"Economic growth of Ukrainian regions and determinants of financial resilience: Modeling the causal nexus"

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ECONOMIC GROWTH OF UKRAINIAN REGIONS AND DETERMINANTS OF FINANCIAL RESILIENCE: MODELING THE CAUSAL NEXUS

Abstract

Stable economic progress and upward dynamics of economic growth in the regions depend on their level of security and ability to withstand adverse macroeconomic and other shocks, as well as the state of affairs in which risks cannot be transformed into threats and dangers. The study aims to assess the causal nexus and the level of sensitivity of regional economic growth components to changes in financial resilience determinants. The research methods include systemic and structural analyses (building an information and analytical model for studying financial resilience), Granger test (identifying causal relationships between the variables under study), risk theory (studying the nature of fluctuations), and spatial and temporal approach. Data from the regions (oblasts) of Ukraine between 2015 and 2021 form the informational and analytical basis of the study. The paper reveals that the targeted use of transfers for socio-economic progress, increasing investment capacity, and bolstering financial and budgetary autonomy through increasing local budget revenues are the dominant financial determinants of regional economic growth. The results show that the most dominant causal nexus exists between (1) budgetary efficiency, interest rates on consumer/mortgage loans, and SME development, (2) the volume of loans/deposits and labor market efficiency and SME development, and (3) innovation development and foreign economic cooperation. Intensification of investment activity is crucial for ensuring real changes in the economic structure of all regions, particularly outsiders, accelerating transformation processes, mitigating regional economic divergence, and increasing competitiveness.

Keywords	growth, regions, resilience, risks, determinants, Ukraine, transfers, budgets, economic progress
JEL Classification	O18, R12, F36

INTRODUCTION

The present condition of regional development in Ukraine is determined by imbalances in the sectoral structure of social production, loss of competitive market positions by domestic enterprises, a decrease in the share of knowledge-intensive and innovative industrial products, significant divergence in technological development, and low efficiency of structural transformations of regional economies. Socio-political turmoil, the military conflict in the east of the country, the annexation of the Autonomous Republic of Crimea (2014), the global COVID-19 pandemic (2020–2022), and Russia's full-scale military aggression against Ukraine (since February 2022) have resulted in significant losses in industrial infrastructure, a slowdown in the development of the real sector of the economy, and thus a critical reduction in GDP, outflow of investment assets, loss of competitive advantage, and economic stagnation.

Without a reliable financial base, establishing efficient economic processes, creating highly competitive industrial and economic complexes, and ensuring sustainable and balanced development of regional economies are impossible. Ensuring the financial resilience of the country and its regions is a fundamental condition not only for local economic development and socio-economic progress but also for increasing the resources for economic recovery in the post-war period. The presence of systemic destabilizing influences on the economic growth of Ukrainian regions complicates the implementation of relevant financial mechanisms, instruments, and tools, especially in times of macroeconomic and socio-political instability.

The emergence of new and the aggravation of old destructive factors in times of crisis, which are catalysts for weakening the financial resilience of regions and, ultimately, the economic regression of regional economies, raises the need to revise the classical principles and methodological approaches to ensuring the financial resilience of territories as a new paradigm of regional economic growth, especially in the period of post-war recovery. Financial and economic resilience involves establishing protection or resistance against adverse macroeconomic and other shocks that ensure stable economic development and upward dynamics of regional economic growth and prevent exogenous risks from becoming threats.

1. LITERATURE REVIEW

Economic growth is a crucial category in economics. Despite different scientific approaches to its definition, it is mainly interpreted as a measure of the prosperity of a state, region, or community (Piętak, 2014; Khayati & Terzi, 2023; Ziky & El-Abdellaoui, 2023; Polyakov et al., 2023; Panigrahi, 2023; U. Khan & A. M. Khan, 2023), a dynamic process of their transformation (Cornwall, 2023; Voznyak et al., 2023; Abdelmoneim & Yasser, 2023; Farhat, 2023; Bushashe & Bayiley, 2023; Yuli & Rofik, 2023). The theory of economic growth is based on the identification of the driving forces that ensure the development of the system. Suppose one considers economic growth as a dynamic process. In that case, the questions arise whether the same factors equally determine its intensity and direction, what these determinants are, and whether the strength of their influence changes over time. Scientific research shows that the influence of various determinants on economic growth changes over time due to changes in economic structure, the impact of scientific and technological progress, and the conditions for the development of human capital.

Investment and intensification of production capacities were considered the main determinants of economic growth of countries, regions, and communities in conditions of stability, while representatives of neoclassical economics in the early twentieth century considered land, capital, and labor as the main determinants of economic growth (Renelt, 1991; Piętak, 2014). After the end of World War II, a study of the causes of economic growth in the United States identified scientific and technological progress and innovation as the main determinants of the country's intensive development (Solow, 1957). Contemporary scholars of the post-war period reached a somewhat similar conclusion about the causes of economic growth in the United States. However, they name several factors that ensured rapid economic growth: accumulation of physical and human capital, education, development of institutions, and free movement of capital, technology, investment, and information (Sala-i-Martin, 2001).

New theories of economic growth focus more on identifying the role of education and the quality of human capital as key determinants of economic growth (Patrinos, 1994). The impact of scientific and technological progress and innovation on the economic growth of countries, regions, and communities is widely studied. The period covered by these studies begins in the post-war years (50s and 60s of the twentieth century) and continues to the present day. The geography of coverage is also significant. However, there is no single conclusion to be drawn from the study. Most researchers record a significant positive impact when analyzing the role of innovation and public and private R&D expenditures (including their structure) as determinants of the economic growth of a territory (country, region, community) (Romer, 1990; Park,

1995; Aghion & Howitt, 2009; Falk, 2007; Wang, 2007; Jones, 2016; Sayef, 2021; Mewes & Broekel, 2022; Okoyeuzu & Ukpere, 2022; Attor et al., 2022; Tagiyeva et al., 2023). However, some studies provide different results. The analysis of the impact of public and private R&D expenditures in 74 countries in 1964–1989 shows a positive impact of private expenditures on research and innovation and the absence of such an impact (and, in some cases, its negative nature) of public expenditures (Lichtenberg, 1993). An analysis of the relationship between R&D expenditures and long-term economic growth in 52 countries in 1960–1980 reveals a positive impact, but its direction was not identified (Goel et al., 2008). A comparison of the impact of R&D expenditures on economic growth in 20 OECD and 10 non-OECD countries shows a positive relationship. However, it is not a factor in ensuring sustainable economic growth of the territory (Ulku, 2004).

