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на тему: «**ДРАЙВЕРИ БІЗНЕС-ЦИКЛУ В ПЕРІОД ПІСЛЯВОЄННОЇ ВІДБУДОВИ**»

«**BUSINESS CYCLE DRIVERS DURING POST-WAR RECOVERY**»

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INTRODUCTION

The relevance of the topic lies in the fact that post-war periods are always characterized by complexity and instability and require a systematic approach to economic policy and recovery strategies. World history shows that after the end of conflicts, economic recovery and stabilization of society become an important task. Analyzing the drivers of the business cycle during the post-war reconstruction period is of particular relevance in today's environment.

The business cycle is one of the key concepts in modern economic theory and practice. It reflects fluctuations in economic activity and determines periods of growth and decline in economic activity. Under the influence of various factors, the business cycle regulates the processes of production, employment, consumer demand, investment, and, accordingly, affects the socio-economic state of society as a whole.

Among foreign scholars, the issue of business cycle drivers has been studied by V.V. Chari, Patrick J. Kehoe, Ellen McGrattan, Eric Sims and others.

The purpose of the master's thesis is to deepen the theoretical and methodological foundations of business cycles by identifying drivers and developing practical recommendations for the period of post-war reconstruction in Ukraine.

To achieve this goal, the following tasks are substantiated:

- to study of economic literature on the research topic;
- to specify the drivers of the business cycle;
- to summarize the global experience of post-war reconstruction;
- to analyze the economic drivers of the business cycle for different countries;
- to characterize the economic drivers of the business cycle in different countries;
- assess the business cycle in Ukraine in the postwar period;
- to substantiate the vectors of post-war development in Ukraine;

The subject of the study is the theoretical, methodological and practical foundations of the business cycle and the drivers of its impact in the postwar period.

The master's thesis uses a combination of general scientific and special methods

of cognition that contributed to solving the tasks of the work: scientific abstraction (in substantiating the categorical and conceptual apparatus of the study); logical, historical and dialectical (in grouping theories on the business cycle); analysis and synthesis, induction and deduction (in identifying patterns of drivers); method of comparison and method of analogies (in generalizing world experience and developing proposals for Ukraine).

The research is based on statistical and analytical materials of the World Bank, scientific articles and monographs by foreign scholars who study aspects of post-war recovery and the business cycle, as well as online resources, including data and analytical materials from the official websites of government agencies and organizations, as well as academic publications and news resources.

The main provisions that determine the scientific novelty of the master's thesis are as follows:

for the first time:

- application of Business cycle accounting theory to build a VECM model for studying the business cycle of Serbia and Georgia in the post-war period;
- the integral role of business cycle drivers in the context of post-war reconstruction in Ukraine;

improved:

- methods for analyzing business cycle drivers to adapt to the specific conditions of post-war reconstruction;
- defining the essence of business cycle drivers in the context of post-war reconstruction, taking into account specific aspects and features that affect the business cycle during the period of recovery from military conflict;
- scientific and methodological approaches to the study of the business cycle in the context of post-war reconstruction;

were further developed:

- analysis of economic drivers of the business cycle;
- characterization of economic drivers of the business cycle;
- recommendations for Ukraine regarding post-war reconstruction.

The practical significance of the findings is that they provide specific recommendations for policy makers and the business community on how to manage economic development in the post-war reconstruction period. These recommendations will help to increase the sustainability of economic processes, ensure effective risk management and achieve sustainable economic growth in the context of recovery from military conflicts.

Structure of the master's thesis. The thesis consists of an introduction, three chapters, conclusions, a list of references and appendices. The first part of "Theoretical and methodological foundations of the business cycle" examines the essence of the business cycle and its drivers. The generalized methodological approaches to the study of the business cycle are studied in detail, and the world experience of applying of business cycle accounting. The second part explains the main aspects of the applied model and discusses the analysis of conflicts in the world. The second section develops a VECM model for analyzing the main indicators of countries in the period after the war recovery. The third section describes the results of the model for Serbia and Georgia and provides recommendations for Ukraine's post-war recovery.

PART 1. THEORETICAL AND METHODOLOGICAL FOUNDATIONS OF THE BUSINESS CYCLE

1.1 Generalization of methodological approaches to studying the business cycle

The business cycle describes periodic fluctuations in economic activity, which include growth and decline phases. This phenomenon is characterized by changes in the level of production, employment, investment, consumption and other economic indicators in different periods of time. The business cycle reflects the imbalances in the economy and its response to various external and internal influences. As Parkin and Bade noted: "The business cycle is the periodic but irregular up-and-down movements in economic activity measured by fluctuations in real GDP and other macroeconomic variables. A business cycle is not a regular, predictable, or repeating phenomenon like the swing of the pendulum of a clock. Its timing is random and, to a large degree, unpredictable."

The economic cycle, or business cycle, is usually divided into four stages: expansion, peak, contraction, trough. During an expansion, the economy experiences relatively rapid growth, interest rates are generally low, and production increases. The flow of money in the economy remains healthy and the cost of money is low. However, an increase in the money supply can accelerate inflation during the economic growth phase. The peak of the cycle is when growth reaches its maximum rate. Peak growth usually creates certain imbalances in the economy, and as a result, businesses may begin to revise their budgets and spending when they believe that the economic cycle has reached its peak. A correction occurs when growth slows, employment falls, and prices stagnate. When demand declines, businesses cannot immediately adjust their production volumes, which leads to oversupply and lower prices. If the decline continues, the recession may turn into a depression. The bottom of the cycle is reached when the economy reaches its lowest point, when supply and demand bottom out before recovering.

There are several theories that attempt to explain the causes and mechanisms of business cycles. The most prominent work in real business cycle (RBC) theory is the study conducted by Kydland and Prescott in 1982. Real business cycle theory recognizes that cycles in the economy are the result of technological change and resource availability, which affect productivity and lead to changes in long-run aggregate supply. The main principles of this theory include the small role of money in business cycles and the assertion that these cycles are generated by rational agents who optimally respond to real (not nominal) shocks, such as fluctuations in productivity growth and government procurement [1, p. 6]. The underlying assumption about rational agents is that they take into account all available information and respond optimally to changes in the economic environment, maximizing their utility. This assumption implies that economic agents act rationally and understand market mechanisms. Real business cycle believes that the main causes of economic cycles are technological shocks. Changes in technology affect productivity and create fluctuations in the economy. A high level of technological innovation leads to economic growth, while a decline in technology leads to recession.

The Real business cycle methodology is also defined by two main principles: the use of dynamic general equilibrium models with rational expectations and a cautious approach to quantitative impacts, which are assessed through "calibration". This theory uses the calibration method to compare quantitative model predictions with actual data. This allows to check how well the model reproduces the observed economic phenomena.

Real business cycle uses dynamic general equilibrium models to simulate the interaction between different sectors of the economy and the interaction between agents. These models allow analyzing the long-term effects of economic changes and the adaptability of agents to shocks. Attempts to improve the methodology have led to its renaming as "stochastic dynamic general equilibrium macroeconomics". Despite their great influence on academic research, Real business cycles have not been widely used by central banks and other policymakers. The controversy over their usefulness for policy evaluation and the high probability of ignoring the limitations of these

models have led to the continued use of large-scale macroeconomic models [2, p.18].

It should be borne in mind that the this methodology is increasingly being modified and developed. Some researchers add money to the models, take into account various forms of market imperfections, and more flexible conditions for agents' choices. Such models can better explain certain aspects of economic reality and interact with modern economic debates than classical Real business cycle models.

Despite its influence, the Real Business Cycle theory has been heavily criticized. One of the main criticisms is that it focuses on supply-side variables, potentially neglecting the impact of demand-side factors on business cycles. Another key criticism is the assumption that the economy always functions at its natural level, ignoring the immutability of wages and prices and simplifying the complexity of output fluctuations.

Critics also question the conceptualization of recession as a period of technological regression, arguing that it contradicts the multifaceted nature of economic downturns. In addition, doubts have been raised about the theory's ability to explain short-term fluctuations, given the gradual spread of technological innovation and its inconsistent alignment with rapid economic change.

In addition, the limited consideration of monetary factors in RBC models has been criticized, as it is at odds with the real-world scenario where changes in the money supply have a significant impact on economic activity. This omission limits the model's explanatory power for observed output fluctuations.

Thus, although the real business cycle theory has proved useful and influential in certain respects, most economists believe that it does not provide a comprehensive explanation of the underlying fluctuations in output. Recognizing these criticisms and taking into account the ideas of alternative theories could help to improve and refine the Real Business Cycle theory concept [3].

Another group of theories is business cycle monetary theories. They are based on the idea that changes in the money supply and monetary aggregates can determine economic movements through their impact on the overall level of demand. These theories place money at the center of business cycles and examine the mechanisms by

which money affects economic activity.

The first monetary models of the business cycle were developed by the Austrian economist Ludwig von Mises and further developed by Friedrich von Hayek of the Austrian School of Economics. According to this theory, the credit cycle is the basis of business cycles. It starts with the expansion of credit, when banks issue loans and create new money, which leads to an artificial increase in money demand.

This artificial increase in money demand, particularly in the real estate and investment sectors, leads to overheating of markets. The growth in money demand contributes to an artificial increase in investment, as businesses gain access to affordable credit to expand production and projects.

The initial phase of the boom is characterized by rapid economic growth, but over time, instability and market over-saturation occur, leading to a recession. The Austrian theory considers recessions to be a necessary correction of the economy, which allows markets to correct imbalances and restore stability.

The Austrian business cycle theory provides a detailed explanation of the dynamics of economic booms and busts, focusing on the role of credit expansion and its impact on market imbalances. The initial phase of the business cycle, known as the expansionary or boom phase, is characterized by sustained economic growth. Central banks often intervene by lowering interest rates and increasing the money supply to stimulate borrowing and investment. Lower interest rates encourage businesses and consumers to borrow more money, which leads to increased spending on consumer and investment goods. Entrepreneurs undertake long-term capital projects, such as construction and infrastructure development, fueled by artificially cheaper credit. This phase is characterized by rising asset prices, booming stock markets, and a general sense of optimism in the economy. However, as the expansionary phase progresses, signs of instability and glut begin to appear. Excessive credit expansion leads to misallocation of resources as investments are made in projects that are not sustainable in the long run. Price distortions occur as prices for assets and goods are inflated above their true market value. Enterprises may overproduce in the expectation of constant demand. Eventually, the market reaches a saturation point and the boom turns into a

bust. This is followed by a recession, which is characterized by falling asset prices, reduced business investment, rising unemployment, and reduced consumer spending. The Austrian theory views recessions as a necessary correction of the economy, which allows markets to correct imbalances and restore stability.

Although the Austrian Business Cycle Theory has been criticized for its lack of a mathematical model and other theoretical limitations, it remains an important contribution to the understanding of business cycles, especially in the context of the impact of credit and money on economic instability [4, p.239-243].

Another theory is the Keynesian theory of the business cycle, based on the works of John Maynard Keynes and his followers, which highlights important aspects of economic fluctuations. In particular, it focuses on aggregate demand, considering it as a key factor determining the level of economic activity. According to this theory, fluctuations in output and employment arise from changes in aggregate demand.

The basic principle is that domestic consumption and investment are subject to significant changes due to factors such as expectations, income fluctuations, and market instability. Keynesians believe that these fluctuations can be smoothed out by government intervention, which stimulates the economy during downturns and restricts activity during booms.

In this context, monetary policy is seen as an effective tool that can influence the level of overall demand, provided that it is applied in accordance with specific circumstances. This theory also emphasizes the instability of market self-regulation, pointing to the need for active government intervention to achieve full employment. The Keynesian theory also takes into account the possibility of an "inflationary recession" when high unemployment rates coexist with rising prices.

The Keynesian theory of the business cycle, although it has found its application, has been criticized. The main arguments include an over-reliance on fiscal instruments that can be difficult to implement, as well as the risk of inflation due to money supply growth. Critics also point to the lack of consideration of microeconomic aspects and the possibility of reducing initiative and competitiveness due to the predominance of state regulation.

In general, despite criticism, this theory remains important and influential in discussing the mechanisms of business cycles, focusing on aggregate demand and the role of the state in regulating economic fluctuations.

Based on classical Keynesian economic thought, but taking into account a number of critical aspects and using microeconomic principles, the New Keynesian theory of business cycles emerged.

One of the key aspects of New Keynesian theory is the emphasis on price rigidity. Representatives of this theory, such as Nobel laureate Paul Krugman, believe that prices and wages can remain constant or change slowly, which affects aggregate supply and demand. The expectations of agents also play an important role in shaping consumption, investment, and employment decisions.

New Keynesian economists also advocate an active role for fiscal and monetary policy in regulating business cycles. They argue that these policy instruments are necessary to smooth out economic fluctuations and stimulate growth. A defining feature of the new Keynesian theory is the recognition of market imperfections, such as restrictions on competition and information inequality. These imperfections are considered inherent in real economic systems and are crucial to understanding economic dynamics. Scholars such as George Akerlof and Joseph Stiglitz have made significant contributions to the study of these aspects of market behavior. Thus, the new Keynesian approach to business cycle theory offers a comprehensive framework that integrates policy interventions and market realities to explain economic phenomena. [5].

To summarize, all the theories offer different approaches to understanding and explaining economic fluctuations. The real business cycle theory emphasizes technological shocks and long-term factors as the main determinants of economic cycles. This allows us to better understand how changes in productivity and resources shape the economic landscape over the long term.

Monetary theories of business cycles, based on the work of Ludwig von Mises and other representatives of the Austrian School of Economics, see cycles as the result of credit expansion and overheating of markets. Changes in the money supply

determine economic movements by affecting the overall level of demand.

The Keynesian theory of business cycles, based on the work of John Maynard Keynes, puts aggregate demand at the center of determining fluctuations in economic activity. It recognizes the role of government intervention through fiscal and monetary policy in stimulating the economy during recessions and reducing activity during booms.

Each of these theories has its advantages and disadvantages, and an understanding of business cycles can be more complete if we consider their interrelationships and the context in which they are applied. In summary, business cycle theories provide an important tool for studying and forecasting economic fluctuations, helping to uncover the complex mechanisms that determine economic development.

