and, according to new laws for a given time interval, the number of conservatives switching to an innovative model (distraction from old combinations) of behavior and training of new innovators (newly created frames are innovators) was recalculated). Following the indicated research approach, we describe the features of economic development in Russia and the European Union by changing the number of innovative agents affecting economic growth, identifying and implementing a comparative analysis algorithm.

3. Dynamics of innovative agents and conservatives in the economies of the European Union and Russia. For the economies of Russia and the European Union, we will consider the effect of 'creative destruction' expressed in the transformation of conservatives into innovators, that is, diverting labor resources from old ones in favor of new types of activities, and 'combinatorial augmentation', which reduces to preparing a certain number of innovators that will become innovative activities through ongoing educational and professional training efforts. In the first case, the transformation of conservatives into innovators may involve retraining, but it can also happen without retraining if the conservatives are given more opportunities and resources, and at that moment they possessed a certain novelty, which was impeded by institutional and other conditions. Let us conduct a comparative analysis of the effects of these effects not only in the European Union and in Russia. Such a comparative analysis is useful for comparing the processes of innovative development of these countries. An analysis of these effects will highlight the degree of their influence on the use of labor resources in the economy, which is engaged in new types of activities, and which operates already existing (old) types of activities.

The general algorithm of comparative analysis is subordinated to the following points:

— determination of the parameters α and μ, the normative introduction of new laws of change of the relevant parameters α and μ, describing the effects of 'creative destruction' and 'combinatorial augmentation', as well as the determination of the laws of change of their rate $V\alpha$ и $V\mu$, with identification of the existing modes of innovative dynamics and their switching;

— determination of the law of the relationship between GDP dynamics and the number of innovative agents;

— GDP calculation based on the new laws of change of α and μ, describing a different nature of the effects of 'creative destruction' and 'combinatorial augmentation';

— recalculation of the magnitude of emerging innovators for each effect (determination of the required number of innovators for each law of variation of parameters α and μ);

— assessment of the deviation of possible GDP with a new number of innovators according to the effect of 'creative destruction' and 'combinatorial augmentation' from the initial value, thereby establishing the strength of each effect on the change in the main economic development indicator is gross domestic product[3].

We consistently apply this algorithm in the framework of a comparative analysis of the economic development of Russia and the European Union. The results of quantitative estimates are presented graphically.

Figure 2 shows the number of innovators and conservatives in the European Union and Russia for the analyzed period 2000–2018. By the number of innovators, Russia and the EU are characterized by multidirectional dynamics. So, in the EU there is a steady positive upward trend in this indicator, while in Russia there is a slight decline in this time interval. As of 2018, the number of innovators in the EU is 5 times higher than the Russian figure is 2018,1 thousand people and 391,8 thousand people respectively. The number of conservatives is characterized by more stable dynamics. In the EU, the number of conservatives in 2018 reached almost 230 million people, which is the largest value in the studied time interval. In Russia, this indicator is almost 70 million people, while

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3 This algorithm is used on an already lived interval, for which it is possible to determine what dynamics would have developed under different ratios of the effect of the «creative destruction» and «combinatorial augmentation» effect. Thus, it is possible to study the mutual influence of the above two effects not only on innovative development, characterized by a change in the number of innovators, but also on economic development as a whole — a change in GDP.

since 2012, there has been a downward trend in conservatives.

Figure 3 shows the change in the parameters α and μ, as well as the rates of change of $V\alpha$ and $V\mu$ for the Russian economy. Figure 4 is for the European Union. These graphs and models for each parameter are obtained on the basis of empirical data — they are the initial ones for further analysis. They show what are the patterns of innovation dynamics and what is the combination of the effects of 'creative destruction' and 'combinatorial augmentation'. The graphs show an empirically established change in these parameters, a model of their changes is selected, which we consider to be the initial one, since it is obtained from empirical data, and two arbitrary models of changes in α and μ, rates $V\alpha$ and $V\mu$ are given according to the initial models of α and μ (Table 2, lines A, B, C, D are indicated in Figure 3). Initial models are selected on the basis of empirical data, other models are introduced normatively based on the range of parameter changes to provide an increase or decrease in the vicinity of empirical values (Fig. 3). For the European Union similarly and respectively in Figure 4 and Table 3.

Figure 3 (at the top) shows the parameter α — the diversion of the resource from old production facilities in Russia. Verification parameters of the «initial α» model are presented in Table 2 (line 1). The change in this parameter is marked by lines A (increase in the parameter) and B (decrease in the parameter), along which the models were also selected, the characteristics of which are reflected in Table 2 (lines 2–3).

The models and their verification parameters are presented in a similar way for the initial μ — the creation of a new labor resource (Table 2, line 4) and for the changed μ upward and downward (Table 2, lines 5 and 6, respectively).

Based on Figure 3, it can be seen that the parameter α decreases for Russia, that is, the influx of innovators at the expense of conservatives is reduced. The parameter μ first increases slightly, then decreases. In general, the Russian economy is characterized by a reduction in the number of innovators. Thus, economic growth was due to an increase in the number of conservative.

In Figure 3, lines A, B, C, D indicate the laws of changes in the parameters α and μ from time to time, normatively set based on the task of increasing or decreasing each parameter. It is such options that need to be considered when influencing the change in gross domestic product.

As can be seen from Figure 3, the combinatorial effect prevails in the relative ratio of the shares of resource diversion and creation of a new resource. In Russia, according to the ratio of the rates of diversion and resource creation, the dynamics mode changed once — from strengthening the 'combinatorial augmentation' mode to strengthening 'creative destruction' (Fig. 3, right).

Figure 4 shows the calculations of changes in the parameters α and μ, $V\alpha$ and $V\mu$ for the European Union.