The study of the reasons for the low economic growth in Latin America and the Caribbean after the end of the COVID-19 pandemic is of particular interest. Explaining the factors behind the slowdown, Francke et al. (2023) identify determinants of long-term (high inequality in education and healthcare, low level of technology development, and lack of innovation) and short-term impacts, among which they emphasize financial determinants (reduction of budget expenditures, inefficient monetary policy, the non-diversified structure of budget revenues and their inefficient distribution among different levels of government, and inefficient debt policy).

The key role of financial determinants in the economic growth of the Beijing-Tianjin-Hebei region of China is recorded in the period between 2007 and 2016 (Wang et al., 2019). Meanwhile, the research on economic growth in Europe, Central Asia, and selected territories of the Caucasus region emphasizes the secondary nature of financial determinants. Predicting different rates of economic growth in these macro-regions amid the war in Ukraine, financial determinants have the greatest impact on economic growth in different countries, but these determinants are the result of the economy's response to external political factors (Shkolnyk et al., 2021; Melnyk et al., 2022; Sconosciuto, 2023; Kaneva et al., 2023).

Studying the differences in the economic growth of cities in the United States in the context of the influence of households on this process identifies financial (in particular, the level of household income and housing rent) and behavioral factors (the relationship between the need for amenities and the willingness to pay for them) as determinants of development intensity. The causal relationship between them has led to the concentration of people with higher incomes in areas with better economic opportunities and vice versa. According to Gascon and Walstrum (2023), it is the reason for different growth rates.

Numerous studies on the determinants of economic growth of territories have been conducted using different mathematical approaches chosen for different research purposes. The role of regions in ensuring the economic growth of OECD countries is analyzed using the mathematical method of decomposition, which allows to assess the relative importance of several demographic and economic factors in stimulating regional growth. The study based on this mathematical method made it possible to identify the main sources of economic growth in each region (Spiezia & Weiler, 2007).

Econometric panel data modeling and stochastic marginal analysis with the use of the Cobb-Douglas production function and the translog functional form to analyze the determinants of economic growth in 34 OECD countries in 2003–2012 allowed to rank countries by the level of economic efficiency and reveal that countries with higher economic growth have higher efficiency ratings (Fuente-Mella et al., 2020). The unified growth theory (Galor & Weil, 2000; Galor & Moav, 2002) on the example of 21 OECD countries for the period 1750–2000 is tested based on FAS analysis aimed at determining the relevance of the instrument and the sensitivity of structural parameters to different combinations of instruments. Madsen and Strulik (2023) and Makarenko et al. (2021), studying the development of countries over 250 years, revealed a significant positive impact of technological progress on education but a negative impact on fertility.

Nayak and Sahoo (2022) analyzed the peculiarities of economic growth in the regions of India using the estimation of absolute and conditional beta (β)-convergence and sigma (σ)-convergence.

The results show the presence of absolute and conditional β-convergence. Regions with low per capita income grow faster than those with high per capita income. Financial (the amount of attracted investment) and infrastructure (access to electricity) determinants are identified as the main ones in the regional economic growth. The results also record the existence of σ-divergence, which indicates an increase in economic inequality between regions in India in the period 1990–2018.

Compared to holistic and systemic studies of the causes and intensity of economic growth in OECD countries, research on economic growth in Ukraine and its regions is not comprehensive (it does not cover long periods and/or does not take into account many determinants and is usually not based on the analysis of large data sets). Consequently, it is impossible to identify the specifics of regional development, their contribution to the country's economic growth, and their resilience in the face of instability. In the modern context, such a study is relevant due to the need for new adaptive approaches to ensuring the country's economic growth in the spatial dimension. An analysis of the causal relationship between economic growth and the determinants of financial resilience will help identify the dominant indicators to ensure regional development.

Thus, the study aims to assess the causal nexus and the level of sensitivity of regional economic growth components to changes in financial resilience determinants.

2. METHOD

The level of economic growth of regions is suggested to be calculated in the form of an empirical indicator based on the consideration of six components: economic stability (ES_t^n), economic efficiency (EE_t^n), innovative development, and foreign economic cooperation ($IDFC_t^n$), SME development ($DSMB_t^n$), labor market efficiency (LM_t^n), and infrastructure development (DI_t^n). Since the transformational changes in regional economies are dynamic and influenced by environmental factors, the decomposition of the empirical growth rate is not permanent but can be supplemented, considering endogenous and exogenous conditions.

To build a series of empirical indicators of economic growth of Ukrainian regions using the spatial-temporal approach, the indicators are normalized by formula 1 based on the rank of regions in a given period. Unlike other approaches, this one helps group regions according to the criteria of (1) their economic growth rate and (2) their position in the projection of catalysts and regressors of economic progress (formula 2).

$$a_{\text{int}\,k}^{eg} == \begin{cases} \left(\dfrac{x_{it}^n - 100}{100} \right) \cdot Rk_{in}^{eg} & (1) \\[2mm] \left(\dfrac{x_{it}^n - x_{it-1}^n}{x_{it-1}^n} \right) \cdot Rk_{in}^{eg}, \\[2mm] \left(\dfrac{x_{it}^n - x_{it-1}^n}{100} \right) \cdot Rk_{in}^{eg} \end{cases}$$

where a_{int}^{eg} are the normalized values of the i indicator of the k economic growth component of the n region in the t period; x_{it-1}^n are the output values of the i economic growth indicator of the n region in the previous ($t-1$) period.

$$Rk_{\text{int}}^{eg} = \frac{RANG_{it}^n - RANG_{it-1}^n}{\overline{Q}_{it}}, \qquad (2)$$

where Rk_{in}^{eg} are the rank coefficients of economic growth of the n region by the i indicator in the t period; $RANG_{it}^n$ is the position of the n region by the i economic growth indicator in the t period; $\overline{Q}_{it}$ is the average number of regions studied by the i indicator in the t period.

The series of component indicators of economic growth are constructed using formula (3).

$$EGg_{tn}^k = \frac{a_{\text{int}\,k}^{eg}}{l}, \qquad (3)$$

where EGg_{tn}^k is the empirical value of the k economic growth component (group coefficient) of the n region in the t period; l is the number of indicators in the component.