1.2 Approaches to defining drivers of the business cycle

In its original formulation, the Real Business Cycle theory theory asserts that technological shocks play a dominant role in driving economic fluctuations [6, p.562]. An initial shock in the form of technological progress shifts the production function upward. This leads to an increase in available resources, investment, consumption, and real output. As investment increases, the capital stock increases, which further increases real output, consumption, and investment. The theory of real business cycles explains short-term economic fluctuations based on the assumptions of the classical theory. According to this theory, business cycles are a natural and efficient response of the economy to the economic environment. This process of economic expansion continues unsteadily due to changes in technology that occur over time. According to Plosser, "this is a very real pattern driven by technological perturbations, and so it is called the real business cycle model."

Other shocks either have minimal or no impact on the cyclical behavior of the economy. In general, the main "wedges" considered in the RBC theory, in addition to technological shocks, include labor market wedges and monetary policy wedges.

Labor market wedges are associated with frictions or imperfections in the labor

market that lead to deviations from the efficient allocation of labor. Factors such as sticky wages or mismatches between workers and available jobs contribute to these wedges.

There is also a certain connection with the technology shock. When technological progress leads to a boom, the marginal product of labor increases. Employment and real wages increase. In response to high real wages, workers reduce their leisure time.

Conversely, when technological progress is unfavorable and declines, marginal product of labor, employment, and real wages are low. In response to low real wages, workers increase their leisure time. Thus, an important implication of the real business cycle theory is that real wages are procyclical.

Another important point is that the real business cycle theory assumes that wages and prices are flexible. They adjust quickly to clear markets. There are no market imperfections. It is the "invisible hand" that clears the market and leads to the optimal allocation of resources in the economy.

Real business cycle theory can also take into account the role of the real interest rate in response to a technology shock. Real interest is equal to the marginal product of capital. When favorable technological change leads to a boom, the marginal product of capital and the real interest rate increase. On the contrary, an unfavorable technological change leading to a recession reduces the marginal product of capital and the real interest rate. When the economy reaches a new steady state, the real interest rate eventually returns to its initial level.

The monetary wedge also includes deviations between the actual interest rate and the natural rate of interest, and various actions of central banks. Unexpected changes in monetary policy can create imbalances and affect the business cycle.

Fiscal policy plays a minor role in the real business cycle theory. Since the "invisible hand" controls the economy, the role of the state is limited. In fact, business cycles are the natural and efficient response of the economy to favorable and unfavorable technological shocks. A fiscal policy measure such as an income tax will negatively affect output and employment.

Money, on the other hand, plays no role in the theory of the real business cycle.

The money supply is endogenous in the real business cycle theory. It is fluctuations in output that cause fluctuations in the money supply. For example, when a favorable technological change occurs, output increases and the amount of money demanded increases. The banking system responds by increasing lending, and the central bank increases the money supply. As the money supply increases, prices rise [7].

Most modern dynamic macro models are based on a prototype of a real business cycle model. In an important paper, Chari, Kehoe, and McGrattan develop a methodology they call "business cycle accounting." The authors begin their analysis by applying a fundamental single-sector model of the real business cycle. They introduce four exogenous stochastic variables, which they call "wedges". These wedges function purely as simplified accounting tools-their appearance can be the result of external shocks or potential errors in the underlying RBC model due to frictions or adjustment costs. Using the underlying RBC model as a basis, they subsequently quantified the impact of these four separate wedges. This research has two main objectives: to identify the most promising external shocks affecting the business cycle, and to identify the types of frictions and adjustment costs that researchers should include in their models [8, p.1-2].

The efficiency wedge, the labor wedge, the investment wedge, and the government consumption wedge are four separate elements that are introduced into the analysis as stochastic variables. These wedges serve as accounting devices in the study, representing potential sources of inefficiencies, distortions, or external shocks within a single-sector model of the real business cycle. The efficiency wedge reflects variations in overall economic efficiency, the labor wedge takes into account labor-related factors, the investment wedge considers the impact on investment decisions, and the government consumption wedge covers variations in the structure of government consumption. The purpose of the study is to empirically measure these wedges to shed light on their role as business cycle drivers and to determine how to incorporate the relevant frictions and adjustment costs into economic models [9, p. 1-3].

In the article "On the Role of Technology Shocks as a Source of Business Cycles: Some New Evidence", Jordi Gali explores the importance of technology shocks in

shaping business cycles. The main objective of the study is to examine the role of technology shocks in shaping business cycles.

This paper revisits the empirical results on the role of technology shocks in business cycles, first presented in a previous paper by Jordi Gali in 1999. The author provides new evidence that supports the main conclusion of the 1999 study that exogenous technological change plays a limited role in shaping business cycles, if any.

In summary, the study confirms the findings of Galí that exogenous changes in technology play a limited role, if any, as a source of the business cycle. The author provides new evidence in support of the identification of technology shocks proposed in the previous paper. It is found that these shocks have a significant positive correlation with independent measures of technological change and are uncorrelated with measures of changes in capital gains tax.

In addition, the analysis extends the results to the euro area using a new dataset. Similar results for the euro area indicate that the limited role of technology shocks in causing economic fluctuations is not limited to the United States, but extends to both regions. In general, the study questions the relevance of real business cycle (RBC) models for understanding economic fluctuations in both the United States and the euro area [10, p.25-35].

The study "Investment Shocks and the Relative Price of Investment" by Alejandro Justiniano, Giorgio E. Primicieri and Andrea Tambalotti aims to evaluate the business cycle model of the new neoclassical synthesis, which includes two types of investment shocks. The paper discusses the following key aspects:

- first investment shock - this shock is identified with the relative price of investment, which indicates its role in shaping the value of investment goods;
- second investment shock - affects the production of fixed capital from investment goods or the transformation of savings into future investment. This shock is believed to be the main factor behind the business cycle fluctuations in the United States after World War II.

The overall goal is to understand and evaluate the impact of investment shocks on the business cycle, in particular, their ability to predict and explain economic

fluctuations in different periods. Investment technology shocks are identified as the main sources of variability of key macroeconomic variables with the frequency of the business cycle. An important conclusion is their role in the 2008-2009 recession, which emphasizes the importance of these shocks in understanding and predicting economic transformations [11, p.111-123].

In conclusion, the drivers of the business cycle are diverse and multifaceted, reflecting the complexity of economic dynamics. While some economists emphasize the role of monetary and fiscal policies in influencing economic fluctuations, others focus on factors such as technological innovation, consumer and business confidence, external shocks, and supply-demand dynamics. These varied approaches underscore the intricate interplay of factors that contribute to the cyclical nature of economic activity. In addition, recognizing the interconnectedness of these factors allows for a better understanding of how different economies respond to internal and external challenges, which ultimately contributes to more effective economic management and policy making on a global scale.

1.3 Theory of Business Cycle Accounting

In modern economic science, understanding and predicting fluctuations in economic activity is an important task for economists and policy makers. Having a systematic approach to analyzing these fluctuations allows for a better understanding of their causes and consequences, which in turn can contribute to more effective economic management.

Kydland & Prescott introduced real business cycle (RBC) modeling to understand macroeconomic fluctuations. Although this concept plays an important role in economics, there are cases when the neoclassical model needs to be adjusted to more accurately represent empirical data. For example, when building quantitative models, researchers are faced with decisions that sometimes deviate from the assumption of perfectly competitive markets in order to capture key features of the data. However, determining the optimal choice can be challenging.

While RBC models provide valuable insight into the sources and propagation mechanisms of business cycles, they are often criticized for their simplicity and inability to fully account for certain empirical features of the data. For example, RBC models tend to generate excessively volatile fluctuations in key macroeconomic variables, such as output and employment, that are not always consistent with observational data.

Business cycle accounting offers a method to help researchers navigate these decisions. Similar to growth accounting, which separates economic growth into factor accumulation and a residual component, business cycle accounting scrutinizes the origin of macroeconomic fluctuations based on changes in endogenous variables and four residual factors [12].

Business cycle accounting is a concept used in macroeconomics to understand fluctuations in economic activity over time, commonly referred to as business cycles. Its purpose is to decompose these fluctuations into various structural factors that can explain observed changes in economic variables such as output, employment, and investment.

The key idea behind business cycle accounting is to identify and quantify the contribution of different factors to the fluctuations observed in the economy. These factors typically include technology shocks, changes in productivity, fluctuations in the labor force, and changes in preferences or institutional arrangements. By decomposing the business cycle into these components, economists can gain insight into the underlying drivers of economic fluctuations.

Business cycle accounting often involves the use of mathematical models and econometric techniques to analyze historical data and estimate the contribution of various factors to observed economic fluctuations. This framework helps economists and policymakers better understand the sources of business cycles and formulate appropriate policy responses to mitigate their negative effects or enhance their positive impact.

The Business cycle accounting consists of two stages:

1. using the prototype economy to calculate wedges and injecting them back

into it, individually or in groups, to infer which ones have the greatest quantitative relevance to economic observations;

2. applying equivalence theorems, which are equivalence relations between the detailed economies models and the prototype economy.

The first generation of modern business cycle models consisted of simple, mostly real-world business cycle models with a representative consumer and a small number of factors affecting him or her. These models were used to study the extent to which a small number of shocks, say one or two, could explain the movement of major aggregates such as output, consumption, investment, and hours worked. In this concept, all economic behavior was derived from a single general equilibrium model in which agents adjust their behavior when policies, defined as rules, change and predict the future using the true probability distributions predicted by the model. A prominent example of such a model is the Prescott model (1986 year), which contains a representative consumer, one real exogenous technology shock, frictionless markets, and no money or nominal variables. Earlier versions of the first-generation business cycle models by Kidland and Prescott (1982 year) and Long and Plosser (1983 year) included much more complex real-world aspects of the economy [13, p. 151-153].

The first studies in this area documented the properties of macroeconomic data, which were often summarized in the form of a table of data moments, such as standard deviations, autocorrelations, and cross-correlations for variables such as output, consumption, investment, labor hours, and others. This table, called the "KP-table" after Kydland and Prescott, compares these moments in the data with those obtained by the model. The main differences between the model predictions and the actual data were often described as "anomalies". For example, one of the key anomalies in early studies was that the modeled changes in working hours fluctuated half as much as the actual data.

The then basic models of the real business cycle, which took into account only random changes in total factor productivity, generated fluctuations in the main aggregates that were mostly consistent with what was observed in the data, provided that the technology parameter was treated only as an exogenous factor. As shown in

Kydland and Prescott, they were impressed that their simple model, which ignored monetary factors, successfully coped with this task. However, this approach also raised some regular questions about its purpose and concept.

The early proponents of the real business cycle approach focused on developing models that did not take money and monetary policy into account for several reasons. First, their main goal was to create simple models based on consistent assumptions that could reproduce fluctuations in key aggregate variables such as output, consumption, investment, and labor hours as observed in real data. Second, the simplicity of these models was partly due to computational limitations in the late 1970s, which prevented the solution of more complex models that included multiple agents, frictions, and nonlinear dynamics. Third, real business cycle researchers were influenced by the failures of policy recommendations derived from earlier Keynesian models that contributed to the stagflation of the 1970s. As a result, they adopted a more cautious approach, focusing on building a solid foundation of macroeconomics, avoiding the pitfalls pointed out by Lucas's critique and the overconfidence of previous methodologies.

Real-world business cycle models are usually explained by technology shocks. The first researchers chose the aggregate productivity parameter in the production function as the key stochastic variable for two practical reasons. First, productivity is easier to measure given the functional form of the aggregate production function and data on aggregate output, capital stock, and labor hours. Second, the addition of a single shock almost anywhere in a single-sector growth model makes it difficult to determine the relationship between output, consumption, investment, and labor time that is reflected in the data.

For example, when a shock leads to a sharp decline in investment, it may cause consumption and investment to move in opposite directions, which is not consistent with the data. Investment may decline, but output will remain almost unchanged due to resource constraints. Thus, consumption must increase to meet the resource constraint. Cooper and Ejarke (2000 year) showed that shocks that affect the investment channel can lead to a negative correlation between consumption and

investment.

Consider the impact of shocks that reduce the desire to work, which leads to a decrease in the number of hours worked. With Cobb-Douglas production technology and a labor share of two-thirds, even with a 10% reduction in working hours, output falls by only 6.7%. However, if such shocks are the main drivers of the business cycle, then labor becomes much more volatile than output. This is not consistent with business cycles from the US to the Great Recession. Some researchers, such as Lagos (2006), show that policies that subsidize employment or the cost of firing labor can lead to a drop in average firm productivity and total factor productivity. Others, such as Chari, Kehoe, and McGrattan (2007 year), investigate how financial distress across sectors can distort the factor structure and lead to a drop in overall productivity [13, p. 156-158].

The second generation of business cycle models are medium-scale dynamic stochastic general equilibrium models, which are mainly related to the neo-Keynesian approach. They are more sophisticated than their predecessors and are designed to provide central banks with a tool for forecasting the real impact of money. These models are designed to simulate the behavior of about 10 aggregate time series, including output, consumption, investment, hours, and nominal rates. An important emphasis is placed on reproducing the behavior of these aggregates, but a clear explanation of the added shocks and disciplining the parameters remain problematic. As a result, these models are characterized by a complex combination of mechanisms that makes them difficult to understand.

One of the main methodological issues that divides second-generation macroeconomists is the development of models that avoid the Lucasian criticism. This means creating models that remain robust to political interventions, but that allow agents to freely choose contracts subject to constraints. First-generation models are based on technologies and constraints that determine the possibility of contracts and asset trading. Second-generation models also impose direct constraints on contracts, even if they are not in the agents' best interest, which may require government intervention. However, this approach can cause problems, as government intervention

can distort incentives and lead to unintended consequences.

Modern second-generation business cycle models, mostly neo-Keynesian, are aimed at helping central banks with medium-term forecasting and can be used to conduct policy experiments. In contrast, third-generation models aim to develop new, deeply grounded mechanisms for explaining business cycles and provide external validation. They are characterized by a focus on external validation of key mechanisms through independent evidence, as well as the consideration of heterogeneity at the micro level and a large number of micro data. This generation of models strives for disciplined inclusion of new parameters and features based on direct evidence, while maintaining complexity and not requiring aggregation for solution, unlike the first generation models.