The correspondence of the parameters α and μ for the European Union with the characteristics of the constructed models are reflected in Table 3. Models and verification parameters for
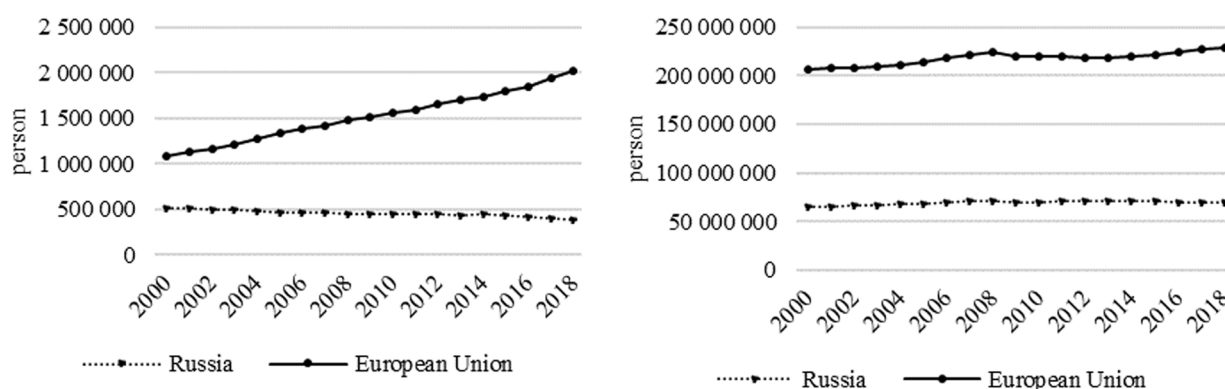

Fig. 2. The number of innovators (left) and conservatives (right) in the European Union and Russia, 2000–2018[4]
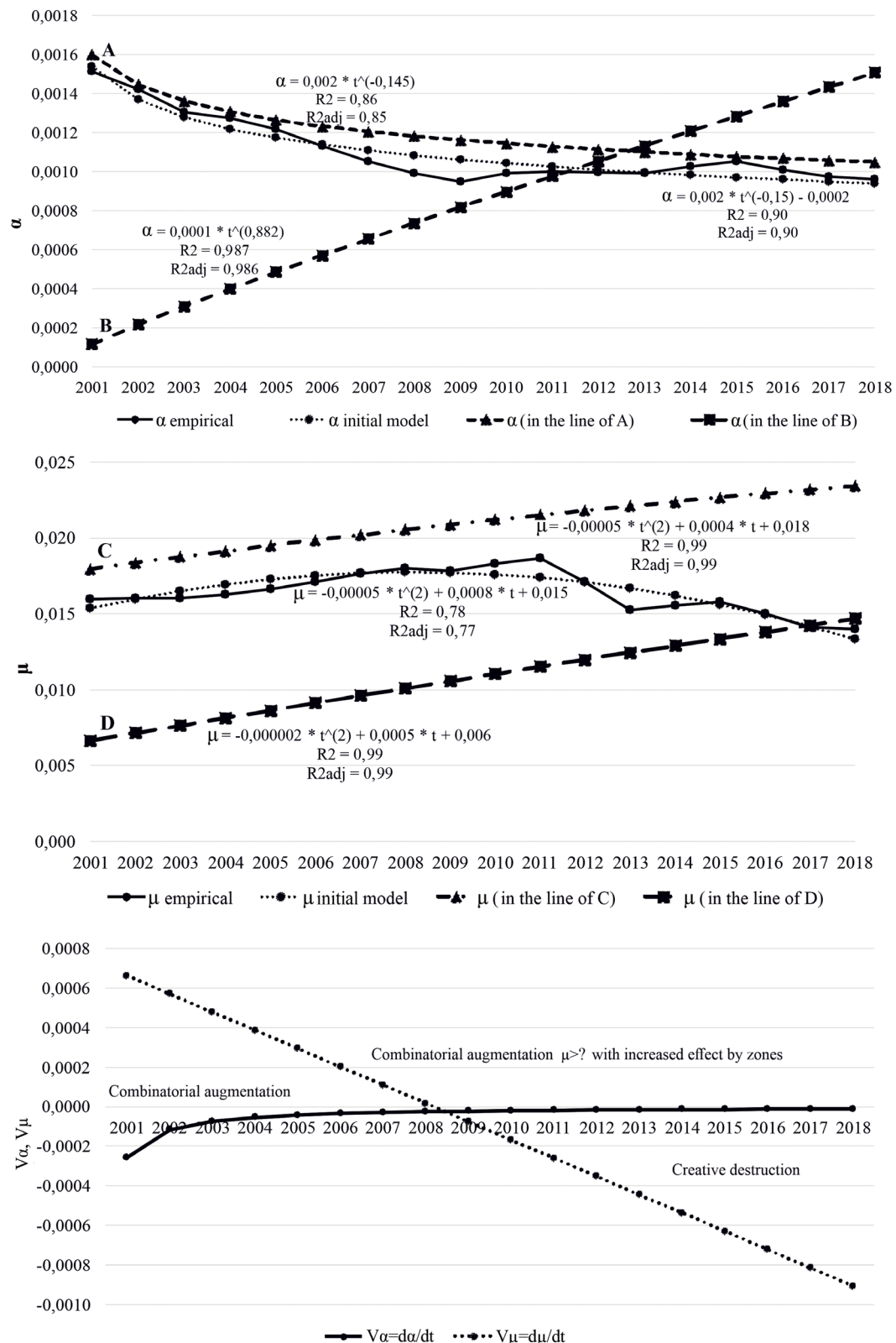
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[4] Authors' calculations based on OECD. URL: https://data.oecd.org/rd/researchers.htm.