Principal Component Analysis is used to calculate the weighting coefficients of the economic growth components (w_{kt}^{eg}). The empirical indicators of regional economic growth are calculated by the method of linear weighting using formula (4).

$$I_{nt}^{eg} = \left(\sum EGg_{tn}^{k} \cdot w_{kt}^{eg} \right) \cdot 100,$$

$$0 < Y_{nt}^{ED} < 100 \text{ \%,} \tag{4}$$

where I_{nt}^{eg} is the value of the empirical indicator of economic growth of the n region in the t period; w_{kt}^{eg} is the weight of the k regional economic growth component in the t period.

The determinants of financial resilience of the regions are grouped into four components: (1) budgetary resilience, (2) financial sector resilience, (3) price stability, and (4) investment efficiency (Table 1).

The Granger test is applied to determine the causal relationship between economic growth and the determinants of financial resilience of regions. The stages of testing the causality of the studied variables are:

1) logarithmization of the initial data in order to bring the indicators to one logical series, including the reduction of the statistical error;

2) selection of the required number of time lags (one lag was chosen for the study since the testing was carried out within each group of regions for each year separately);

3) validation or rejection of the null hypotheses according to the obtained probability values.

The β value is calculated to demonstrate the level of sensitivity of regions' economic growth or regression to changes in the determinants of financial resilience (formula 5). Higher β values indicate a high level of sensitivity among the variables under study. For example, if $\beta > 1$, fluctuations in economic growth are higher than fluctuations in

Table 1. Decomposition of regional financial resilience: An informational and analytical framework

Determinants	Measurement unit	Symbol
Component I. Budgetary resilience		
1. Revenues with transfers (per capita)	UAH	a_{1t}^{1n}
2. Tax revenues to revenues without transfers		a_{2t}^{1n}
3. Transfers to total revenues (with transfers)	coefficient	a_{3t}^{1n}
4. Revenues without transfers to total revenues		a_{4t}^{1n}
5. Rate of change in local budget revenues (without transfers)	%	a_{5t}^{1n}
6. Index of changes in personal income tax revenues (year-on-year)		a_{6t}^{1n}
7. Capital expenditures of local budgets without transfers from the state budget (per capita)	UAH	a_{7t}^{1n}
8. Share of own revenues of the local budget (without transfers) in the revenues of the consolidated budget of Ukraine	%	a_{8t}^{1n}
9. Share of economic activity expenditures in total expenditures		a_{9t}^{1n}
10. Economic activity expenditures (per capita)	UAH	a_{10t}^{1n}
11. Share of local taxes and fees in local budget revenues (without transfers)	%	a_{11t}^{1n}
Component II. Financial sector resilience		
1. Deposits of non-financial corporations attracted by depository corporations (other than the NBU) (per capita)	UAH	a_{1t}^{2n}
2. Loans granted by depository corporations (other than the NBU) to non-financial corporations		a_{2t}^{2n}
3. Interest rate of depository corporations (other than the NBU) on loans (weighted average annualized rates)	%	a_{3t}^{2n}
4. Consumer loans granted by depository corporations (other than the NBU) to households for the intended purposes (per capita)	UAH	a_{4t}^{2n}
5. Mortgage loans granted by depository corporations (other than the NBU) to households for the intended purposes		a_{5t}^{2n}
6. Interest rate of depository corporations (other than the NBU) on new consumer loans to households	%	a_{6t}^{2n}
7. Interest rate of depository corporations (other than the NBU) on new mortgage loans to households	%	a_{7t}^{2n}
Component III. Price stability		
1. Consumer price index (year-on-year)	%	a_{1t}^{3n}
Component IV. Investment activity		
1. Capital investment index (year-on-year)	%	a_{1t}^{4n}
2. Capital investments (excluding investments from the state budget) (per capita)	UAH	a_{2t}^{4n}
3. Index of changes in foreign direct investment (equity) (at the beginning of the year)	%	a_{3t}^{4n}
4. Foreign direct investments (per capita)	USD	a_{4t}^{4n}

Table 2. Interpretation of the indicator of regional economic growth sensitivity to changes in the determinants of financial resilience (β value)

β value	Trends	Feature
β = 1	In line with the economic trend	Fluctuations in economic growth and financial resilience are identical
β > 1		Economic growth fluctuations higher than that of financial resilience
β < 1		Economic growth fluctuations below that of financial resilience
β = 0	No relevant connection to the economic situation	Fluctuations in economic growth and financial resilience are inert
β < 0	The opposite relationship with economic trends	Inverse trend of fluctuations in regional economic growth and financial resilience

the determinants of financial resilience, and vice versa (Table 2).

$$\beta_{lkt}^s = \frac{V_{lkt}^\sigma (EGg \mid FR)}{\sigma_{lkt}(FR)}, \qquad (5)$$

where β_{lkt}^s are the economic growth sensitivity coefficients of the l group of regions to changes in the determinants of the k financial resilience component in the t period; $V_{lkt}^\sigma(Egg|FR)$ is the economic growth covariance of the l group of regions with the determinants of the k financial resilience component in the t period; $\sigma_{lkt}(FR)$ is the dispersion of the k financial resilience component of the l group of regions in the t period.

The study of fluctuations in the economic development of regions according to the amplitude of changes in the financial resilience components based on risk theory helps classify macroeconomic shocks into two groups: permanent (systematic) and inert (non-permanent). Permanent shocks are caused by general market and economic changes that have a significant impact on the financial system and, therefore, weaken its resilience. Inert shocks cannot be regulated and are difficult to predict, so their impact on the financial and economic system can be critical.

3. RESULTS AND DISCUSSION

The results of the empirical study prove (the study was conducted with a time lag of 2015–2021) that the economic growth rates of Ukrainian regions are differentiated, and, therefore, regional economic development is characterized by significant imbalances (Table 3). Ukrainian regions show signs of divergence in local economic develop-

ment (leading, average-level, and outsiders), which can be mitigated by forming stable socio-economic ties based on regional and interregional division of labor and harmonization of regional economic interests. For example, in 2015–2016, Kirovohrad, Poltava, and Sumy oblasts were outsiders with negative economic growth rates (–0.7%, –0.5%, and –0.3%, respectively); Zhytomyr, Luhansk, Vinnytsia, and Zakarpattia oblasts showed the highest economic growth rates (from 2.2% to 3.1%). Meanwhile, in 2018–2019, the leading regions were Kyiv, Zhytomyr, Volyn, Vinnytsia, Luhansk, and Donetsk, with growth rates of 2.1%-3.8%, and the outsiders were Chernihiv, Poltava, Chernivtsi, Khmelnytskyi, and Kharkiv oblasts with the lowest economic growth rates.