Modern third-generation business cycle models are basically a continuation of the first-generation models, but thanks to the development of algorithms and computer technology, it is now possible to study them in greater detail. Previously, when creating models, researchers had to make assumptions to reduce heterogeneity to a representative level. However, now, thanks to new algorithms, it is possible to consider even accumulated heterogeneity without aggregating it.

The Great Recession did not lead to radical changes in macroeconomic modeling, but it did encourage researchers to develop models that better account for the interconnectedness of finance and the real economy. Since then, attention has focused on developing models that not only capture micro-level dynamics in detail, but are also capable of predicting macro aggregates from data.

The diversity of modern business cycle theories reflects fundamental differences in how economic systems function and fluctuate. Some attribute depressions to friction, external forces, or government mismanagement, while others see them as an inherent feature of self-regulating economic systems that may require government intervention. These opposing views, based on different worldviews and methodologies, may be irreconcilable. However, such debates, triggered by real crises, have historically stimulated theoretical progress in economics by benefiting from diverse perspectives.

The Business cycle accounting has become a widely used tool for business cycle

analysis, and since its inception, numerous studies have been conducted using the original methodology. Examples of such applications include Kobayashi and Inaba focusing on Japan, Simonovska and Soldering on Chile, and Lama on Argentina, Mexico, and Brazil. Some researchers concentrate their analyses on specific types of distortions, as seen in the studies by Restrepo-Echavarria and Cheremukhin or Cociuba and Ueberfedt, which delve into the labor-leisure margin, or in numerous studies focusing on total factor productivity, such as those by Islam, Dai, and Sakamoto. Another avenue of research examines selected sets of countries during particular periods of economic fluctuations, such as output declines, as demonstrated by Dooyeon & Doblas-Madrid [14].

Business cycle accounting is most often used to analyze various "crisis" situations such as war and post-war periods, crises, and depressions. Among the most recent studies, Daniel Fernandes analyzed the business cycle accounting framework for the COVID-19-induced recession in the Eurozone and the United States. His findings suggest that the efficiency wedge played the most significant role in causing economic fluctuations in the Eurozone, followed by the labor wedge and the investment wedge. Conversely, in the United States, the labor wedge was the main driving force, while the investment wedge played a secondary role. He proposes hypotheses, supported by his theoretical framework, to explain the different impact of the efficiency wedge in these two regions. This study sheds light on the distinctive dynamics of the COVID-19-induced recession in these countries, offering valuable insights for policy makers and researchers [15].

To summarize, business cycle accounting theory offers a systematic framework for analyzing the main drivers of business cycles in the economy. By decomposing fluctuations in aggregate output into various factors, such as an investment wedge and a government consumption wedge, among others, this theory provides valuable insights into the sources of economic fluctuations. By empirically analyzing and quantifying these wedges, policymakers and economists can better understand the underlying causes of business cycle fluctuations and develop more targeted policy responses.

PART 2. ASSESSING THE IMPACT OF DRIVERS ON THE BUSINESS CYCLE IN THE POST-WAR PERIOD

2.1 World experience of the war's impact on the country's economy

In the aftermath of military conflicts, countries face not only the immediate consequences of violence, but also the daunting task of rebuilding and revitalizing their economies. This section serves as a key to understanding the dynamics of military conflicts and their implications for post-war economic landscapes. By analyzing the data on military conflicts, we lay the foundation for a deeper study of the driving forces of the business cycle in the postwar period.

Armed conflicts have long been recognized as significant disruptors of economic activity, often with devastating consequences for affected countries. The destruction of infrastructure, displacement of populations, and depletion of resources associated with armed conflict can have a profound and lasting impact on economic development and prosperity.

National economies face a dilemma during economic recessions when some countries choose to stimulate the economy through war. This can be justified for several reasons. First, wars are known to stimulate domestic demand for goods, which can lead to increased production and economic prosperity. Secondly, the sharp increase in government spending that often accompanies wars usually stimulates economic growth through a multiplier effect. Studies also show that military spending can stimulate economic growth. In addition, wars sometimes expand foreign markets for domestic goods and provide access to strategic resources. From this point of view, war can be a decisive tool for a country to recover from an economic crisis.

While some researchers believe that external wars can have beneficial effects for countries in recession, there are others, such as A. L. McPhee, Jeffrey Blaney, and Vladimir Lenin, who dispute this claim. Some of them argue that wars occur mainly during periods of economic boom. Such scholars consider that a prosperous economy is necessary to support foreign wars and also believe that preparations for war take time

[16, p. 212].

McPhee studied historical data and found that wars tended to occur during periods of economic boom. He explained this phenomenon by the fact that the psychological impact of economic depression lasts longer than its economic consequences. Thus, when a country recovers from a depression, the economic recovery creates the conditions for war.

Other researchers, such as Jeffrey Blaney, share a similar view, believing that economic resources are a key condition for conducting external wars. This means that a country in economic recession is not able to effectively intervene in military conflicts. Blaney emphasized this idea by examining historical examples, such as Austria's failed attempt to recapture Silesia in 1749 and the postponement of the Japanese intervention in the Chesapeake in 1873 due to economic difficulties. Thus, he concludes that wars often do not occur during economic recessions.

At the same time, Vladimir Lenin, in his analysis of imperialism, focuses on the competition between monopolistic capital, which, in his opinion, leads to imperialist wars during economic booms. This is due to the growing concentration of capital and the competition for monopoly control. That is, he believed that imperialist wars occur after economic growth.

In fact, most on both sides have reached a consensus that emphasizes the political and economic benefits of war and that these benefits can influence the outbreak of war. According to this consensus, the economic reason for going to war is recession, and the rise or prosperity of the economy creates the preconditions for war in a country [16, p. 212-213].

Nevertheless, war can occur at any stage of the economic cycle, including expansion, crisis, recession, and recovery, and it is unrealistic to assume that wars occur only at certain stages of the business cycle. Even during periods of economic downturn, when domestic problems become particularly prominent, it is worth noting that they can exist at any stage of the cycle. In cases where countries cannot solve their problems through conventional economic measures, they may resort to military expansion to achieve their goals, which is known as the theory of "lateral pressure."

On the other hand, while countries in depression may have significant resource constraints for war, the decision to go to war is often based on a cost-benefit analysis. Even in times of economic crisis, governments can raise funds by issuing bonds to finance military operations. For example, Argentina, despite being in economic stagnation, decided to go to war for the Malvinas Islands (Falklands), forcing its economy to take a back seat. It is important to note that at the initial stage of an economic downturn, despite the crisis and possible depression, a country may still have the ability to engage in military action using its economic and military power.

Second, economic reasons for war include downward pressure on the economy or competition for monopoly capital. This means that wars can arise not only as a result of optimism or competition for capital, which can exist at any stage of the economic cycle. In particular, even in times of economic prosperity, there is a fear of a potential economic recession, which can serve as a catalyst for war.

Blaney pointed out that wars often occur during periods of economic boom, when general optimism fosters confidence in victory. However, this explanation does not take into account the difference in power between the warring parties. Such wars can be unequal, where one side has an advantage, and the outcome of the war does not necessarily depend on the economic condition of the country.

In addition, Lenin's theory, which explains war as competition between monopolistic capital, is limited in its application. It applies only to developed countries at the late stage of capitalism and does not explain most external wars, including those between developing countries.

Third, the business cycle may be related to the intensity rather than the outbreak of war. Some scholars, such as Nikolai Kondratiev and Joshua Goldstein, believe that the business cycle is not directly related to the outbreak of war, but that the outbreak of war during an economic boom seems to be more intense and long-lasting. In their analysis of the business cycle and war, Kondratiev and Goldstein found that the most dramatic and deadly wars occurred during periods of economic recovery.

Although the relationship between the outbreak of war and the business cycle is not entirely clear, the scale of war is likely to be influenced by the phase of the business

cycle in which the belligerents are located. This phenomenon may make sense, as countries in economic recovery have better financial capacity, making them more likely to engage in large-scale wars.

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In times of war, economies often undergo significant economic restructuring, as noted in the reviews by Rasler and Thompson and Van Raemdonk and Diehi. For example, military spending rose to 40% of GDP in the United Kingdom and the United States during the World Wars, and military personnel accounted for up to 10% of the population. Although increased military production, improved utilization rates, and higher productivity can potentially contribute to GDP growth, wars, especially those fought on a country's own territory, can also lead to significant disruptions in economic activity, increased uncertainty, and increased fiscal burdens.

In addition to affecting annual value added production, wars can have long-term consequences for the population, manifested in casualties, refugee flows, and declining birth rates. For example, ten years after the First World War, the populations of France, Germany, and the United Kingdom were smaller than in 1913, while the populations of Denmark, the Netherlands, and Spain were 13-24 percent higher than pre-war levels. Wars also damage human capital, and educational attainment stagnates or declines during wartime, while in comparator countries it continues to rise in non-war times. Ichino and Winter-Ebmer (2004) demonstrated that individuals in Austria and Germany who were 10 years old during World War II received less education than

their peers in neutral countries such as Switzerland and Sweden. As a result, these people suffered significant income losses even 40 years after the war, which indicates the long-term effects of war shocks [13, p.4].

Wars can severely deplete fixed assets through the destruction or displacement of infrastructure, while new investments can stall. For example, Mozambique's railroads lost more than 90 percent of their rolling stock during the 1977 civil war. Similarly, it took the United States 20 years after the 1861 civil war to rebuild its capital stock, and agricultural investment in the affected areas was suppressed for nearly 60 years. After the Second World War, in France, Germany, and Italy, fixed assets declined by 20-40% compared to 1939 and returned to pre-war levels in 20-25 years. Total factor productivity (TFP) may decline during wartime due to disruptions in production processes, but it may also increase to compensate for declines in population and capital stocks. This can happen if military technology is repurposed for civilian use (e.g., the Internet, nuclear power, or aircraft construction), government military research and development stimulates private investment, or firms innovate to compensate for labor and capital shortages (e.g., between 1941 and 1944, the number of man-hours required to produce the Liberty cargo ship in the United States decreased by 55%) [13, p.5-6].

Post-war recovery trajectories show considerable diversity, even when variations in economic destruction are taken into account (see Figure 2.1). In some cases, such as Italy after World War II, there was a marked surge in growth compared to pre-war levels. Conversely, in cases such as Egypt in the 1970s, the economy returns to its hypothetical growth trajectory shortly after the conflict ends. In many scenarios, however, recovery efforts stretch over decades. Take, for example, Japan's post-World War II reconstruction, often cited as an example of successful recovery, which took 23 years to reach the level of GDP per capita seen in a constructed comparison group. In some situations, income levels never fully recover to levels seen in comparable circumstances, as was the case in Iran after the Islamic Revolution and the Iran-Iraq War in the 1980s. Recovery can be particularly lengthy when subsequent conflicts disrupt the process, as in the case of Greece's recovery after World War I, which was hampered by World War II and the subsequent civil war [17].

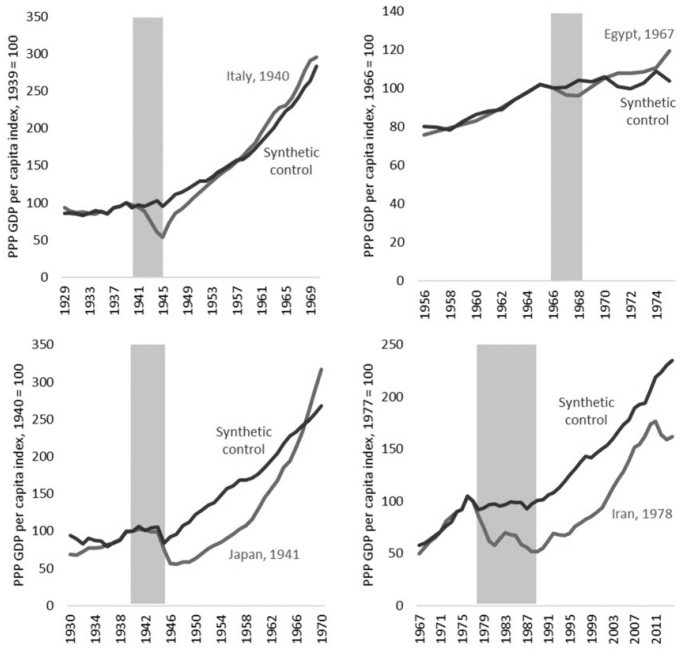

Figure 2.1 - Post-war reconstruction experiences vary widely across countries

Source: [17]

History shows that reconstruction after wars becomes particularly difficult in the case of fragile peace. After prolonged or unresolved conflicts and unstable peace agreements, the threat of renewed hostilities and persistent security problems make reconstruction much more difficult (as in the case of Afghanistan and Iraq).

Unfortunately, wars often recur. Only about 20% of wars end with at least 25 years of peace (see Figure 2.2). Surprisingly, 53% of civil wars are followed by new wars within the next six years.