Fig. 3. Change in α (at the top), μ (in the center), $V\alpha$ and $V\mu$ (below), Russia, 2001–2018[5]

$\alpha = 0{,}003 * t + 0{,}004$
$R2 = 0{,}99$
$R2adj = 0{,}99$ **A**

$\alpha = -0{,}00007 * t\hat{}3 + 0{,}002\hat{}2 - 0{,}009 * t + 0{,}02$
$R2 = 0{,}85$
$R2adj = 0{,}83$

$\alpha = -0{,}0009 * t + 0{,}009$
$R2 = 0{,}99$
$R2adj = 0{,}99$

Legend (top): α empirical — α model — α (in the line of A) — α (in the line of B)

$\mu = 0{,}003 * t + 0{,}04$
$R2 = 0{,}99$
$R2adj = 0{,}99$

$\mu = -0{,}00004 * t\hat{}3 + 0{,}0006 * t\hat{}2 - 0{,}004 * t + 0{,}05$
$R2 = 0{,}97$
$R2adj = 0{,}96$

$\mu = -0{,}003 * t + 0{,}04$
$R2 = 0{,}99$
$R2adj = 0{,}99$ **B**

Legend (center): μ empirical — μ model — μ (in the line of C) — μ (in the line of D)

combinatorial augmentation
$\alpha < \mu$

unstable $V\alpha > V\mu$

stable $V\alpha < V\mu$

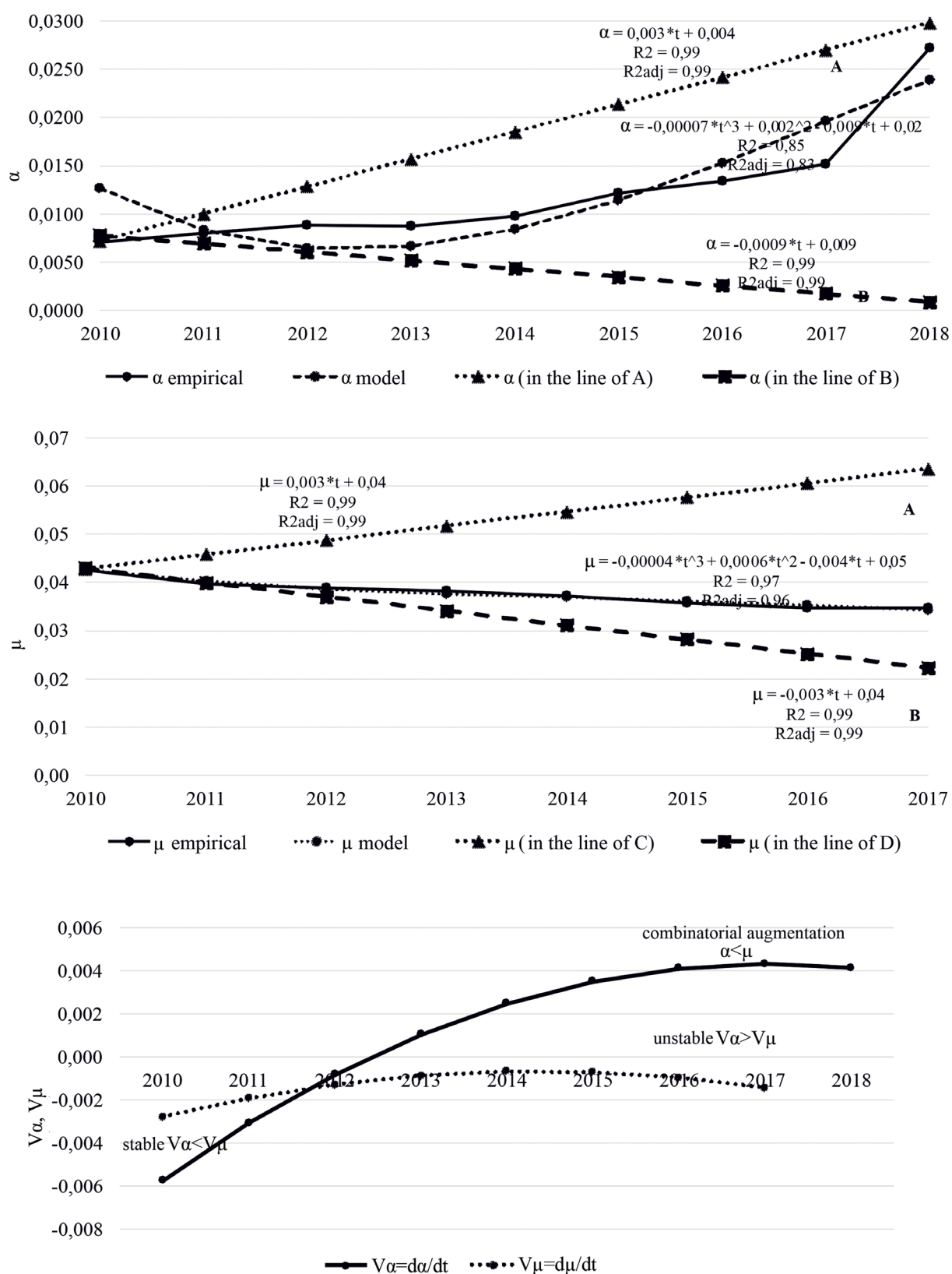Legend (below): $V\alpha = d\alpha/dt$ — $V\mu = d\mu/dt$

Fig. 4. Change in α (at the top), μ (in the center), $V\alpha$ and $V\mu$ (below),
European Union, 2000–2018

the initial α and taking into account the modeled growth and decrease of α are presented in Table 3 (lines 1–3). The same applies to the parameter of creating a new labor resource — μ — Table 3 (lines 4–6).