In 2020–2021 (the period of the COVID-19 pandemic), the business activity of economic entities and, consequently, the pace of the domestic market development significantly reduced, leading to the aggravation of systemic problems of endogenous socio-economic development in Ukrainian regions. Thus, the regional economic growth rates in 2020 were either significantly low (less than 1%) or negative. Low levels of investment and income and the lack of mechanisms to encourage SME development at the local level are the major triggers of the lack of regional economic growth. It is worth mentioning that 2019 and 2020 saw no leading regions in economic growth. Some regions of Ukraine showed slightly positive economic growth (average level), while others experienced economic regression due to economic stagnation during the pandemic (Table 4).

The economic growth of Ukrainian regions is determined by foreign direct investment. Its increase contributes to capital and technology transfer, job

Table 3. Empirical indicators of economic growth in the regions of Ukraine: Compositional approach, 2015–2021, %

Regions	Periods					
	2016/2015	2017/2016	2018/2017	2019/2018	2020/2019	2021/2020
Vinnytsia	2.30	1.52	−0.31	2.23	−0.33	2.35
Volyn	1.06	3.04	1.81	2.70	0.83	2.67
Dnipropetrovsk	0.27	0.33	0.75	1.24	−3.22	1.98
Donetsk	1.67	1.27	2.07	3.84	−0.12	2.22
Zhytomyr	3.07	3.00	2.15	2.80	0.51	3.42
Zakarpattia	2.23	4.04	2.50	2.12	−2.03	1.93
Zaporizhzhia	0.26	0.40	0.24	1.44	−1.34	1.74
Ivano-Frankivsk	0.46	2.43	1.38	1.54	−0.68	2.83
Kyiv	0.76	0.81	0.39	1.00	0.00	1.34
Kirovohrad	−0.67	1.37	1.04	2.07	−1.14	1.47
Luhansk	4.49	−3.06	−0.41	2.18	−0.03	4.38
Lviv	1.09	1.41	1.08	1.39	−0.25	1.58
Mykolaiv	0.42	0.99	0.94	1.52	−1.59	1.35
Odesa	0.23	1.14	0.78	0.37	−1.15	1.60
Poltava	−0.48	0.14	0.26	0.22	0.25	0.37
Rivne	0.44	1.05	0.95	0.73	0.67	1.34
Sumy	−0.35	0.51	1.02	0.92	−0.26	1.01
Ternopil	0.50	1.33	1.34	0.67	0.56	1.72
Kharkiv	0.21	0.24	0.56	−0.28	0.18	0.51
Kherson	0.63	1.29	0.81	0.82	0.35	0.91
Khmelnytskyi	0.28	0.73	0.63	0.15	0.67	0.72
Cherkasy	0.26	0.21	0.36	0.48	−0.42	0.53
Chernivtsi	0.21	0.54	1.27	0.15	−0.21	0.30
Chernihiv	0.03	0.35	0.31	0.29	0.20	0.28

Table 4. Groups of Ukrainian regions by the criterion of economic growth, 2015–2021

Periods	Groups of regions		
	Leaders	Average level	Outsiders
2016/2015	Zhytomyr, Luhansk, Vinnytsia, Kharkiv, Kyiv, Donetsk, Lviv, Volyn	Kherson, Ivano-Frankivsk, Rivne, Mykolaiv, Khmelnytskyi, Dnipropetrovsk, Zaporizhzhia, Cherkasy, Odesa, Zakarpattia, Chernivtsi	Ternopil, Chernihiv, Sumy, Poltava, Kirovohrad
2017/2016	Volyn, Zhytomyr, Kyiv, Vinnytsia, Lviv, Dnipropetrovsk, Kharkiv, Odesa	Rivne, Zakarpattia, Kherson, Donetsk, Mykolaiv, Khmelnytskyi, Chernivtsi, Sumy, Zaporizhzhia, Chernihiv, Cherkasy	Ivano-Frankivsk, Kirovohrad, Poltava, Ternopil, Luhansk
2018/2017	Kyiv, Zhytomyr, Dnipropetrovsk, Kharkiv, Zakarpattia, Ivano-Frankivsk, Zaporizhzhia, Lviv, Donetsk, Sumy	Rivne, Kirovohrad, Mykolaiv, Chernivtsi, Kherson, Odesa, Khmelnytskyi, Cherkasy, Chernihiv	Poltava, Volyn, Ternopil, Vinnytsia, Luhansk
2019/2018	Kyiv, Zhytomyr, Volyn, Vinnytsia, Luhansk, Donetsk	Ivano-Frankivsk, Mykolaiv, Zaporizhzhia, Lviv, Dnipropetrovsk, Zakarpattia, Kirovohrad, Sumy, Kherson, Rivne, Ternopil, Cherkasy, Odesa	Chernihiv, Poltava, Chernivtsi, Khmelnytskyi, Kharkiv
2020/2019		Rivne, Khmelnytskyi, Kherson, Poltava, Volyn, Chernihiv, Kharkiv, Ternopil, Zhytomyr, Kyiv	Luhansk, Donetsk, Chernivtsi, Lviv, Sumy, Vinnytsia, Cherkasy, Ivano-Frankivsk, Odesa, Kirovohrad, Zaporizhzhia, Mykolaiv, Zakarpattia, Dnipropetrovsk
2021/2020	Volyn, Vinnytsia, Donetsk, Dnipropetrovsk, Zaporizhzhia, Luhansk	Zakarpattia, Ternopil, Odesa, Lviv, Kirovohrad, Zhytomyr, Mykolaiv, Rivne, Kyiv, Sumy	Kherson, Ivano-Frankivsk, Khmelnytskyi, Cherkasy, Kharkiv, Poltava, Chernivtsi, Chernihiv

creation, new market access, and rapid search for new financial resources. The substantial impact of macroeconomic shocks on the capacity for economic recovery raises the issue of implementing new mechanisms to achieve balanced economic development in Ukrainian regions and finding means to ensure stable economic growth. The use of adaptation mechanisms for regional economic recovery contributed to the fact that some regions of Ukraine demonstrated positive economic growth dynamics in 2021 (Volyn, Luhansk, Vinnytsia, Donetsk, Dnipropetrovsk, and Zaporizhzhia). The continuing inability to solve the problems of stable economic development of the regions in 2015–2021 indicates the low efficiency of financial mechanisms, namely:

1. Targeted use of transfers. Subsidies constitute a significant share of local budget transfers. Regions with a share of transfers in local budget revenues of more than 40% demonstrated low economic growth in 2015–2021, and the share of subventions for socio-economic development in these regions is insignificant (Poltava, Volyn, Ternopil, Vinnytsia, and Luhansk oblasts, 2017).