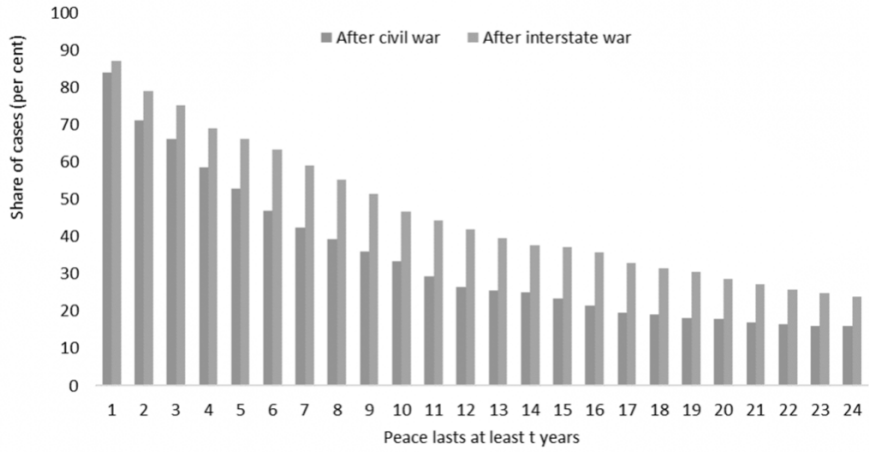

Figure 2.2 - Number of years from the war to the beginning of a new one

Source: [17]

Researchers Olaf de Groot, Carlos Bozzoli, Anusheh Alamir and Tilman Bruck

analyzed the economic impact of violent conflicts in 190 countries from 1970 to 2014. In their study, they compared actual GDP growth rates during conflicts with hypothetical rates in the absence of conflict. They also analyzed the effects of different types of conflicts (civil, interstate, and non-territorial), the intensity of the conflict, and the impact on neighboring countries. Their findings emphasize the significant economic impact of war. They show that global GDP could have been 12% higher on average if there had been no violent conflict since 1970. Civil conflicts have had a particularly significant impact on global GDP growth. Ongoing civil and international conflicts have impeded growth, especially as conflicts escalate. However, researchers have also observed a "phoenix effect," where conflict-affected countries have seen economic growth resume within a decade of the cessation of hostilities.

Cross-border conflicts negatively impact the growth of neighboring countries, but their economies thrive when they engage in conflicts beyond their borders. Looking at global and regional trends, developing countries bear the brunt of the economic damage from conflict, while most high-income countries benefit from engaging in mostly non-territorial conflicts [18].

2.2 Analysis of data on military conflicts

Analyzing data on conflicts worldwide from 1946 to 2022 reveals a concerning trend of increasing conflict frequency. Over this period, the number of conflicts surged from 17 to 55, representing a staggering 224% increase (Figure 2.3). This escalation underscores the persistent challenges faced by nations in maintaining peace and security.

These conflicts can broadly be categorized into two types based on the scale of violence and casualties:

- Minor Conflicts: These are characterized by between 25 and 999 battle-related deaths in a given year. While less intense in terms of casualties compared to major wars, minor conflicts still inflict significant harm on societies, disrupting livelihoods, and causing human suffering.

- Wars: This category encompasses conflicts with at least 1,000 battle-related deaths in a given year. These are the most severe forms of armed conflict, often involving large-scale military operations and resulting in extensive loss of life, widespread destruction, and profound socio-economic upheaval.

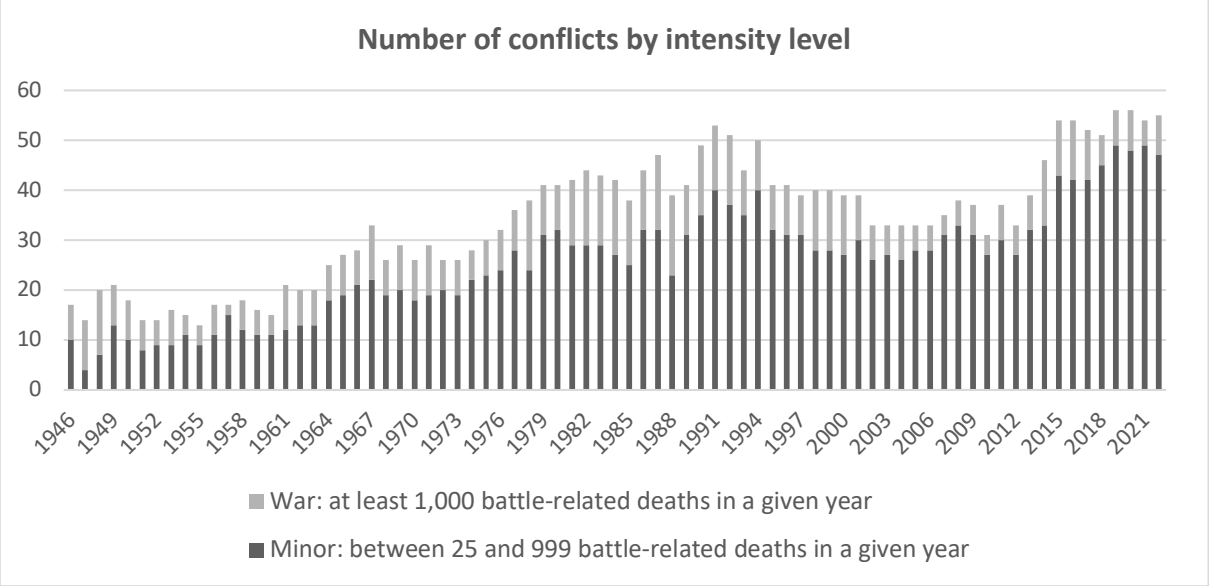

Figure 2.3 - Number of conflicts by intensity level

Source: Compiled by the author based on [19]

During the analyzed period, the majority of conflicts fell into the category of minor conflicts. Despite the lower casualty thresholds, these conflicts should not be underestimated in their capacity to inflict harm and hinder economic progress. Even minor conflicts can disrupt trade, deter investment, and divert resources away from productive uses, thereby impeding economic growth and development.

The analysis of conflicts can be further enriched by considering their classification into separate types, each characterized by specific dynamics and consequences. Here are four types of conflicts that are commonly distinguished (Figure 2.4):

- Extra-systemic conflicts: These conflicts occur between a state and a non-state group outside of its own territory. In such conflicts, the governmental party typically seeks to maintain control over territory that lies outside the state's conventional borders.
- Interstate conflicts: In interstate conflicts, both sides are states that are members of the Gladwich and Ward membership system. These conflicts are traditional forms of warfare between nation-states and can range from border

disputes to full-scale wars between sovereign nations.

- Intrastate conflicts: Intrastate conflicts, also known as civil wars, occur when a government faces opposition from one or more rebel groups within its own territory. These conflicts are characterized by internal disagreements and struggles for political power or control over resources.
- Internationalized intrastate conflicts: This category covers conflicts that are inherently intrastate (between the government and rebel groups) but are further complicated by the intervention of foreign governments with troops. In these conflicts, external actors may intervene directly or indirectly to support one or more parties, which often exacerbates existing tensions and prolongs the conflict. Internationalized intra-state conflicts blur the lines between domestic and international affairs, creating complex challenges for conflict resolution and peacebuilding efforts.

Figure 2.4 - Number of conflicts by types of conflict

Source: Compiled by the author based on [19]

Between 1946 and 2023, there were 88 intense armed conflicts that ended, including the war in Afghanistan, the Annexation of Hyderabad, the Libyan Civil War, the Iraq War, the Ethiopian Civil War, and others. Among them, there were 26 interstate conflicts, some of which started several times, such as the war between India and Pakistan. The confrontation between the countries began when both countries gained independence from Great Britain in 1947. The main stages of the conflict

include several wars, border clashes, and political tensions:

- the first Indo-Pakistani war (1947-1948): began immediately after the partition of British India and ended with a ceasefire and the establishment of the Line of Control in Kashmir;
- the second Indo-Pakistani war (1965): centered mainly around Kashmir, ended with no significant changes in territorial control;
- the third Indo-Pakistani war (1971): led to the creation of the independent state of Bangladesh from the former East Pakistan.

This was followed by the Kargil conflict in 1999 in the Kargil mountainous region of Kashmir, caused by the penetration of Pakistani forces into Indian territory.

The Indo-Pakistani wars had a significant impact on the economies of both countries and their post-war recovery. The first armed conflict between India and Pakistan occurred shortly after their independence in 1947. The 1947-1948 war for control of Jammu and Kashmir resulted in the expenditure of significant financial resources of both countries for military needs. This diverted funds from the economic reforms and social programs necessary for the newly created states, which affected their economic development in the first years of independence.

The second war in 1965 and the third war in 1971 also had a significant economic impact. The 1965 war again forced both countries to increase defense spending, which led to increased budget deficits and debt burdens. The 1971 war, which ended with the formation of independent Bangladesh, had even greater consequences for Pakistan, as the country lost a significant part of its territory and population, as well as important economic resources.

Postwar reconstruction in both countries was a complex and lengthy process. In India, the government tried to stimulate the economy through state planning and industrialization, which required significant financial resources. Pakistan, in turn, also focused on economic development, particularly agriculture and industry, but faced serious internal challenges, such as political instability and social problems.

Both countries eventually realized the need to normalize relations for economic growth. In the 1990s, after a series of reforms and economic opening, Pakistan began

to show high GDP growth rates, which significantly improved its economic condition (Figure 2.5). India, albeit at a less pronounced pace, has also implemented certain economic reforms.

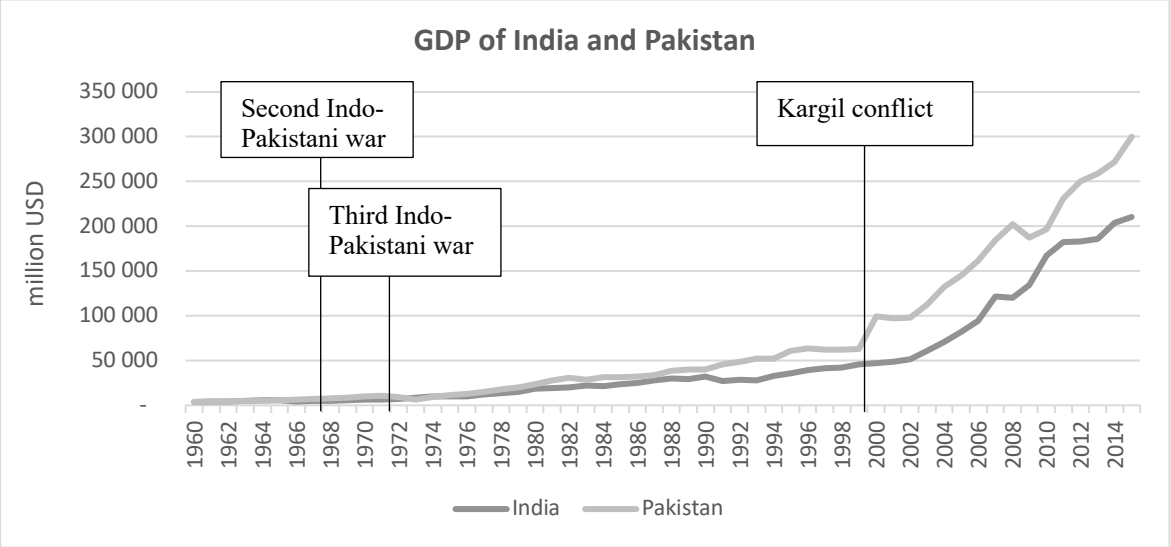

Figure 2.5 - GDP of India and Pakistan

Source: Compiled by the author based on [20]

Another major conflict is the Iran-Iraq War (1980-1988), a protracted military conflict between Iran and Iraq in the 1980s. Open warfare began on September 22, 1980, when Iraqi armed forces invaded western Iran along the common border, although Iraq claimed that the war began earlier, on September 4, when Iran shelled several border posts. The fighting ended in a ceasefire in 1988, but the restoration of normal diplomatic relations and the withdrawal of troops took place only after the signing of an official peace agreement on August 16, 1990.

The war engulfed Iraq's key oil production and export facilities in the south, disrupting plans to expand the oil sector and causing significant damage. Although Iraq continued to produce and export oil during the conflict and gained access to global trade due to distrust of Iran, its economic base was narrowed by prioritizing defense and food imports. The country's access to the capital market was effectively limited to official sources, such as export credit guarantees and loans from the Gulf Cooperation Council countries.

As shown in Figure 2.6, Iraq's development during this period was characterized by a stagnation of growth rather than a collapse of the economy. Although GDP per

capita stagnated during the 1980s, this was typical for oil exporters in the region due to low oil prices and production cuts in response to falling global demand. While in other developing countries, the loss of development momentum spurred structural reforms, in Iraq political reforms were postponed, leaving in place the structures of the 1970s with their strong state influence, rigid administrative procedures, subsidies, and the crowding out of the private sector.

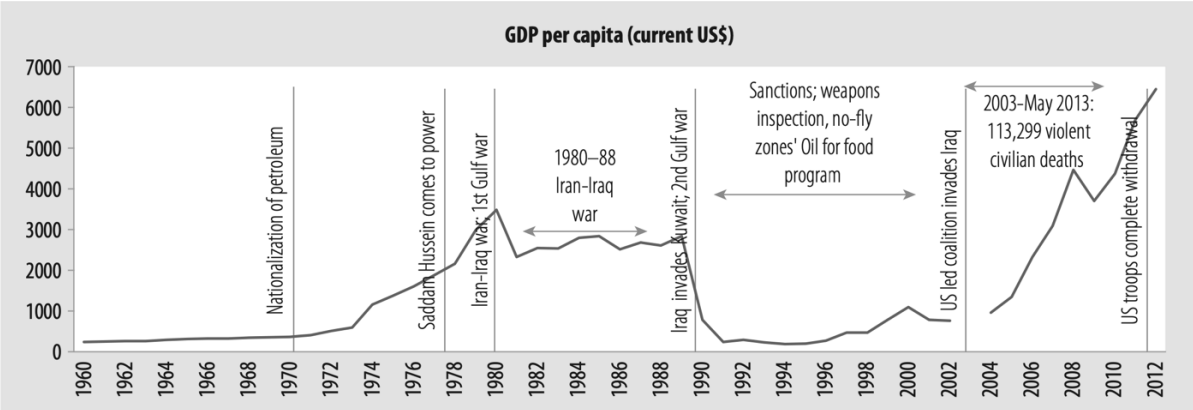

Figure 2.6 – Iraq GDP per Capital

Source: [21]

The end of the Iran-Iraq war did not bring a respite for Iraq. Although Iraq had the opportunity to use reconstruction efforts to rebuild, Saddam's regime focused on its own consolidation, creating an atmosphere of impunity that deterred any opposition. The war left the country with a large debt, much of which consisted of military loans from the Gulf states. Deteriorating relations with these countries due to the debt and Saddam's growing nationalist resentment led to the invasion of Kuwait in July 1990. This invasion provoked a multinational military operation to liberate Kuwait and the defeat of Iraqi forces in January 1991 [21].