As you can see, the diversion of labor resources from old activities in favor of new ones is more significant than in Russia and increases. The creation of innovators for new activities in relation to the Russian economy is also significant, but decreases over the considered time interval. In the relative dimension, 'combinatorial augmentation' prevails over 'creative destruction', however, the distraction of personnel for new activities in the absolute dimension is superior to the creation of new personnel for new activities. The stable dynamics of this effect has been replaced since about 2012 by the unstable dynamics in the European Union, since since 2012 there has been an increase in the increment of the movement of workers from old industries to new ones while reducing the growth of the newly created labor resource for new industries, and in some years the growth of such a resource negative — 2014–2015 in the Russian economy, such a change occurs in 2009 — the most crisis year for this economy. Figure 3–4 also shows the normative changes in the parameters α and μ are the laws of change are set in order to see the possible impact of the current change in the nature of the diversion of the labor resource from old types of activities and the creation of new

personnel (innovators) in new types of activities. For these laws, the GDP will be recalculated as it would be if the diversion and creation of the labor resource occurred according to the introduced laws of change of α and μ. Changing the laws of these parameters requires additional institutional research. It is associated with the impact on the movement of labor resources and their retraining and the work of the educational system to create new personnel.

Figures 5–6 show the prevailing laws linking changes in GDP and the number of innovators in Russia and the EU. GDP for Russia and the EU is reduced to the single prices of 2010 using the GDP deflator index and calculated in million US dollars. For Russia, the selected model demonstrates the inverse relationship between the number of innovators and GDP, and the GDP growth rate in Russia is ahead of the rate of decline in the number of innovators. The reverse situation is typical for the European Union, where the growth in the number of innovators is accompanied by an increase in GDP. These are fundamentally different development models.

In Tables 2–3 (lines A, B, C, D are shown in Figures 3–4), as noted above, the initial models for the parameters α and μ are collected and the laws of change of these parameters from time to time, with the corresponding statistics, which selected the best dependencies for Russia and the European Union. These dependences are shown
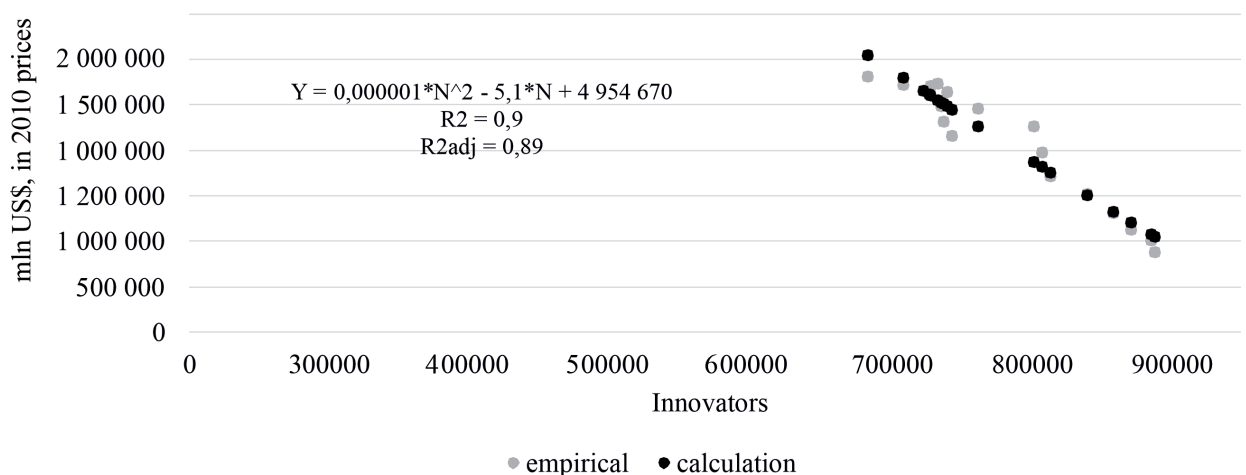

$$Y = 0{,}000001 \cdot N^2 - 5{,}1 \cdot N + 4\,954\,670$$
$$R2 = 0{,}9$$
$$R2adj = 0{,}89$$

● empirical   ● calculation

Fig. 5. Dynamics of GDP and the number of innovative agents, Russia, 2000–2018[6]

6 Model statistics: F-test = 238,7, D-W$_{calculation}$ = 1,4 $\in$ [1,4; 2,6]. White test: $\chi^2_{calculation}$ = 1,18, $\chi^2_{crit.}$ = 28,9. Authors' calculations based on Rosstat. URL: https://www.gks.ru/folder/14477, https://www.gks.ru/labour_force.

in Figure 3–4 on the left and in the center, the rates in Figure 3–4 on the right are plotted according to the dependences obtained from the initial models α and μ (selected from the empirical values of α and μ).

The laws α and μ change normatively according to four scenario variants. Changes in the law along the line A means that α is the share of the diversion of resources from old industries in favor of new industries, is greater than the initial value and tends to increase over time, i.e. the authors suggest that over time there is an increasing diversion of the number of employed from old industries to new ones. Changes in the law along line B suggests, on the contrary, a gradual decrease in α, i.e. the outflow of human resources from old to new production decreases.Normative changes in the law μ (along lines C and D) mean, respectively, an increase or decrease in the number of newly created resources for new production.

It should be noted that for Russia and the European Union, the author's models were built with an identical regulatory change in the laws of 'creative permission' and 'combinatorial augmentation' are α and μ.

Figures 7–8 show the development options that are achievable during the implementation of macroeconomic policies. Deviations of model GDP from actual for the European Union and Russia are presented in the cases described above, i.e. depending on changes in laws α and μ, along lines A, B, C, D.

The initial model parameters α and μ correspond to the actual GDP. Due to the fact that changing the law with respect to α and μ gives a different number of innovators that affect economic dynamics, the problem arises of determining the deviation of the new total GDP created over the period under a different influence of 'creative destruction' and 'combinatorial augmentation' from the actual one. Actually, this deviation will mean the influence that can be estimated separately for each law of change in α and μ, choosing the most powerful effect, that is, the largest deviation in GDP in a positive direction (in the area of increase).

Next, we determine the average growth rate at the actual dynamics for α and μ of the original model, and provided that the laws of change of for α and μ were different. Figure 7 shows the total deviation of Russia's GDP for the period according to the for α and μ models for each line A, B, C D embodying the specific law of for α and μ change (Table 2).