2. Increasing investment capacity. The regions with the highest investment volumes demonstrated high economic growth rates over the study period (Dnipropetrovsk, Kyiv, Kharkiv, Zhytomyr, and Vinnytsia oblasts). The volumes of capital and foreign investment, as well as their growth rates, were the existential financial determinants of the economic development of the leading regions.

3. Ensuring financial and budgetary autonomy by increasing own revenues of local budgets. Thus, the deprivation of local government budgets of significant revenue sources has led to a slowdown in economic growth in some regions of Ukraine, especially in 2015–2016 (Ternopil, Chernihiv, Sumy, Poltava, Kirovohrad, Odesa, Chernivtsi, and Khmelnytskyi oblasts), where the reduction in own revenues amounted to 70%.

Ensuring stable economic growth in Ukrainian regions strongly correlates with efficient structural transformations in economic systems and efficient local financial-budgetary policy implementation. Finding rational tools to strengthen financial resilience is one of the priority vectors for en-

suring the sustainable functioning of the regional economy in the face of transformations and instability. Ensuring the optimal level of financial resilience of the regions will help create the foundation for stable economic growth in the region and build capabilities to mitigate internal and external threats arising in the transformational conditions of the development of the economic system. The Granger causality test results show that different financial instruments will be effective for leading, average-level, and outsider regions in periods of crisis and relative stability, as the impact of financial determinants on regional economic progress varies in terms of economic growth pace and dynamics. For instance, the level of budgetary efficiency caused an increase in economic growth for the leading regions in 2015–2016 and 2018–2019, while for the outsiders – during the study period, except for 2015–2016 and 2017–2018 (statistical significance was 90%). The following financial determinants had the highest causal impact on the increase in economic growth in average-level regions during the crisis (2015–2016): the level of tax independence (99%), the volume of loans (90%), the interest rates on consumer loans (90%), the volume of capital investments (90%), and the rate of increase in foreign investments (95%) (Appendix A). Interestingly, during the pandemic period (2020–2021), these regions were most dependent on the level of tax independence and subsidies (95%), the share and volume of economic activity expenditures (90% and 99%, respectively), deposits (90%), capital investments (95%), and the rate of increase in foreign investments (95%).

In 2019–2020, during the period of adaptation of regional economies to the new conditions of functioning and development, the triggers of economic growth in regions with average level (positive but insignificant percentage of economic growth) included budgetary efficiency, autonomy, and independence, capital expenditures of local budgets (statistical significance of each determinant is 90%), loans granted by depository corporations (other than the NBU) to non-financial corporations (90%), interest rates of depository corporations (other than the NBU) on loans (95%), mortgage loans granted by depository corporations (other than the NBU) to households for the intended purposes (90%), and interest rates of depository corporations (other than the NBU) on

new consumer and mortgage loans to households (90% and 95%, respectively). Moreover, they included the consumer price index (90%), as well as the volume of capital (excluding investments from the state budget) and foreign direct investments (95% and 90%), and the growth (decline) rate of foreign direct investment (95%). It is worth mentioning that financial determinants such as the level of subsidization, the share of economic activity expenditures in total expenditures, the growth (decline) rate of foreign direct investment (equity), and the volume of foreign direct investments have a causal relationship with the economic growth rates of leading regions, average-level regions, and outsiders. Meanwhile, the growth (decline) rates of local budget revenues (without transfers) and capital investments (excluding investments from the state budget) are determined by a causal relationship with the economic growth rates of the leading regions and outsiders, respectively.

Therefore, the implementation of efficient tools and mechanisms for forming the revenues of local budgets allows to influence of economic activity and ensure stable amounts of financial resources, which is especially important for outsiders. Meanwhile, the structure of local budget expenditures should be aimed at solving the problems of regional economic modernization and creating a favorable environment for its development and resilience. Increasing capital expenditures as a determinant of financial resilience has a positive impact on boosting economic growth. It is imperative to increase the efficiency of expenditures, taking into account the expediency of updating the tools of program-targeted budgeting for regions with low or no economic growth.

The current stage of regional development in Ukraine is characterized by an increase in the financial and economic independence of the territory, which actualizes the need to build a new model of financial resilience based on the strength of influence and the level of sensitivity of financial determinants to economic growth for each group of regions separately. Therefore, the existential determinants of the financial resilience model as a basis for ensuring regional economic growth include financial self-sufficiency, budgetary and tax independence, stable tax revenues, credit and deposit resources, economic activity expenditures,

capital and foreign direct investment, low inflation, and developed financial infrastructure. Thus, the study of the strength of the relationship and the elasticity of economic growth parameters with changes in the financial stability determinants is of practical value.

In 2021, budgetary efficiency had a moderate impact on the economic efficiency of the leading regions, as well as on infrastructure development, while there was no such relationship for regions with an average level, and it was weak for outsiders. The level of budgetary efficiency has a moderate relationship with innovation development and foreign economic cooperation in average-level regions and outsiders and a weak relationship in the leading regions. Instead, they are characterized by a strong correlation with the level of tax independence and the growth rate of foreign direct investment. Interestingly, SME development in the regions with high economic growth rates depends mostly on the level of tax independence, the growth (decline) of local budget revenues (without transfers), the growth (decline) of personal income tax revenues, capital expenditures of local budgets (without transfers from the state budget), and the growth of foreign direct investment. The SME development in the leading regions has a moderate relationship with the volume of loans granted by depository corporations (other than the NBU) to non-financial corporations and consumer loans granted by depository corporations (other than the NBU) to households for the intended purposes, as well as interest rates of depository corporations (other than the NBU) on new mortgage loans to households.

The labor market in the regions with the highest economic growth rates does not have a strong relationship with the financial determinants of the financial sector resilience and price stability components; there is a weak relationship with the level of tax independence, the growth (decline) rates of local budget revenues (without transfers), personal income tax revenues, and capital expenditures of local budgets (without transfers from the state budget). Instead, the labor market in Volyn, Vinnytsia, Donetsk, Dnipropetrovsk, Zaporizhzhia, and Luhansk oblasts (the regions with the highest economic growth rates in 2021) was determined by the strongest relationship

with the volume of capital and foreign direct investment (excluding investments from the state budget), and the growth (decline) in the volume of foreign direct investment (equity).