A large number of armed conflicts are also observed in Israel. The Arab-Israeli war began after Israel's declaration of independence on May 14, 1948. The next day, a coalition of Arab countries, including Egypt, Syria, Jordan, Iraq, and Lebanon, invaded the newly created state. The war lasted until 1949 and ended in Israel's victory, although the country suffered significant losses and destruction. After the war, an armistice was signed that established temporary borders known as the Green Line.

In June 1967, tensions between Israel and neighboring Arab countries rose again.

Israel launched a preemptive strike against Egypt, Syria, and Jordan. In six days, Israel captured the Sinai Peninsula and Gaza from Egypt, the West Bank and East Jerusalem from Jordan, and the Golan Heights from Syria.

The ensuing War of Attrition (1967-1970) was a conflict between Israel and Egypt, supported by other Arab countries, following the 1967 Six-Day War. The fighting included artillery bombardments, air strikes, and localized skirmishes along the Suez Canal. The Yom Kippur War (1973) began with a surprise attack by Egypt and Syria on Israel during the Jewish holiday of Yom Kippur. The conflict lasted three weeks and ended with a UN-mediated ceasefire. The Lebanon War (1982) was an Israeli invasion of Lebanon to destroy the bases of the Palestine Liberation Organization. The operation led to a prolonged Israeli occupation of southern Lebanon. The Second Intifada (2000-2005) was a Palestinian uprising against the Israeli occupation that included mass protests, terrorist attacks, and military operations. Since 2008, Israel has conducted several major military operations in the Gaza Strip in response to Hamas rocket attacks, including Operation Cast Lead (2008-2009), Operation Pillar of Defense (2012), Operation Protective Edge (2014), and Operation Protective Edge (2021).

After the Lebanon War and the Second Intifada, Israel once again focused its efforts on restoring its economy and social stability. The country has been actively working to rebuild the destruction caused by these conflicts and has focused on improving the security of its citizens.

After the Lebanon War, which resulted in significant losses, Israel turned to reconstruction programs aimed at restoring infrastructure, housing and economic development in the affected areas.

During the Second Intifada, Israel again faced serious security and stability challenges. The country was forced to take decisive measures to strengthen its military presence in the border areas and introduce social programs to support those affected by the conflict. These measures helped to restore Israel's GDP, as shown in Figure 2.5.

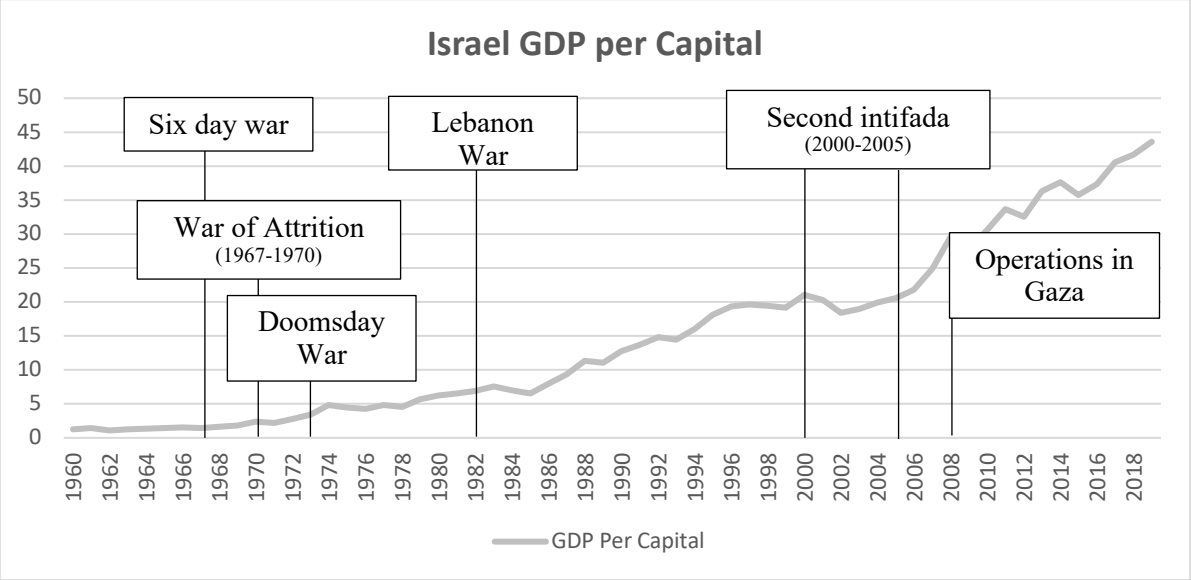

Figure 2.5 – Israel GDP per Capital

Source: Compiled by the author based on [20]

After the war in Pakistan, Israel, and India, these countries demonstrated an impressive ability to recover quickly. They actively focused their efforts on rebuilding infrastructure, economies, and social order, moving forward with determination and efficiency. In contrast, Iraq found itself in a more difficult situation, resulting in a slower and more drawn-out recovery process. The country suffered severe losses, and recovery was complicated by internal conflicts, political instability, and economic challenges. Although Iraq has also been actively working to rebuild its infrastructure and economy, the process has been slower and more convoluted due to the country's complex political and social environment.

2.3 Development of models for the analysis of the business cycle in the post-war period

In this section, we will focus on the subtleties of business cycles experienced by two countries: Georgia and Serbia in the post-war period. Each of these countries experienced war, albeit in different periods, leading to different economic landscapes in the aftermath. Therefore, our analysis will be tailored to understand the unique impact of these conflicts on each country's business cycles.

To achieve our research objectives, we chose the VAR (vector autoregression)

model, a powerful analytical tool widely used in econometrics. Unlike traditional ARIMA models, which focus on analyzing a single time series, VAR models extend the scope by simultaneously modeling multiple time series variables. The "vector" aspect refers to the inclusion of two or more variables, while the "autoregressive" aspect refers to the inclusion of lagged values of these variables in the model equation. With the help of VAR modeling, we can effectively investigate the relationships between different economic variables and determine how changes in one variable affect the entire system.

The significance of this study goes beyond the theoretical realm, as it has pragmatic implications for policy-making and strategic planning, especially in post-conflict scenarios. By revealing the complex dynamics of business cycles and identifying the driving forces behind economic fluctuations, our analysis aims to provide valuable information for the development of sound recovery and development strategies. These conclusions are relevant not only at the macroeconomic level, but also for the development of targeted political and economic policies tailored to the unique circumstances of each country.

To build the model, we selected the following indicators for the countries:

- GDP (productivity wadge): GDP is one of the most important economic variables, as it reflects the total production of all goods and services in a country. GDP is an important indicator of a country's economic health and growth;
- Foreign Direct Investments (investment wadge): This variable reflects the amount of foreign direct investment that flows into the country. Foreign direct investment is an important source of capital for economic development and can have a major impact on economic growth and stability;
- CPI (Consumer Price Index) (monetary wadge) - The Consumer Price Index reflects the average change in prices for consumer goods and services compared to the base period. This indicator is used to measure the level of inflation in the economy and its impact on consumer needs and the cost of living. The consumer price index is an important indicator for monitoring

inflation because it reflects how fast the prices of goods and services that consumers buy on a daily basis are changing. High inflation can lead to a decrease in the purchasing power of money and affect the economic stability of a country.

- Government deficit (government wadge): The fiscal deficit measures the difference between the government's revenues and expenditures. It is an important economic indicator because a deficit can indicate the need for borrowing to cover expenditures, which can affect the country's economic stability and credit rating.
- Net exports/GDP (external wadge): This indicator reflects the difference between the value of exports and imports as a share of GDP. It is a key indicator of external influence on the economy, showing how much a country depends on international trade. A positive value indicates a trade surplus, while a negative value indicates a trade deficit. As economies are open, this indicator is important for understanding economic dynamics and global competitiveness.

These variables reflect key aspects of a country's economic performance and can be used to analyze its economic cycle after a period of war. By analyzing the quarterly changes in these indicators over the 15 years after the war, we can get an idea of how each variable responds to different economic conditions and how they interact with each other.

Vector autoregressive (VAR) models are a powerful tool for analyzing the dynamics and relationships between multiple time series variables. However, for the effective application of VAR models, it is very important that the time series variables are stationary. Stationarity means that the statistical properties of the time series (such as mean, variance, and autocorrelation) remain constant over time. Non-stationary time series, on the other hand, exhibit trends, seasonal patterns, or other forms of systematic change over time [22].

When working with non-stationary time series, it is common to transform them into stationary ones by means of differentiation. This involves calculating the

differences between consecutive observations, which can help eliminate trends and make the series stationary.

In the context of the study, it was determined that the time series of price indices (GDP, external effect (Net exports/GDP), Consumer Price Index and Government deficit) are non-stationary in their levels, as evidenced by the test results (Figure 2.5).

Im, Pesaran and Shin Unit Root Test on UNTITLED

Null Hypothesis: Unit root (individual unit root process)
Series: GDP, FI, EF, CPI, BD
Date: 05/21/24 Time: 18:29
Sample: 2009Q1 2023Q4
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 5
Total number of observations: 286
Cross-sections included: 5

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-1.25784	0.1042

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Series	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
GDP	-0.0323	0.9511	-1.452	0.853	5	10	54
FI	-4.9755	0.0001	-1.520	0.750	0	10	59
EF	-1.5773	0.4877	-1.520	0.750	0	10	59
CPI	-0.6691	0.8459	-1.491	0.792	2	10	57
BD	-2.7151	0.0777	-1.491	0.792	2	10	57
Average	-1.9939		-1.495	0.787			

Figure 2.5 - Results of checking a group of data for stationarity (level) using the Dickey-Fuller test

Source: author's calculations based on data [23], [24]

However, after taking the first differences, all indicators become stationary. This transformation allows us to mitigate the problem of non-stationarity and ensures that the data are suitable for VAR modeling (Figure 2.6).

Im, Pesaran and Shin Unit Root Test on D(UNTITLED)

Null Hypothesis: Unit root (individual unit root process)
Series: GDP, FI, EF, CPI, BD
Date: 05/21/24 Time: 18:32
Sample: 2009Q1 2023Q4
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Total number of observations: 284
Cross-sections included: 5

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-13.1958	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Series	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
D(GDP)	-3.5999	0.0089	-1.456	0.833	4	10	54
D(FI)	-8.2544	0.0000	-1.521	0.773	1	10	57
D(EF)	-9.8003	0.0000	-1.521	0.751	0	10	58
D(CPI)	-7.2235	0.0000	-1.521	0.773	1	10	57
D(BD)	-4.6586	0.0003	-1.521	0.751	0	10	58
Average	-6.7073		-1.508	0.776			

Figure 2.6 - Results of checking a group of data for stationarity (1st difference) using the Dickey-Fuller test

Source: author's calculations based on data [23], [24]

There are different approaches to cointegration testing, including the two-step Engle-Granger test, the Johansson test, the nonparametric Phillips-Perron test, etc. We chose the Johansson test for the test. The Johansen test is a widely used method to test for cointegration between several variables in a time series. It is especially useful when dealing with systems of variables where the number of cointegration relationships is not known a priori. The test consists of estimating a vector autoregressive model (VAR) for the variables of interest and then examining the eigenvalues of the resulting model to correct for errors. The Johansen test provides two sets of statistics: the trace statistics and the maximum eigenvalue statistics:

- Trace statistics: This statistic tests the null hypothesis that the number of cointegration relationships is less than or equal to a given value. If the trace statistic exceeds the critical values provided by the Johansen test, then there is reason to reject the null hypothesis, indicating the presence of cointegration. The number of cointegration relationships is determined by counting the number of eigenvalues that exceed the critical values.
- Maximum eigenvalue statistic: This statistic tests the null hypothesis that the

number of cointegration relationships is less than or equal to a given value minus one. Similar to the trace statistic, if the maximum eigenvalue exceeds the critical values provided by the test, then the null hypothesis is rejected, indicating the presence of cointegration.

According to the first one, one cointegration equations are found, and according to the second one, one cointegration equation is found. Let's focus on the first option, since this statistic is considered more common in practice and more powerful (Figure 2.7). Identification of cointegration means that there is a long-term equilibrium relationship between the variables, which allows you to assess stable long-term relationships and facilitates the interpretation of their dynamic interaction.

Johansen Cointegration Test

Date: 05/21/24 Time: 18:38
Sample (adjusted): 2009Q3 2023Q4
Included observations: 58 after adjustments
Trend assumption: Linear deterministic trend
Series: GDP FI EF CPI BD
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.569408	87.60224	69.81889	0.0010
At most 1	0.320925	38.73181	47.85613	0.2711
At most 2	0.153148	16.28440	29.79707	0.6921
At most 3	0.079054	6.643095	15.49471	0.6195
At most 4	0.031670	1.866553	3.841465	0.1719

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.569408	48.87043	33.87687	0.0004
At most 1	0.320925	22.44741	27.58434	0.1983
At most 2	0.153148	9.641308	21.13162	0.7776
At most 3	0.079054	4.776543	14.26460	0.7697
At most 4	0.031670	1.866553	3.841465	0.1719

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Figure 2.7 - Results of the Johansen test

Source: author's calculations based on data [23], [24]

When a cointegration test, such as the Johansen test, shows cointegration between variables, it means that these variables can be considered in a vector error correction model (VECM).

The vector error correction model (VECM) is an extension of the vector autoregressive model (VAR) and takes into account the presence of cointegration

between variables. The peculiarity of VECM is that it allows to take into account both short-term and long-term relationships between variables.

After conducting the VECM analysis (Vector Error Correction Model) the model is further refined by testing the significance of individual lags. This process involves performing lag elimination tests to determine whether including or excluding certain lagged variables significantly improves the model's fit.

The lag elimination test shows that lags 1 and 2 are significant. This indicates that lagged values of variables from the previous one or two periods play a crucial role in explaining the current behavior of the system.

The significance of these lags indicates that there is a strong time relationship between the variables, and their past values have a lasting impact on the current dynamics. By including these significant lags in the model, we can account for time dependencies and better understand the dynamic interaction between variables.