Figure 8 shows the total deviation of the European Union's GDP for the considered period of time for the α and μ models in accordance with the lines A, B, C, D in Table 3.

Comparing Figures 7–8, we note that for Russia the best scenario conditions for development are lines B and D, in which the number of
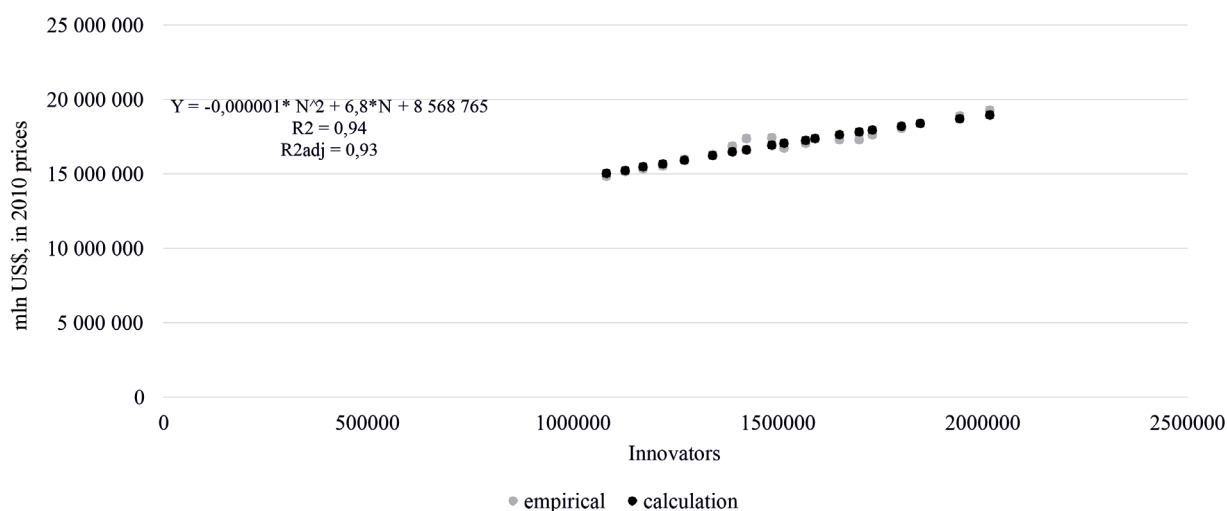

Fig. 6. Dynamics of GDP and the number of innovative agents, EU, 2000–2018[7]

Table 2

Models of the parameters α and μ for Russia, 2001–2018 (authors' calculations)

Model name	Formula	Verification parameters
α initial model	$\alpha = 0{,}002 \times t^{-0{,}15} - 0{,}0002$	$R^2 = 0{,}902$
		$R^2_{adj} = 0{,}896$
		F-test = 148,8
		D-W$_{calculation}$ = 1,52 $\in$ [1,39; 2,61]
		White test: $\chi^2_{calculation} = 1{,}89$, $\chi^2_{crit.} = 27{,}6$
α model (line A)	$\alpha = 0{,}002 \times t^{-0{,}145}$	$R^2 = 0{,}86$
		$R^2_{adj} = 0{,}85$
		F-test = 88,1
		D-W$_{calculation}$ = 1,5 $\in$ [1,39; 2,61]
		White test: $\chi^2_{calculation} = 0{,}94$, $\chi^2_{crit.} = 27{,}6$
α model (line B)	$\alpha = 0{,}0001 \times t^{0{,}882}$	$R^2 = 0{,}987$
		$R^2_{adj} = 0{,}986$
		F-test = 1474,1
		D-W$_{calculation}$ = 1,8 $\in$ [1,39; 2,61]
		White test: $\chi^2_{calculation} = 0{,}19$, $\chi^2_{crit.} = 27{,}6$
μ initial model	$\mu = -0{,}00005 \times t^2 + 0{,}0008 \times t + 0{,}015$	$R^2 = 0{,}78$
		$R^2_{adj} = 0{,}77$
		F-test = 66,9
		D-W$_{calculation}$ = 1,5 $\in$ [1,39; 2,61]
		White test: $\chi^2_{calculation} = 3{,}79$, $\chi^2_{crit.} = 27{,}6$
μ model (line C)	$\mu = -0{,}00005 \times t^2 + 0{,}0004 \times t + 0{,}018$	$R^2 = 0{,}992$
		$R^2_{adj} = 0{,}992$
		F-test = 1866,4
		D-W$_{calculation}$ = 1,6 $\in$ [1,39; 2,61]
		White test: $\chi^2_{calculation} = 0{,}21$, $\chi^2_{crit.} = 27{,}6$
μ model (line D)	$\mu = -0{,}000002 \times t^2 + 0{,}0005 \times t + 0{,}006$	$R^2 = 0{,}99$
		$R^2_{adj} = 0{,}99$
		F-test = 7684,9
		D-W$_{calculation}$ = 1,5 $\in$ [1,39; 2,61]
		White test: $\chi^2_{calculation.} = 0{,}09$, $\chi^2_{crit.} = 27{,}6$

Table 3

Models of the parameters α and μ for EU, 2010–2018 (authors' calculations)