The labor market in Zakarpattia, Ternopil, Odesa, Lviv, Kirovohrad, Zhytomyr, Mykolaiv, Rivne, Kyiv, and Sumy oblasts (regions with low economic growth in 2021) does not have a strong relationship with the financial determinants of the budgetary resilience component, except for the growth rate of personal income tax revenues (moderate relationship). Interestingly, the labor market in outsiders has a moderate relationship with the volume of foreign direct investment and a weak relationship with the levels of subsidization and budget independence and the rate of change in local budget revenues (without transfers).

β-coefficients are calculated to determine the nature and magnitude of fluctuations in the economic growth rates of regions in the projection of changes in the financial resilience determinants based on risk theory. The results of the study prove the thesis that the financial resilience of Ukrainian regions in 2015–2021 was not sufficient to ensure their economic growth (for most financial determinants, $\beta < 1$), and a relevant, inverse relationship or identical fluctuations were observed for some of them (Appendix B). Thus, in 2021, the leading regions experienced greater fluctuations in innovative development and foreign economic cooperation than fluctuations in the share of local budget revenues (4.7%); in economic resilience – than in the volume of economic activity expenditures (3.2%), consumer loan interest rates (2.3%), and the consumer price index (2.4%); in infrastructure development – than in the share of local taxes and fees in local budget revenues.

Fluctuations in the economic growth of Volyn, Vinnytsia, Donetsk, Dnipropetrovsk, Zaporizhzhia, and Luhansk oblasts (the leading regions in terms of economic growth in 2021) are lower than fluctuations in those financial determinants with sensitivity coefficient values below 1 (e.g., levels of budgetary efficiency, tax independence, subsidization, on the one hand, and economic resilience, innovation development and foreign economic cooperation, labor market development, and infrastructure, respectively, on the other hand). It is worth mentioning that the trend of strengthening financial resilience to ensure economic growth in Ukraine's leading regions demonstrates both a relevant (e.g., the level of budgetary efficiency and the SME development, the volume of loans/deposits and the labor market efficiency, etc.) and an inverse relationship (e.g., interest rates on consumer/mortgage loans and the SME development, innovation development and foreign economic cooperation, the consumer price index and economic efficiency).

The fluctuations of the financial resilience determinants in the regions with an average economic growth rate (2021) were lower than those of the economic growth components, except for the subsidization level determinant, the fluctuations of which were higher than those of the economic resilience and economic efficiency components (β values of 1.250 and 1.229, respectively). According to the empirical results, 20 out of 23 financial resilience determinants do not fully ensure the economic growth of the regions ($\beta < 1$). Meanwhile, the financial determinants of budgetary efficiency and consumer price index had inverse trends in fluctuations of economic growth and financial resilience ($\beta < 0$). Such fluctuations can be explained by the systemic impact of financial determinants on the macroeconomic and regional situation.

The economic growth rates of all regions, especially outsiders, largely depend on the efficiency of the investment process. The intensification of investment activity is the key to ensuring real changes in the structure of the regional economy, accelerating transformation processes, reducing regional economic divergence, and increasing competitiveness. However, in regions with an average level (2021), financial and investment determinants showed an inertial effect on the components of economic growth, as the volume of foreign direct investment and the growth rate of investment capacity were insufficient to ensure the economic development of the territories.

In 2021, fluctuations in the financial resilience determinants in the outsiders (Kherson, Ivano-Frankivsk, Khmelnytskyi, Cherkasy, Kharkiv, Poltava, Chernivtsi, and Chernihiv oblasts) did not show a trend in line with regional economic

growth rates (all β values are greater than 1). The efficiency of investment activity did not have a relevant relationship with economic development ($\beta = 0$), while the determinants of the price stability and budgetary resilience components had an opposite relationship with the regional economic situation. Thus, acute crisis phenomena characterize the economic situation of the outsiders in Ukraine, caused not only by external challenges and unfavorable macroeconomic trends but also by the negative consequences of industrial restructuring, the military conflict (2014–2021), and the Russian war against Ukraine (since February 2022). Increasing the volume of capital and foreign investment is an important prerequisite for the gradual resumption of economic growth by creating a favorable investment climate in these regions, which closely correlates with favorable business conditions for the operation and development of businesses, especially SMEs.

The study of the causality of regional economic growth and the determinants of financial resilience supports the thesis that financial resilience is the basis of economic growth, a trigger for increasing economic capacity, and a driver of regional economic development. Thus, the determinants of budgetary resilience are most closely related to innovative development and foreign economic cooperation, as well as SME development, including the rate of change in local budget revenues (without transfers), the share of local budget revenues (without transfers) in the revenues of the consolidated budget of Ukraine, and the share of economic activity expenditures in total expenditures. It is worth mentioning that the volume of subsidies correlated with economic resilience and efficiency only in regions with low economic development in 2021 (Kherson, Ivano-Frankivsk, Khmelnytskyi, Cherkasy, Kharkiv, Poltava, Chernivtsi, and Chernihiv oblasts), while budgetary efficiency and tax independence had a weak to moderate correlation with all parameters of economic growth (except for infrastructure development, which is not influenced by the level of tax independence, as well as the level of subsidization, budgetary independence, and the rate of change in personal income tax revenues).

Interestingly, studying the relationship between financial resilience and economic growth in China's regions in 2007–2016, Wang et al. (2019) revealed that the economic growth rates of the country's regions have a dominant causal relationship with two financial determinants: (1) the cost of credit resources (their financial availability) and (2) the distance between the lender and the borrower (physical availability of the resource), i.e., the number of bank branches. Similar results are obtained in studies of the impact of banking sector development on the economic growth of countries in general. There is a high density of correlation between the efficiency of realization of the banking sector capacity and the level of socio-economic development of EU countries (Rushchyshyn et al., 2021; Storonyanska et al., 2021), as well as a causal relationship between the determinants of financial security and economic growth of territories (Lupak et al., 2021; Vasyltsiv et al., 2023).

The economic growth of outsider regions in Ukraine shows a weak correlation with the consumer price index and the determinants of financial sector resilience, while moderate (capital investment and FDI growth rates) and strong (FDI) correlation with the efficiency of investment activity. Foreign direct investment is a priority catalyst for economic growth in both leading regions and outsiders. Increasing the investment capacity of outsiders will help reduce the deficit of financial resources, strengthen financial resilience, ensure the financial self-sufficiency and autonomy of the territory, and thus guarantee innovative development, including the transfer of innovations and capital. This is confirmed by numerous studies on innovative development as a determinant of regional economic growth (Wang, 2007; Jones, 2016; Sayef, 2021). According to the calculations conducted to identify the mutual influence of innovative development and economic growth of 159 NUTS 2 regions in the EU, innovation is an important prognostic indicator of regional economic growth (Mewes & Broekel, 2022). An average 10% increase in the level of innovation development in a region leads to a 0.45% increase in GDP per capita. On the other hand, studies on the impact of R&D expenditures in developed countries suggest that R&D investments in the high-tech sector have a relatively higher impact on economic growth in the long run (Falk, 2007; Ilyash et al., 2021).