When constructing a vector error correction model (VECM), the initial assumption is that all variables included in the model are endogenous, i.e., they are jointly determined within the system. However, in some cases, it is important to investigate whether certain variables can act as exogenous factors, influencing the behavior of endogenous variables without being affected by them.

To assess the exogeneity of certain indicators, VECM usually uses the Granger causality test. This test helps to determine whether past values of one variable provide useful information for predicting another variable, thereby indicating a potential causal relationship between them. The Granger causality test identifies Net exports/GDP as an exogenous variable (Figure 2.8).

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 05/21/24 Time: 18:47
Sample: 2009Q1 2023Q4
Included observations: 55

Dependent variable: D(GDP,2)

Excluded	Chi-sq	df	Prob.
D(FI,2)	11.20156	3	0.0107
D(EF,2)	1.647261	3	0.6487
D(CPI,2)	11.83554	3	0.0080
D(BD,2)	4.182583	3	0.2424
All	33.92179	12	0.0007

Dependent variable: D(FI,2)

Excluded	Chi-sq	df	Prob.
D(GDP,2)	38.46340	3	0.0000
D(EF,2)	13.26336	3	0.0041
D(CPI,2)	21.98692	3	0.0001
D(BD,2)	17.87915	3	0.0005
All	75.63549	12	0.0000

Figure 2.8 - Results of the Grander Causality test

Source: author's calculations based on data [23], [24]

This classification of the variable as exogenous can be explained by several reasons. First, the structure of the economy and its specialization can make exports stable and less dependent on domestic economic conditions. Second, international prices and global demand for goods and services have a greater impact on exports than domestic economic changes. Third, exchange rate fluctuations have a short-term impact on exports, but in the long run the impact is determined by the country's international economic position. Fourth, investments in infrastructure and production capacity for exports are long-term and independent of short-term domestic changes. Finally, political stability and government support for exports also contribute to the stability of this indicator, making it less sensitive to domestic economic changes.

Responses to external shock can be easily understood through impulse response functions, which play an essential role in unraveling the intricacies of a Vector Error Correction Model (VECM). Moreover, these functions help us determine the sensitivity levels of different variables within the model to any such outside innovation. By using these functions, we can observe how variables react with time following an initial disturbance due to an innovation or change introduced into one of the model's variables; typically viewed as cumulative effect over several periods. An insight drawn

from this study involves understanding the factors contributing towards sustaining or diminishing impact: magnitude, direction, and persistence of response that are usually identified by researchers through assessment procedures applied on shocks generated by system dynamics systems.

Impulse response functions were constructed as a tool to analyze the responsiveness of different indicators in the VECM model to external disturbances (Figure 2.9). With these responses computed, we are able to see how variations in one variable affect changes in other variables; this provides us with information on the transmission channels through which impacts are propagated, thus helping us understand the way disturbances evolve and their effects on business cycles.

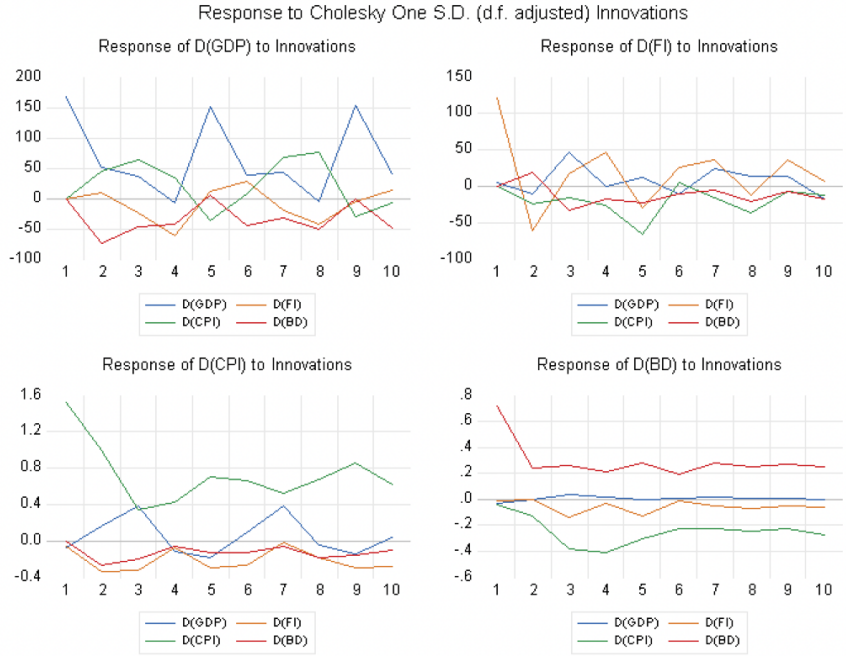

Figure 2.9 - Impulse response function (Combined graphs)

Source: author's calculations based on data [23], [24]

The graphical representation of the variance decomposition estimate for 15 periods provides valuable information about the variability and volatility of the variables under study. The analysis of variance decomposition allows us to understand the relative contribution of different sources of variation to the overall variability observed in the data (Figure 2.10).

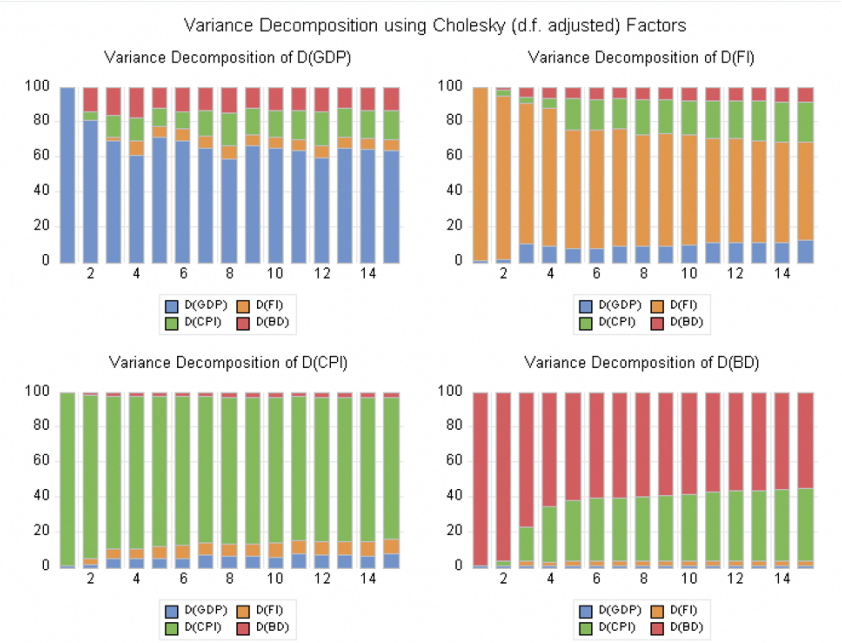

Figure 2.10 - Graphical display of the variance decomposition of the estimated VECM model (Combined graphs)

Source: author's calculations based on data [23], [24]

The Dickey-Fuller test is a widely used statistical test to assess the stationarity of a time series. In the context of applying to a group of residuals, the Dickey-Fuller test is analyzed using the vector error correction model (VECM). These residuals represent the difference between the observed values and the values predicted by the VECM model.

The main purpose of checking the residuals for white noise is to ensure that they exhibit random, uncorrelated behavior over time. White noise residuals indicate that the model has effectively captured and accounted for all systematic patterns and structures in the data, leaving behind only random fluctuations.

Figure 2.11 shows the results of the Dickey-Fuller test for the residuals. The test evaluates the null hypothesis that the residuals contain unit roots, which means non-stationarity. If the p-value is less than the selected significance level (usually 0.05), the null hypothesis is rejected, indicating stationarity.

Im, Pesaran and Shin Unit Root Test on UNTITLED

Null Hypothesis: Unit root (individual unit root process)
Series: RESID01, RESID02, RESID03, RESID04
Date: 05/21/24 Time: 19:12
Sample: 2009Q1 2023Q4
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Total number of observations: 215
Cross-sections included: 4

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-12.3796	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Series	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
RESID01	-7.0396	0.0000	-1.524	0.756	0	10	54
RESID02	-7.2510	0.0000	-1.524	0.756	0	10	54
RESID03	-7.5927	0.0000	-1.524	0.756	0	10	54
RESID04	-5.8111	0.0000	-1.523	0.778	1	10	53
Average	-6.9236		-1.523	0.761			

Figure 2.11 - Results of the residuals check for white noise

Source: author's calculations based on data [23], [24]

The results of the Dickey-Fuller test show that the residuals of each individual equation (RESID01-04) demonstrate stationarity, as evidenced by p-values less than 0.05. In addition, the aggregate p-value for all residuals is also less than 0.05, which indicates that the residuals of the developed VECM model in aggregate behave like white noise.

The finding that the residuals are white noise is important because it indicates that the VECM model adequately captures the underlying dynamics of the variables and effectively eliminates any systematic patterns or structures. This gives confidence in the reliability and validity of the model's predictions and forecasts.

In general, the results of the Dickey-Fuller test confirm the stationarity of the residuals and support the conclusion that the VECM model developed is reliable and suitable for analyzing the dynamics of the variables under study.

When testing residuals for normality of distribution, one common approach is to analyze the Jarque-Bera statistic, which assesses whether the skewness and kurtosis of the residuals deviate significantly from a normal distribution. The analysis focuses on the Joint Prob associated with the Jarque-Bera statistic, as shown in Figure 2.12.

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: Residuals are multivariate normal
Date: 05/21/24 Time: 19:17
Sample: 2009Q1 2023Q4
Included observations: 55

Component	Skewness	Chi-sq	df	Prob.*
1	-0.217802	0.434844	1	0.5096
2	0.867705	6.901693	1	0.0086
3	-0.251944	0.581863	1	0.4456
4	1.183057	12.82988	1	0.0003
Joint		20.74828	4	0.0004

Component	Kurtosis	Chi-sq	df	Prob.
1	2.611539	0.345817	1	0.5565
2	5.288772	12.00485	1	0.0005
3	3.132000	0.039930	1	0.8416
4	5.991304	20.50560	1	0.0000
Joint		32.89620	4	0.0000

Component	Jarque-Bera	df	Prob.
1	0.780661	2	0.6768
2	18.90654	2	0.0001
3	0.621793	2	0.7328
4	33.33548	2	0.0000
Joint	53.64448	8	0.0000

*Approximate p-values do not account for coefficient estimation

Figure 2.12 - Results of the test for the normality of the distribution of residuals

Source: author's calculations based on data [23], [24]

The Jarque-Bera test evaluates the null hypothesis that the residuals are normally distributed, with a p-value less than a selected significance level (usually 0.05) indicating rejection of the hypothesis, indicating a non-normal distribution.

In our case, the Joint Prob associated with the Jarque-Bera statistic is less than 0.05, which suggests that the distribution of the residuals is not normal. This means that the skewness and kurtosis of the residuals are significantly different from the normal distribution.

It is important to note that such situations when the residuals have a non-normal distribution are often encountered with small sample sizes. According to the Central Limit Theorem, as the number of observations increases, the distribution of sample means tends to approach the normal distribution. However, in our analysis, a small sample size can lead to a deviation from the normal distribution observed in the residuals.

While the deviation of residuals from the normal distribution can pose problems for certain statistical analyses, it is very important to interpret the results in the context

of the specific data set and research objectives.

The autocorrelation LM test is a statistical test used to evaluate whether the residuals of a model exhibit serial correlation, also known as autocorrelation. Autocorrelation occurs when the residuals at different points in time are correlated with each other, indicating that the model does not capture all the time dependencies present in the data.

In our analysis, the Autocorrelation LM Test command was applied to the residuals obtained with the VECM model. The results of the test, as shown in Figure 2.13, provide valuable information about the presence of serial correlation in the residuals.

VEC Residual Serial Correlation LM Tests
Date: 05/21/24 Time: 19:21
Sample: 2009Q1 2023Q4
Included observations: 55

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	9.663941	16	0.8836	0.590950	(16, 101.5)	0.8842
2	13.79401	16	0.6141	0.860014	(16, 101.5)	0.6157
3	8.488626	16	0.9330	0.516236	(16, 101.5)	0.9334
4	18.32834	16	0.3050	1.167456	(16, 101.5)	0.3069
5	10.04881	16	0.8641	0.615593	(16, 101.5)	0.8648
6	12.19148	16	0.7307	0.754394	(16, 101.5)	0.7320
7	17.96801	16	0.3258	1.142551	(16, 101.5)	0.3277
8	11.15537	16	0.7998	0.686933	(16, 101.5)	0.8008
9	8.785629	16	0.9220	0.535040	(16, 101.5)	0.9224
10	18.22071	16	0.3111	1.160008	(16, 101.5)	0.3130

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	9.663941	16	0.8836	0.590950	(16, 101.5)	0.8842
2	25.93867	32	0.7663	0.792447	(32, 108.5)	0.7719
3	48.67223	48	0.4458	1.011060	(48, 98.3)	0.4710
4	70.34412	64	0.2737	1.107297	(64, 84.5)	0.3281
5	86.29960	80	0.2953	1.055775	(80, 69.5)	0.4100
6	104.0310	96	0.2703	1.013163	(96, 54.0)	0.4874
7	116.5315	112	0.3657	0.850616	(112, 38.3)	0.7455
8	173.3814	128	0.0047	1.160384	(128, 22.5)	0.3540
9	244.8350	144	0.0000	1.036310	(144, 6.7)	0.5433
10	3820.568	160	0.0000	NA	(160, NA)	NA

*Edgeworth expansion corrected likelihood ratio statistic.

Figure 2.13 - Results of the test for serial correlation of residuals

Source: author's calculations based on data [23], [24]

The key parameter to consider when interpreting the results is the probability value (Prob). A Prob value greater than 0.05 indicates that there is no significant evidence of a serial correlation in the residuals for the corresponding lag. Conversely, a Prob value of less than 0.05 indicates that there is a consistent correlation.

In our case, the Prob values for most lags are greater than 0.05, which indicates that there is no significant serial correlation in the residuals. This means that the VECM

model adequately reflects the time dependencies in the data, and the residuals show random fluctuations that are not systematically related to each other over time.