Model name	Formula	Verification parameters
α initial model	$\alpha = -0{,}00007{\times}t^3 + 0{,}002^2 - 0{,}009{\times}t + 0{,}02$	$R^2 = 0{,}85$
		$R^2_{adj} = 0{,}83$
		F-test $= 44$
		$\text{D-W}_{calculation} = 1{,}4 \in [1{,}32; 2{,}68]$
		White test: $\chi^2_{calculation} = 7{,}5$, $\chi^2_{crit.} = 15{,}5$
α model (line A)	$\alpha = 0{,}003{\times}t + 0{,}004$	$R^2 = 0{,}99$
		$R^2_{adj} = 0{,}99$
		F-test $= 1764{,}3$
		$\text{D-W}_{calculation} = 1{,}8 \in [1{,}32; 2{,}68]$
		White test: $\chi^2_{calculation} = 0{,}24$, $\chi^2_{crit.} = 15{,}5$
α model (line B)	$\alpha = -0{,}0009{\times}t + 0{,}009$	$R^2 = 0{,}99$
		$R^2_{adj} = 0{,}99$
		F-test $= 26241{,}2$
		$\text{D-W}_{calculation} = 2{,}6 \in [1{,}32; 2{,}68]$
		White test: $\chi^2_{calculation} = 0{,}21$, $\chi^2_{crit.} = 15{,}5$
μ initial model	$\mu = -0{,}00004{\times}t^3 + 0{,}0006{\times}t^2 - 0{,}004{\times}t + 0{,}05$	$R^2 = 0{,}97$
		$R^2_{adj} = 0{,}96$
		F-test $= 190{,}7$
		$\text{D-W}_{calculation} = 1{,}9 \in [1{,}33; 2{,}67]$
		White test: $\chi^2_{calculation} = 0{,}85$, $\chi^2_{crit.} = 14{,}1$
μ model (line C)	$\mu = 0{,}003{\times}t + 0{,}04$	$R^2 = 0{,}99$
		$R^2_{adj} = 0{,}99$
		F-test $= 1162{,}6$
		$\text{D-W}_{calculation} = 2{,}1 \in [1{,}33; 2{,}67]$
		White test: $\chi^2_{calculation} = 0{,}74$, $\chi^2_{crit.} = 14{,}1$
μ model (line D)	$\mu = -0{,}003{\times}t + 0{,}04$	$R^2 = 0{,}99$
		$R^2_{adj} = 0{,}99$
		F-test $= 2668{,}8$
		$\text{D-W}_{calculation} = 2{,}4 \in [1{,}33; 2{,}67]$
		White test: $\chi^2_{calculation} = 0{,}66$, $\chi^2_{crit.} = 14{,}1$
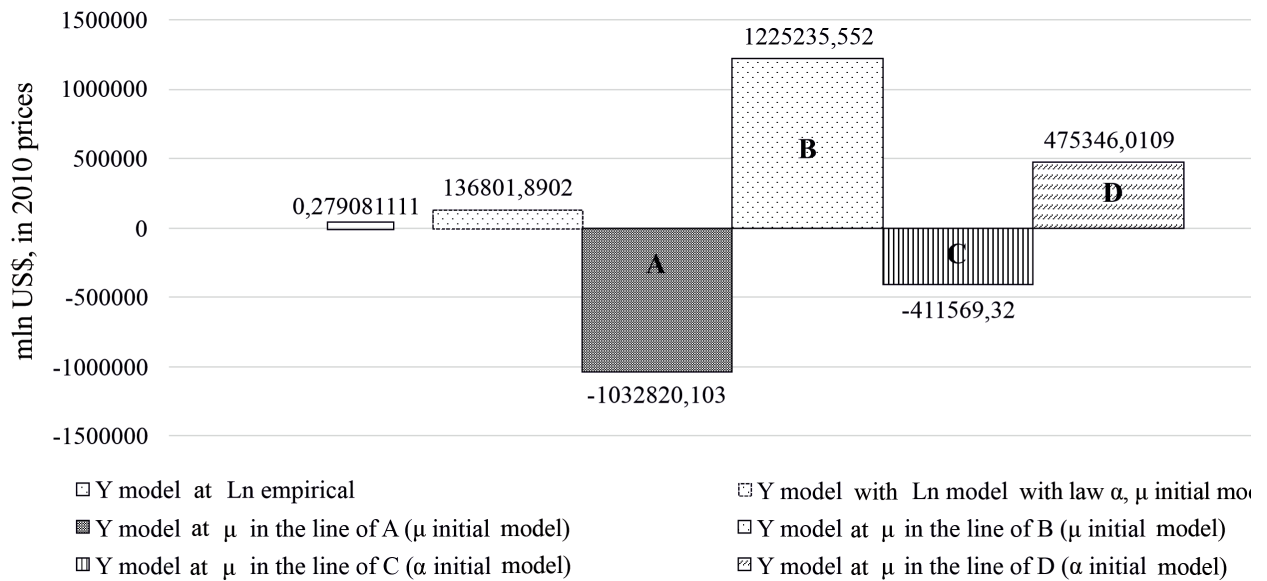
Fig. 7. The total deviation of GDP by models $\alpha,\ \mu$ from the actual GDP of Russia[8]
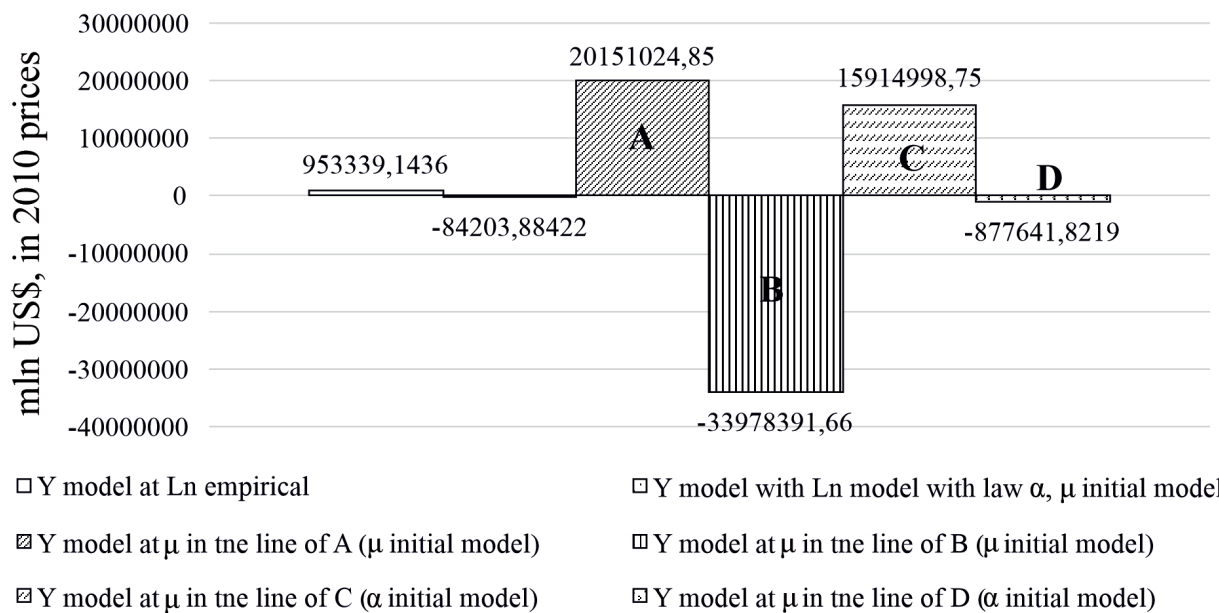
Fig. 8. The total deviation of GDP by models $\alpha,\ \mu$ from the actual GDP of the European Union[9]