CONCLUSION

The study aimed to determine the causal relationship and the level of sensitivity of regional economic growth rates to changes in the determinants of financial resilience (on the example of all regions of Ukraine in 2015–2021). The results of the study validate the thesis that there is a dominant yet differentiated dynamics in the relationship between the studied variables for assessing the causal relationship and the level of sensitivity of the components of regional economic growth to changes in the determinants of financial resilience. The study reveals that the most dominant causal relationship for the leading regions in Ukraine was observed between (1) budgetary efficiency, interest rates on consumer/mortgage loans, and SME development, (2) the volume of loans/deposits and labor market efficiency and SME development, and (3) innovation development and foreign economic cooperation. For these regions, fluctuations in innovation development and foreign economic cooperation were higher than fluctuations in the share of local budget revenues; in economic resilience – higher than in the volume of economic activity expenditures, consumer loan interest rates, and the consumer price index; in infrastructure development – higher than in the share of local taxes and fees in local budget revenues. The outsider regions are characterized by a causal relationship between economic growth and the volume of mortgage loans granted by depository corporations to households for the intended purposes, interest rates of depository corporations on new consumer and mortgage loans to households, the consumer price index, and the volume of capital (excluding investments from the state budget) and foreign direct investment.

Therefore, the economic growth of regions is the most complex object of the state regional policy, which requires taking into account the specifics of the sectoral and territorial structure of the local economy, as well as the level of sensitivity of the economic growth rates of territories to changes in the determinants of financial resilience, the specifics of capital accumulation, the specifics of the financial sector, and the degrees of price stability and budgetary resilience. Assessing the elasticity of economic growth rates during the war and post-war recovery, on the one hand, and price and market fluctuations, business environment, labor market competitiveness, investment attractiveness, financial market efficiency, innovation efficiency, as well as financial self-sufficiency and autonomy of regions, on the other hand, is a promising area for further research.

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APPENDIX A

Table A1. Causal relationship between the financial resilience determinants and economic growth of Ukrainian regions, 2015–2021: Granger causality test

FD	Periods																	
	2016/2015			2017/2016			2018/2017			2019/2018			2020/2019			2021/2020		
	LR	AR	OR	LR	AR	OR	LR	AR	OR	LR	AR	OR	LR	AR	OR	LR	AR	OR
Budgetary resilience																		
a_{1t}^{1n}	→(90%)	–	–	–	–	→(99%)	–	→(90%)	–	→(90%)	–	→(90%)	–	→(90%)	→(90%)	–	–	–
a_{2t}^{1n}	–	→(99%)	–	–	→(95%)	–	–	–	–	→(90%)	→(90%)	→(90%)	–	→(90%)	–	–	→(99%)	→(95%)
a_{3t}^{1n}	↔(90%)	–	↔(90%)	–	–	–	–	↔(90%)	↔(90%)	↔(95%)	↔(90%)		–	–	↔(99%)	–	–	↔(95%)
a_{4t}^{1n}		–	→(90%)	–	–	–	–	→(90%)	→(95%)	–	–	–	–	→(90%)	–	–	–	–
a_{5t}^{1n}	↔(95%)	–	–	–	–	→(90%)	–	→(95%)	–	↔(90%)	–	→(90%)	–	–	–	–	→(99%)	–
a_{6t}^{1n}	→(90%)	–	–	–	–	–	–	%)→(95%)	→(90%)	–	–	→(90%)	–	→(90%)	–	→(90%)	→(95%)	–
a_{7t}^{1n}	–	–	→(90%)	–	→(90%)	–	–	→(90%)	→(90%)	→(90%)	–	–	–	→(90%)	–	→(90%)	→(90%)	–
a_{8t}^{1n}	↔(90%)	–	–	–	–	↔(90%)	↔(90%)	–	–	–	–	–	–	–	–	–	–	↔(90%)
a_{9t}^{1n}	→(99%)	–	→(90%)	–	–	→(90%)	–	–	–	→(90%)	–	–	–	–	–	–	↔(95%)	↔(99%)
Financial sector resilience																		
a_{1t}^{2n}	–	–	–	–	→(90%)	–	→(90%)	–	–	–	→(95%)	–	–	→(95%)	–	–	–	→(90%)
a_{2t}^{2n}	–	→(90%)	→(95%)	–	→(90%)	–	→(90%)	–	–	–	→(95%)	–	→(90%)	–	–	→(95%)	–	–
a_{3t}^{2n}	–	–	→(90%)	→(95%)	→(90%)	→(90%)	–	–	–	–	→(90%)	→(99%)	–	→(95%)	→(95%)	→(95%)	→(90%)	–
a_{4t}^{2n}	→(95%)	→(90%)	–	→(90%)	–	–	–	–	–	–	–	–	→(90%)	→(90%)	–	–	–	–
a_{5t}^{2n}	–	–	→(95%)	–	–	→(90%)	–	–	–	→(90%)	→(95%)	–	–	→(90%)	–	–	→(99%)	–
a_{6t}^{2n}	→(90%)	→(90%)	–	–	–	→(90%)	→(90%)	→(95%)	→(90%)	–	→(90%)	→(90%)	–	→(90%)	–	–	→(90%)	–
a_{7t}^{2n}	–	–	→(99%)	→(90%)	→(90%)	–	→(90%)	→(90%)	–	–	→(90%)	–	–	→(95%)	–	–	→(90%)	–
Price stability																		
a_{1t}^{3n}	–	–	–	→(99%)	→(90%)	–	–	–	–	–	→(90%)	–	→(90%)	→(90%)	–	–	–	–
Investment activity efficiency																		
a_{1t}^{4n}	→(95%)	–	–	→(90%)	–	–	→(90%)	–	–	→(90%)	→(90%)	–	–	–	–	→(90%)	–	–
a_{2t}^{4n}	–	→(90%)	→(95%)	–	→(99%)	–	→(90%)	–	–	→(99%)	→(90%)	↔(95%)	–	→(95%)	–	–	→(95%)	↔(95%)
a_{3t}^{4n}	↔(90%)	↔(95%)	–	↔(90%)	↔(90%)	–	–	↔(90%)	–	↔(95%)	–	↔(90%)	–	↔(95%)	↔(90%)	–	↔(95%)	↔(95%)
a_{4t}^{4n}	↔(95%)	–	↔(90%)	–	↔(90%)	↔(90%)	–	↔(95%)	↔(90%)	↔(95%)	–	↔(90%)	–	–	–	–	–	–

Note: → means unilateral impact (of financial resilience determinants on economic growth); ↔ means bilateral influence (causal relationship); *FD* – financial determinants, *LR* – leading regions, *AR* – regions with average growth rate, *OR* – outsiders.