The absence of consistent correlation in the residuals increases the reliability and validity of the VECM model's estimates and forecasts. This indicates that the model effectively reflects the underlying dynamics of the variables and provides unbiased and efficient parameter estimates.

In general, the results of the autocorrelation LM test provide confidence in the quality of the VECM model and confirm its suitability for analyzing the relationships and dynamics of the variables under study.

The results of the testing indicate that the VECM model is adequate for analyzing the business cycle in the context of post-war Georgia. The main conclusions drawn from the testing include:

- the white noise test confirms that the residuals of the model are random and have no systematic correlation with each other;
- all variables, except for export, are endogenous, which reflects their interdependence and influence on economic processes in Georgia;
- the residuals of the model do not contain autocorrelation, which confirms the correctness of the model specification and its ability to adequately reflect the data structure;
- the model is stable, which means that the impact of shocks on indicators disappears over time, and the system returns to a stable state;
- variance decomposition shows that the indicators of the model are interrelated and influence each other according to changes in the magnitude of shocks;
- the selected model specification is adequate, as it takes into account autoregression processes for many variables, of which 5 are stationary at levels and 3 are stationary at first differences.

The overall conclusion is that the selected model is suitable for analyzing the impact of shocks on the business cycle of Georgia in the post-war period, as it adequately captures the structure of the data and considers the interrelationships

between economic variables.

In a similar way, we estimated the post-war business cycle (15 years after the war) in Serbia. To define the model specification, we determined that all variables are stationary in first differences, 2 lags were chosen for the model, and as in Georgia, the variable that measures the external market (Net exports/GDP) is exogenous. According to the test results, the VECM model is adequate, the residuals are white noise and normally distributed, all variables are exogenous, and there is no autocorrelation in the residuals. In addition, the model is stable, and the impact of shocks on the indicators disappears over time.

The decomposition of variances in the analysis of the business cycle in Serbia after the war indicates a significant impact of some key factors on various aspects of the country's economy:

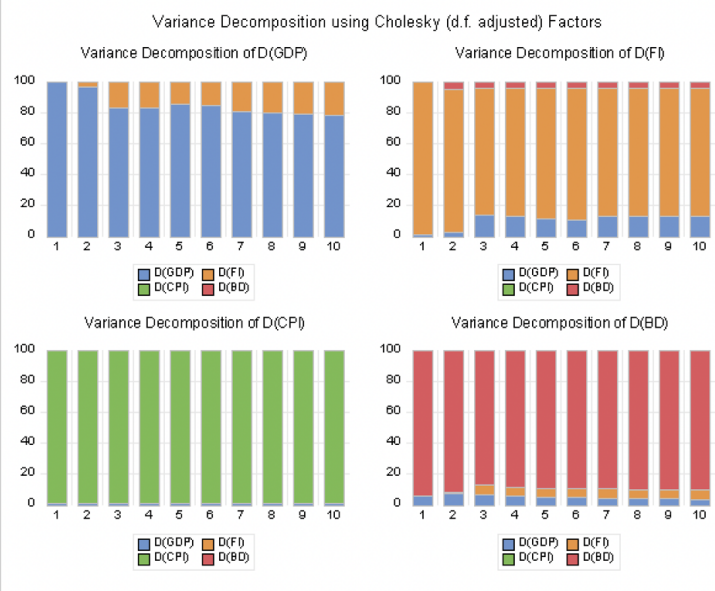

Figure 2.14 - Graphical display of the variance decomposition of the estimated VECM model (Combined graphs) Serbia

Source: author's calculations based on data [23], [24]

Overall, the results of the variance decomposition provide important insights into the key factors that influence Serbia's economic development and its foreign trade. They can be useful for formulating policies and strategies to promote sustainable economic growth and reduce the vulnerability of the country's economy to external factors.

PART 3. MODEL RESULTS AND RECOMMENDATIONS FOR POST-WAR RECONSTRUCTION IN UKRAINE

3.1 Georgia modeling results

In the previous section, we created VECM models to assess the post-war recovery of the two countries of Georgia and Serbia. The South Ossetian War, which began in August 2008, was an armed conflict between Georgia and Russia over disputes over the status and control of the regions of South Ossetia and Abkhazia. The conflict escalated when Georgian troops invaded South Ossetia in an attempt to establish control over the region, which had declared independence from Georgia. In response to this intervention, Russia launched a military operation, sending large numbers of troops and launching air and artillery strikes against Georgian positions. After several days of fighting, the parties agreed on a ceasefire and then a peace agreement under the auspices of international mediators, including the European Union and the Organization for Security and Cooperation in Europe.

The graphical display of the GDP variance decomposition of the estimated VECM model of Georgia shows that GDP itself has the largest impact on the country's GDP, followed by Consumer Price Index and the state budget deficit. There is also a small impact of foreign investment (Figure 3.1).

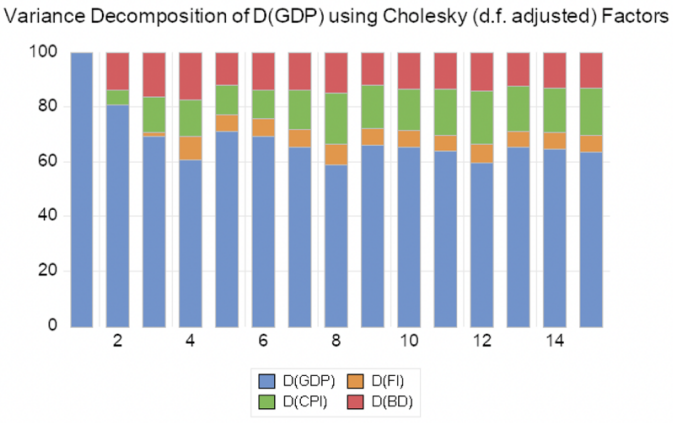

Figure 3.1 - Graphical display of the GDP variance decomposition of the estimated VECM model of Georgia

Source: author's calculations based on data [23], [24]

Heightened anxiety on August 11, sparked by fears of a further Russian military offensive, triggered a surge in bank withdrawals that amounted to nearly half a billion dollars in a few days. Despite efforts to stem the outflow, only a fraction of the withdrawn funds returned to banks over the next month, underscoring the serious economic problems faced by post-war Georgia [25, p.1]. This is why we can observe the impact of the monetary wedge in the period of 15 years after the war in Georgia.

To mitigate the risk of a banking crisis, the National Bank of Georgia made strategic decisions. It resumed refinancing commercial banks, providing a vital source of affordable credit for the banking sector. In addition, the bank lowered the interest rate on certificates of deposit from twelve to ten percent to discourage banks from buying NBG securities. In addition, the minimum reserve requirement for commercial banks was reduced from fifteen to five percent. While these measures averted a banking catastrophe, they also stimulated monetary expansion, which led to inflation. Faced with a difficult dilemma, the National Bank of Georgia prioritized preventing a banking collapse, realizing the dire consequences it could have had on the economy.

A significant trade deficit in Georgia's trade balance, when imports far exceeded exports, according to the analysis, caused instability of the Georgian lari exchange rate. The transition to a free trade regime with the United States and the European Union could have attracted more foreign direct investment, but negotiations with the US were at an early stage. The European Union has set conditions for Georgia's participation, including the adoption of labor and antitrust legislation aligned with European standards [25, p.2].

In October 2008, a donor conference in Brussels led by the World Bank allocated $4.5 billion in aid to Georgia, including $2 billion in grants and $2.5 billion in loans. This financial assistance, which was allocated in 2008-2010, was aimed primarily at overcoming the economic consequences of Russia's military aggression, which affected the country's business cycle and GDP, as we can see from the model we built for Georgia, and the investment leverage also had an impact on the post-war business cycle.

After the conflict, the International Monetary Fund also provided Georgia with a

$750 million stand-by arrangement, of which $250 million has already been transferred to the bank's reserves. Instead of allowing a gradual devaluation of the lari, the National Bank of Georgia opted for regular interventions in the foreign exchange market, spending over $300 million within a month to limit the devaluation of the lari to only 2.5% against the dollar.

However, on November 7, the demand for dollars from commercial banks increased to more than $31 million in the absence of an offer from them during the month. In response, Bank offered only $270,000 for sale, then suspended operations due to alleged technical problems, causing mass panic. After that, the bank organized "Green Friday", but the panic did not subside over the weekend. When the interbank currency exchange reopened on Monday, the National Bank of Georgia put up $47 million for sale, which led to a 15% devaluation of the lari compared to the morning of Green Friday. This led to a surge in attempts to sell the national currency, the reluctance of banks to issue loans, and a significant increase in the dollarization of the Georgian economy. With imports accounting for 80% of the consumer market, exchange rate inflation became a major post-war economic problem for Georgia [25, p.3-4].

Thus, according to the model, the business cycle in Georgia was significantly affected by the monetary, government, and investment wedges. This influence is observed because a large amount of money was withdrawn due to the population's fears of another attack, and to avoid a banking crisis, the central bank resumed refinancing commercial banks, but this led to inflation. In addition, Georgia received significant assistance from the World Bank and the International Monetary Fund, which helped stabilize the economy. The data shows the impact of foreign investment on GDP, reflecting the crucial role of international financial support in mitigating economic instability and promoting recovery. This assistance not only helped to overcome the immediate financial crises, but also contributed to long-term economic growth and structural reforms, emphasizing the interrelationship between monetary policy, government actions, and foreign investment in shaping the business cycle in post-war Georgia.

3.1 Serbia modeling results

The Kosovo conflict, which lasted from 1998–99, pitted ethnic Albanians against ethnic Serbs and the government of Yugoslavia (the remnant of the former federal state consisting of the republics of Serbia and Montenegro) in Kosovo. The conflict attracted widespread international attention and was resolved thanks to the intervention of the North Atlantic Treaty Organization.

The conflict in Kosovo and neighboring regions has caused significant economic damage to the economies of Southeast Europe. In Kosovo and other regions of the former Yugoslavia, especially Serbia, the destruction has resulted in tens of billions of dollars worth of infrastructure and production facilities. The conflict has seriously disrupted trade and transportation networks and increased the burden on already overstretched national budgets [26].

The conflict in Southeastern Europe is a significant external shock that has added to a series of challenges that have arisen since the beginning of transition in 1989. These included the collapse of the Comecon trading bloc, the trade embargo against the Federal Republic of Yugoslavia, and various emerging market crises. The conflict has upset the domestic political balance in several countries in the region, raising concerns about potential social unrest and diminishing support for ongoing reforms.

The large influx of refugees has put enormous strain on the social and economic structures of countries such as Albania and the "former Yugoslav Republic of Macedonia," not least in terms of immediate aid from national budgets.

Disruptions in trade and transportation (road and river), including due to more than sixty bombed bridges in the Serbian part of the Federal Republic of Yugoslavia, have harmed all neighboring countries for which the Federal Republic of Yugoslavia has traditionally been a major export market, including Bosnia and Herzegovina and the "former Yugoslav Republic of Macedonia". Bulgaria and Romania, as well as other countries such as Ukraine, were forced to look for alternative and more expensive transit routes around the Federal Republic of Yugoslavia in their trade with, say, Western Europe.

The graphical display of the GDP variance decomposition of the estimated VECM model of Serbia shows that GDP itself has the largest impact on the country's GDP, followed by foreign investment (Figure 3.2).

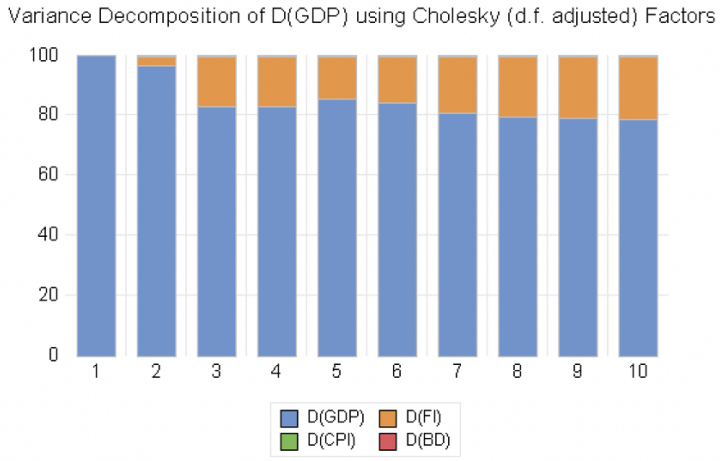

Figure 3.2 - Graphical display of the GDP variance decomposition of the estimated VECM model of Serbia

Source: author's calculations based on data [23], [24]

Serbia received substantial financial assistance after the Kosovo conflict under the European Union's Community Assistance for Reconstruction, Development and Stabilization program. The goal of this program was to contribute to the stabilization and development of the region through financial and technical support covering a wide range of sectors. The main areas of the CARDS program for Serbia included: institutional reform and capacity building, economic development and infrastructure rehabilitation, and support to the social sector.

In 2006, the CARDS Program was replaced by the Instrument for Pre-accession (IPA) which ran until 2013. The IPA was followed by the IPA II which brought Serbia 1.5 billion EUR in grants in the period from 2014-2020 (some 200 million EUR per year). The IPA II Program is focused on the key areas that should facilitate Serbia's preparation for its membership in the European Union. The European Union has provided more than EUR 3 billion in grant aid over the past two decades and has become Serbia's largest donor and number one partner in supporting development and ongoing reforms [27].

Serbia also received assistance from the International Monetary Fund. Under the

Stand-By Arrangement, assistance was provided in 2001, 2002, and 2009 to support macroeconomic stability and structural reforms, stabilize the budget, and support the financial sector. In 2011, the International Monetary Fund approved a new Stand-By Arrangement of approximately USD 1.3 billion to support public finance reforms and improve macroeconomic stability, and in 2015, a new three-year Stand-By Arrangement of approximately USD 1.2 billion was signed. This agreement included measures for fiscal consolidation, public sector reform, and improvement of the business environment.

In addition, Serbia has received assistance from the European Bank for Reconstruction and Development for infrastructure rehabilitation projects, small and medium-sized business development, and the banking sector. The U.S. Agency for International Development (USAID) and the German government provided assistance through the German Society for International Cooperation (GIZ) and the KfW Development Bank also provided bilateral assistance to Serbia to support economic and social development. International organizations such as the Organization for Security and Cooperation in Europe and the United Nations provided assistance in the areas of social development, poverty reduction, and environmental sustainability [28].