innovators decreases relative to the existing initial level. For the European Union, on the contrary, the growth of innovators, i.e. development options along lines A and C are the best of the four scenarios considered. The worst case scenario for Russia is the A line scenario, where the growth of innovators occurs due to the overflow of employed from old to new industries, while for the EU, a significant decrease in GDP may be, on the contrary, due to a decrease in the flow from old industries to new ones. Thus, the EU and Russia are demonstrating the exact opposite trend in GDP growth due to innovators and conservatives. Moreover, for Russia, taking into account the considered regulatory development scenarios, there is a locking innovative development model when innovators do not contribute to development, and 'creative destruction', that is, the diversion of the labor resource from old activities, increasing, for Russia, will slow down the increase in GDP, but for the European Union, the opposite.

Table 4 summarizes the final best parameters of economic dynamics for Russia in terms of the excess of the total GDP over the actual product, and the corresponding excess of the number of innovators in terms of the effect of the creative destruction '(α) and combinatorial growth (μ). As follows from Table 4, the Russian economy is losing innovators with the best options for increasing the product. It should be noted that when changing the law on μ is 'combinatorial growth', the average annual growth rate, which was estimated on the fact, does not exceed.

Of course, the selection of laws of changes in α and μ over time, resulting in an assessment of the training of new innovators or the transfer of a certain number of conservatives to innovators, which depends on many conditions and retraining opportunities, can be continued as part of scenario planning and taking into account the institutional conditions for the appearance of innovators in the economy. However, the main task, the impact of 'creative destruction' and 'combinatorial augmentation' on the emergence of innovators, innovative and economic dynamics, was solved here. In the Russian economy, the question on the fundamental change in the development model is on the agenda, precisely at the expense of innovators, not conservatives, because on the considered time interval, innovators hinder development.

Table 5 presents the summary parameters of economic and innovation dynamics in the European Union.

Based on Table 5, it can be seen that the greatest result of exceeding the total GDP over the actual one is obtained along line A, when α increases, while μ remains at the initial level. In this case, the estimated GDP exceeds the actual one by $ 20,151 billion, in 2010 prices. Otherwise, with an increase in μ and the preservation of α, the excess of the estimated GDP over the actual one will amount to $ 15,915 billion. Those the effect of 'creative destruction' provides a larger GDP growth than the effect of 'combinatorial augmentation', increasing the GDP of the European Union by 27%. The excess of model GDP over the actual one corresponds to the average annual increase in the number of innovators in the EU by 658,2 thousand people and 359,8 thousand people by changing the laws α and μ, respectively. Due to the growth in the number of innovators, the average value of the GDP growth rate when the law α and μ is changed is provided in the amount of 1,96% and 1,67%.

Based on Tables 4–5, it can be seen that Russia's GDP growth can be achieved by reducing the number of innovators, i.e. with a decrease in the number of newly created resources, or with a decrease in the flow from old industries to new ones. According to the author's models, an increase in EU GDP can be achieved by increasing the number of innovators whose relationship with GDP is positive, while a greater GDP growth can be achieved with a greater flow of employed from old to new industries. Accordingly, the average value of the EU GDP growth rate when the law α changes (upward) will be 1,93% and 1,67% when μ changes (upward), i.e. when creating a workforce to ensure new industries. For Russia, a decrease in the flow from old to new production, according to scenario models, can provide an average annual GDP growth rate of 0,9%, and a decrease in the newly created resource for new industries will increase the average annual GDP growth rate of Russia to 3,2%. These comparisons suggest that the Russian economy needs a systemic change in the model of economic development, so that the reaction of the housekeeper to newly trained personnel for new production is associated with an increase in the product, as well as the diversion of personnel from old activities due to retraining. In the

Table 4

Summary parameters of economic (GDP size and growth rate) and innovation dynamics (by innovators), Russia (authors' calculations)

Excess of total GDP over actual (best option), constant 2010 mln US$		The average annual value of the GDP growth rate for the period, %	The average annual increase in innovators for the period, thousand people				The excess of the number of innovators over the initial, in α and μ, thousand people		The average value of the GDP growth rate with the change in the law α and μ, %	
			Initial		Model (corresponding to the best option for the excess of total GDP over actual)					
α	μ		α	μ	α	μ	α	μ	α	μ
1 225 236 (in the line of B)	475 346 (in the line of D)	3,52	99,3	12,8	59,4	7,6	−303,7 (in the line of B)	−82,6 (in the line of D)	0,9	3,2

Table 5

Summary parameters of economic (size and growth rate of GDP) and innovation dynamics (by innovators), European Union (authors' calculations)

Excess of total GDP over actual (best option), constant 2010 mln US$		The average annual value of the GDP growth rate for the period, %	The average annual increase in innovators for the period, thousand people				The excess of the number of innovators over the initial, in α and μ, thousand people		The average value of the GDP growth rate with the change in the law α and μ, %	
			Initial		Model (corresponding to the best option for the excess of total GDP over actual)					
α	μ		α	μ	α	μ	α	μ	α	μ
20151025 (in the line of A)	15914999 (in the line of C)	1,57	189	8	658,2	359,8	21322,3 (in the line of A)	9901,5 (in the line of C)	1,93	1,67

European Union, such a scheme works, which is shown for comparison in the calculations used here for the European Union.