APPENDIX B

Table B1. A measure of sensitivity of economic growth components to changes in the financial resilience determinants: β value by groups of Ukrainian regions, 2021

FD	EGg_{tn}^l						EGg_{tn}^p						EGg_{tn}^d					
	ES_t^n	EE_t^n	$IDFC_t^n$	$DSMB_t^n$	LM_t^n	DI_t^n	ES_t^n	EE_t^n	$IDFC_t^n$	$DSMB_t^n$	LM_t^n	DI_t^n	ES_t^n	EE_t^n	$IDFC_t^n$	$DSMB_t^n$	LM_t^n	DI_t^n
Budgetary efficiency component																		
a_{1t}^{1n}	0.073	0.074	0.014	0.000	0.006	0.307	−0.085	0.008	−0.090	−0.005	0.015	0.004	0.082	0.057	0.041	0.003	0.001	0.040
a_{2t}^{1n}	0.633	0.173	0.227	0.019	0.135	0.499	0.008	0.004	0.003	0.000	0.000	0.005	0.380	0.406	0.120	0.018	0.129	0.075
a_{3t}^{1n}	0.335	0.172	0.004	0.003	0.012	1.045	1.250	1.229	0.251	−0.023	0.028	0.053	0.288	0.238	0.044	−0.001	0.035	0.032
a_{4t}^{1n}	0.335	0.172	0.004	0.003	0.012	0.045	0.250	0.229	0.251	0.023	0.028	0.053	0.288	0.238	0.044	0.001	0.035	0.032
a_{5t}^{1n}	0.116	0.116	0.028	0.003	0.018	0.261	0.152	0.220	0.019	0.013	0.037	0.044	0.012	0.019	0.062	0.007	0.023	0.073
a_{6t}^{1n}	0.183	0.474	0.077	0.012	0.106	0.369	0.165	0.183	0.122	0.016	0.102	0.109	0.333	0.342	0.103	0.005	0.040	0.034
a_{7t}^{1n}	0.010	0.006	0.002	0.001	0.002	0.061	0.010	0.016	−0.001	0.000	0.002	0.003	0.000	0.003	0.001	0.000	0.001	−0.006
a_{8t}^{1n}	1.810	0.167	4.712	0.362	0.485	0.803	0.096	0.121	0.214	0.634	0.613	1.068	0.042	0.734	0.057	0.502	0.456	0.086
a_{9t}^{1n}	0.590	0.257	0.016	0.006	0.052	0.935	0.046	0.011	0.105	−0.004	0.042	0.107	0.287	0.320	0.141	0.010	0.002	0.014
a_{10t}^{1n}	3.163	0.053	0.002	0.001	0.008	0.039	0.000	0.004	0.012	0.000	0.003	0.008	0.025	0.020	0.014	0.002	0.002	0.034
a_{11t}^{1n}	0.051	0.606	0.026	0.155	0.757	1.263	1.091	0.866	0.585	0.010	0.058	0.255	0.359	0.097	0.415	0.023	0.140	0.989
Financial sector resilience component																		
a_{1t}^{2n}	0.032	0.021	0.047	0.001	0.000	0.190	0.006	0.063	0.008	0.001	0.010	0.024	0.007	0.001	0.010	0.001	0.002	0.015
a_{2t}^{2n}	0.019	0.035	0.023	0.020	0.000	0.021	0.009	0.037	0.019	0.001	0.010	0.012	0.021	0.024	0.001	0.000	0.003	0.004
a_{3t}^{2n}	1.371	0.209	0.713	0.003	0.016	0.918	1.582	0.386	0.227	0.076	0.284	0.067	0.150	0.135	0.159	0.006	0.148	0.061
a_{4t}^{2n}	0.304	0.100	0.046	0.004	0.011	0.755	0.153	0.028	0.018	0.001	0.007	0.077	0.077	0.118	0.001	0.001	0.003	0.149
a_{5t}^{2n}	0.043	0.023	0.014	0.000	0.002	0.178	0.037	0.004	0.016	0.001	0.011	0.010	0.026	0.033	0.002	0.001	0.006	0.007
a_{6t}^{2n}	2.279	0.886	−0.556	−0.029	0.069	5.335	0.767	0.205	0.256	0.020	0.069	0.368	0.347	0.618	0.567	0.064	0.256	1.060
a_{7t}^{2n}	1.336	0.252	−0.315	−0.006	0.148	0.869	0.934	0.172	0.768	0.049	0.144	0.247	0.279	0.320	0.114	0.005	0.019	0.046
Price stability component																		
a_{1t}^{3n}	2.439	−0.443	0.907	0.045	0.202	6.202	0.611	0.406	0.423	0.056	0.058	0.023	0.257	−0.061	0.183	0.024	0.046	−0.343
Investment activity efficiency component																		
a_{1t}^{4n}	0.001	0.048	0.041	0.001	0.013	0.010	0.020	0.012	0.011	0.001	0.002	0.003	0.036	0.035	0.010	0.001	0.003	0.008
a_{2t}^{4n}	0.024	0.071	0.041	0.001	0.016	0.076	0.042	0.008	0.001	0.001	0.010	0.009	0.089	0.103	0.009	0.001	0.017	0.006
a_{3t}^{4n}	0.010	0.002	0.001	0.000	0.001	0.023	0.001	0.001	0.000	0.000	0.200	0.001	0.001	0.001	0.000	0.000	0.000	0.001
a_{4t}^{4n}	0.003	0.004	0.003	0.000	0.001	0.009	0.001	0.001	0.000	0.000	0.380	0.001	0.001	0.001	0.000	0.000	0.000	0.001

Note: EGg_{tn}^l, EGg_{tn}^p, EGg_{tn}^d are components of economic growth in the leading regions, regions with average growth rate, outsiders, respectively; FD –financial resilience determinants.