4. Discussion of the results. As it can be seen, this study uses an aggregated approach based on taking into account the effects of 'creative destruction' and 'combinatorial augmentation'. The method developed here is significantly different from the applied neo-Schumpeterian approach to Latin America [13], where freedom, social security, knowledge and innovation in general terms are identified as relevant factors in the development of the economic structure. The structure of innovations and the quality of innovators themselves will also undoubtedly influence development. In our study, we identify two mechanisms for the emergence of innovators — from conservatives and completely new innovators. This is a kind of quality consideration, even within the framework of the applied aggregate model. Our approach differs from the long-wave approach in the framework of the Neo-Schumpeterian theory [9], which takes into account the time of the country's entry into a new wave, which forms the technological basis for development. These approaches do not answer the question of how to influence and manage the process of diverting the labor resource from existing activities in favor of new ones, and create a new resource for them. Our analysis is based on statistical and empirical estimates, that is, it is turned to the analysis of real data on a selected time interval, for which it is true. This allows you to adjust macroeconomic and sectoral policies aimed at stimulating an innovative model of economic growth.

Empirical material on the European Union and Russia shows that a change in the number of innovative agents affects the change in GDP. It has been established that, influencing the process of diverting the labor resource from existing types of activities in favor of new ones, as well as creating new types of labor for new types of activities (training of innovators), it is possible to influence the change in gross domestic product and the average growth rate. For this purpose, the laws of the dynamics of the parameters of diversion and resource creation from time to time were arbitrarily changed and the gross domestic product was recalculated based on the obtained dependence of the GDP dynamics and the

number of innovators for the economy of Russia and the European Union. The hypothesis of the study that the effect of creative destruction exceeds the effect of training personnel for new production does not find unambiguous confirmation. The interrelationships and influence on the dynamics of the GDP of the selected groups of agents turn out to be much more complicated and require more complex modeling. However, already at the empirical level of analysis, it is possible, as shown here, to obtain relevant conclusions on planning the economic development policy.

Two processes of the emergence of innovators were considered by us autonomously, but they may turn out to be related. This possible connection is a separate area of future research outside the scope of this article. A conservative, turning into an innovator, can undergo such a transformation by virtue of obtaining the necessary resource for an innovative model of behavior, but also additional training. However, training an innovator from scratch and training a conservative turning into an innovator are two forms of training that differ in both costs and impact on economic dynamics. Such a structural aspect of the emergence of innovators as a condition for modern development is very valuable when planning economic policy measures that stimulate innovative development, the 'knowledge economy' [17], where the effects of trust, overcoming high uncertainty and the formation of positive expectations from innovation are important. Thus, the macro-aggregate approach that we used is not difficult to combine with the microeconomic conditions and circumstances of the development of innovations, introducing these conditions into the preparation of new innovators and into the mechanism of turning a conservative into an innovator. A separate direction in the study is to clarify the effect of the relationship between innovative agents and the number of innovative firms [9, 13, 16, 20], which should be understood as innovative firms that create new products and services, at least for individual consumers, without creating the same products and services by other firms, or by an insignificant number of such firms.

At the micro-micro level, competition becomes competition between conservatives and innovators and between different groups of innovators themselves, since the structure of inno-

vations is not homogeneous, and finances relative to this structure represent a certain common resource for which competition is unfolding [4, 11]. The empirical aggregate approach presented here, unlike others [7] determines the influence of the layered technological mode of economic development according to the structure of conservative innovators and the mechanism of the appearance of an innovator. In the future, it makes it possible, by analyzing the influence of institutional parameters, to determine the effect of changes in the rates of diversion and resource creation on the process of economic and innovative dynamics.

5. Conclusion. Summarizing the ongoing study, we formulate the main most relevant findings.

Firstly, the appearance of innovators determines the model of the country's economic development, which is determined by a combination of the effects of 'creative destruction' and 'combinatorial augmentation.' If the absolute number of innovators is mainly influenced by creative destruction, then in relative terms the effect of 'combinatorial augmentation' has a significant impact on modern development.

Secondly, in the Russian economy, unlike the European one, a model of conservative development has developed, in which innovators do not have a decisive role. GDP growth is accompanied by an increase in conservatives, but not innovators. Despite the fact that the effect of 'combinatorial augmentation' prevails in relative proportion, nevertheless, the greatest number of innovators is formed when they are converted from conservatives. The process is carried out by diverting the labor resource from current activities, although the share of this distraction from the total size of conservatives is less than the share of creating new innovators from the size of existing innovators.

In Russia GDP growth was accompanied by a decrease in the number of innovative agents. In the European Union, a completely opposite trend is occurring and the growth model is associated with innovative dynamics and the emergence of innovative agents, as well as the transfer of agents from old activities to new ones and the creation of new personnel for new activities. Apparently, the migration flow also fits and does not cancel this trend [6, 10]. There is no similar migration flow in Russia, but the existing system of two effects shows that innovative dynamics are blocked in influencing economic development. Consequently, the necessary structural changes of a cardinal nature, which would ensure a change in the placement of not only resources (labor) in the economy, but also the reaction of the economy itself to this allocation, are of an innovative nature. This is especially true when overcoming the crisis caused by a virus attack in 2020.

Conflict of interest
The authors declare no conflict of interest in this paper.

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