Thus, according to the VECM model, Serbia's business cycle in the postwar period has been affected by an investment wedge, which is confirmed by historical data on assistance from the European Union, the World Bank, the International Monetary Fund, the European Bank for Reconstruction and Development, bilateral assistance from the United States and Germany, and other international organizations. This assistance has played a key role in economic recovery and stabilization, contributed to infrastructure development, support for small and medium-sized businesses, financial sector reform, improved social standards, and strengthened environmental sustainability. The interaction between domestic economic performance and external investment has provided the conditions for Serbia's sustainable economic growth in the postwar period.

3.3 Recommendations for post-war reconstruction in Ukraine

As Ukraine finds itself in the midst of a full-scale war, the need for post-war reconstruction is becoming even more urgent and complex. The conflict, which encompasses not only military operations but also hybrid warfare tactics, cyberattacks, and information warfare, has caused significant damage to Ukraine's infrastructure, economy, and social fabric. Against this backdrop, planning for the future and laying the groundwork for post-war reconstruction is of paramount importance for Ukraine's long-term stability and prosperity.

Given the multifaceted nature of the conflict, recommendations for post-war reconstruction in Ukraine must address a wide range of issues, including damage to physical infrastructure, economic hardship, social displacement, deficits in governance, and erosion of trust and social cohesion. In addition, the ongoing nature of the conflict requires a forward-looking approach that takes into account the dynamics and uncertainty of the situation on the ground.

Post-conflict reconstruction in the broadest sense is a complex, comprehensive and multidimensional process that includes a variety of measures aimed at simultaneously improving military (restoration of law and order), political (governance), economic (rehabilitation and development) and social aspects (justice and reconciliation). The economic aspect of post-conflict reconstruction typically includes tasks such as distributing humanitarian aid, restoring physical infrastructure and facilities, improving social services, creating an enabling environment for private sector development, and implementing necessary structural reforms to ensure macroeconomic stability and sustainable growth.

Ukraine's post-war reconstruction challenge has been likened to that of Iraq and Afghanistan, but it differs significantly. Unlike those countries, Ukraine is a modern nation with an operational government and strong national unity. It is not grappling with insurgency or civil conflict and has demonstrated its ability to swiftly rebuild amid adversity. Moreover, Ukraine's digitalization of government services surpasses that of the United States and many European nations.

When seeking parallels, Ukraine's situation aligns more closely with post-war Europe, including Western Europe after World War Two, Central and Eastern Europe after the Cold War, and the Western Balkans following the breakup of Yugoslavia [29].

Based on the modeling in the previous section, we can conclude that monetary, investment, and government wedges are important for postwar recovery, and we believe it is also worth considering a Marshall Plan for Ukraine.

Considered one of the most famous post-World War II reconstruction programs, the Marshall Plan ushered in an era of unprecedented economic growth in Europe for two decades. While it is often cited as a model for rebuilding Ukraine, it is important to note that its impact went beyond simple financial assistance. While financing provided reconstruction assistance, its greater impact was in promoting sound policies. Moreover, the security provided by NATO has played a crucial role in ensuring Europe's successful recovery and sustainable economic progress [30, p.14-16].

The Marshall Plan was aimed at achieving three main goals: stimulating agricultural and industrial production, restoring currencies and public finances, and facilitating international trade. To ensure the effective implementation of the plan, recipient countries were required to develop coordinated recovery plans within the framework of the Organization for European Economic Cooperation. Although the initial proposals of the European countries differed, the United State Department set specific conditions to ensure that common goals were achieved.

The success of the Marshall Plan can be attributed to three key economic factors. First, it contributed to stabilization by overcoming high inflation and distorted production through balanced budgets and the abolition of price controls. Recipient countries were obliged to match the funds provided under the plan, which curbed nationalization tendencies and ensured compliance with stabilization programs.

The Marshall Plan for Ukraine is seen as a strategic partnership aimed at developing trade and investment. It envisages opening markets for Ukrainian goods and removing trade barriers in the form of customs privileges and quotas. This model should be introduced for a long period of time to become not only a component of business planning in Ukraine, but also to attract foreign investment in the production

of Ukrainian goods.

War often causes significant damage to infrastructure and assets, sometimes two to three times the pre-conflict GDP. For example, Constantinescu et al. [31] found that economic activity in Ukraine fell by 45% at the beginning of the war, and Blinov and Dzhankov estimate that Ukraine lost 7.5% of its production potential [32].

As of December 31, 2023, nearly US$152 billion in direct losses have been recorded in the nearly two years of conflict. The residential sector, transportation, trade and industry, agriculture, and energy have been most affected, with the highest concentration of losses in Donetsk, Kharkiv, Luhansk, Zaporizhzhia, Kherson, and Kyiv regions.In addition to direct damage, economic disruption and additional war-related costs, such as rubble removal, have resulted in total economic losses exceeding USD 499 billion.

The recovery and reconstruction needs as of December 31, 2023 are estimated at nearly USD 486 billion over a 10-year period. These needs cover both short-term recovery and medium-term reconstruction efforts aimed at building resilient, low-carbon and climate-resilient infrastructure, excluding needs already covered by the Ukrainian state budget or through existing partnerships and international assistance. Public investment priorities for recovery and reconstruction in 2024 amount to $5.7 million. These priorities include emergency conservation measures, restoration of damaged assets, urgent repairs of key infrastructure, and construction of shelters for cultural facilities.

The government is focusing its attention on financing physical infrastructure, with USD 197 million allocated for immediate measures. These measures include damage assessment, emergency measures such as rubble removal, asset repair, preservation of cultural heritage, capacity building of professionals, strengthening legal protection of the cultural sector, and support for the recovery of the creative industry and intangible cultural heritage [33, p.10-11].

The report points to a funding gap of $9.5 billion for the 2024 recovery and reconstruction priorities identified by the Ukrainian authorities. These priorities, totaling $15 billion per year, are focused on sectors such as industry and services,

housing and utilities, energy, social infrastructure, transportation, and cross-cutting needs.

Although these priorities will require more than $8 billion in investments from the state and state-owned companies, as well as nearly $7 billion in other public spending, a significant portion of the financial needs has already been covered by the state budget and donor assistance. Public spending could catalyze private investment of up to $5.5 billion, underscoring the vital role of the private sector in supporting recovery efforts.

The report emphasizes the importance for the Ukrainian authorities and international partners to strengthen implementation capacity, given the challenges of managing large amounts of funding in the current environment [33, p.15-18].

External assistance plays a crucial role in facilitating recovery efforts. After the Second World War, the US government's implementation of the Marshall Plan, which amounted to 2% of the country's GDP (equivalent to USD 450 billion today), contributed significantly to the post-war recovery and technological progress of European economies. Similarly, after the 1990-91 war in Kuwait, foreign contractors played an important role in exceeding pre-war levels of oil production and refining capacity by 1994.

However, differences in the amount of external aid received explain only about 10% of the variation in the time required for full recovery (within 25 years). Afghanistan and Iraq, despite significant investments (e.g., the United States alone spent $145 billion on reconstruction in Afghanistan), are examples of how large amounts of aid have not necessarily correlated with strong economic performance. According to the VECM model, we also see that the business cycle after the war recovery in Georgia and Serbia was significantly affected by the investment wedge.

Effective use of external assistance requires adequate local administrative capacity as well as lasting peace. Rapid assistance to boost support in the critical early postwar years, when a country's own resources may be limited, increases its effectiveness. Grants, rather than loans, can mitigate additional public debt, as demonstrated by the Marshall Plan, where 90% of disbursements were grants.

In addition, aid effectiveness is enhanced by national ownership and special agency administration, which simplifies bureaucracy and ensures coordination among different sources. Clear end-of-program provisions with predefined multi-year timeframes facilitate efficient budgeting, program clustering, and long-term infrastructure investments, as well as make programs more attractive to donors and help combat “reconstruction fatigue” [17].

Securing financing for reconstruction presents significant challenges. While aid remains critical and has historically catalyzed other sources of financing, it must be directed to high-risk aspects of reconstruction that private investment may avoid. Innovative approaches, such as the enterprise funds used in the post-Cold War reconstruction of Central and Eastern Europe, as well as philanthropic contributions, can complement aid.

Despite the emphasis on external aid, historical evidence suggests that private sector investment has been the main source of financing for reconstruction. Ukraine should attract both domestic and foreign investment, building on the success stories of Western Europe, Japan, and Central and Eastern Europe. To do so, Ukraine should prioritize securing international markets for exports, creating a favorable investment climate, and a reliable judicial system to enforce contractual obligations. Ukraine could attract another source of funding, in addition to aid and private investment: Russian assets-both international reserves and private assets-are frozen in the West. Although the exact figure is unknown, official assets are estimated at $300 billion.

A key challenge Ukraine will face is donor coordination. When donors work independently or duplicate efforts, it can overwhelm Ukraine and impede the reconstruction process. To address this problem, donors should create a framework to prevent overlapping initiatives and ensure that funding is aligned with Ukraine's priorities. It is important that major donors appoint responsible senior reconstruction coordinators with full authority to lead the effort. In addition, these coordinators should maintain regular communication and cooperation with the Ukrainian authorities on the ground, as sporadic donor conferences are not enough.

In addition to donor coordination, another important aspect is to determine the

sequencing and prioritization of key tasks. This includes actions such as demining, rubble removal, and the provision of basic services such as shelter and medical care. The right sequencing not only speeds up reconstruction, but also facilitates the return of refugees and internally displaced persons to their homes or new places of residence. Experience from other countries shows that internally displaced persons and refugees often need support to return, so proactive policies should be implemented to facilitate their resettlement. The introduction of initiatives such as mortgage lending can encourage people to return and kick-start economic recovery.

The second important wedge that may affect Ukraine's postwar business cycle in the future is monetary policy. In general, the analysis of the experience of Georgia and Serbia in conducting monetary policy in the post-war environment shows that there is no specific, generally accepted (and generally applicable) standard. Therefore, in such circumstances, it makes sense to talk about the need to develop our own monetary policy, adapted to a specific situation, which would in one way or another take into account the experience of other countries.

After the war, it is important to stabilize the national currency, control inflation, restore the financial sector, and support economic growth. Finally, it should be noted that the experience of many countries, as well as theoretical conclusions of well-known researchers, indicate that it is necessary to start preparing for post-war economic recovery even under martial law [34, p.156-160].

The third wedge that we identified in our modeling and that affects the business cycle in the post-war period is the government wedge. Confidence in the regulator played a vital role in avoiding trigger events for hyperinflation and potential bank runs, despite large-scale emission to support the budget and a one-time exchange rate adjustment. However, imperfect communication decisions regarding the key policy rate hike, the delay in introducing capital controls, and the slow adjustment of the monetary policy operational design underscore the need for adaptation not only in technical aspects but also in the institutional framework to respond effectively to postwar realities.

In conclusion, based on our research for Georgia and Serbia, we have determined

that in the post-war period, it is important for Ukraine to focus on three wedges: monetary, government, and investment. It is important for Ukraine to develop its own adapted monetary policy for the post-war period, taking into account the experience of other countries, in order to stabilize the national currency, control inflation, and support economic development. The government wedge has played an important role in maintaining confidence in the regulator, which has helped to avoid hyperinflation and bank runs, but communication solutions and the institutional framework need to be improved to respond effectively to postwar realities. It is also worth attracting foreign investment for reconstruction, and it is important to define the main tasks and control the use of funds. One option for post-war reconstruction is to develop a Marshall Plan for rebuilding Ukraine after the war, which could include large-scale financial and technical assistance from Western countries and international organizations. This plan could include providing financial support to rebuild infrastructure, reconstruct damaged facilities, develop the social sphere, and stimulate economic growth.

CONCLUSIONS

World history underscores the need for economic recovery and social stabilization after conflicts end. As Ukraine faces the challenges of post-war reconstruction in the future, understanding the drivers of the business cycle is particularly important in our current context.

The business cycle outlines the cyclical fluctuations in economic activity, which encompass expansion and contraction phases. These fluctuations cause changes in production, employment, investment, consumption, and other key economic indicators over time. A variety of theories, including real business cycle theory, monetary theory, and Keynesian theory, offer different perspectives on interpreting and explaining these economic dynamics. Although each theory has its own advantages and disadvantages, together they serve as indispensable tools for analyzing and forecasting economic fluctuations, unraveling the complex mechanisms underlying economic development.

One of the most important theories of the business cycle is Business cycle accounting, a theory used in macroeconomics to decompose business cycle fluctuations into the factors that cause them. This methodology was developed by V. V. Chari, Patrick Kehoe, and Ellen McGrattan and has similarities with previously implemented methods. The basic idea is that the economy follows a long-term trajectory that is affected by various frictions, or so-called "wedges". The first version of this methodology includes the following wedges: productivity, labor, investment, and government consumption.

We built a model to identify the wedges that affected the business cycle 15 years after the military conflict. The analysis of the post-war business cycles in Georgia and Serbia demonstrates the suitability of VECM models for understanding economic dynamics in these contexts. In both Georgia and Serbia, the VECM model demonstrates adequacy using various tests, confirming the randomness of residuals, endogeneity of variables, absence of autocorrelation, stability and interconnectedness of indicators.

According to the model, the business cycle in post-war Georgia was significantly influenced by monetary, government and investment wedges. This influence is observed because after the war, a large amount of money was withdrawn due to the population's fear of another attack and distrust of keeping money in the bank, and to avoid a banking crisis, the central bank resumed refinancing commercial banks, but this led to inflation - a monetary wedge. In addition, Georgia received significant assistance from the World Bank and the International Monetary Fund, which helped stabilize the economy. The data shows the impact of the investment wedge, reflecting the crucial role of international financial support in mitigating economic instability and promoting recovery.

Based on the VECM model, Serbia's business cycle in the postwar period was affected by an investment wedge, as evidenced by historical data on assistance from the European Union, the World Bank, the International Monetary Fund, the European Bank for Reconstruction and Development, bilateral assistance from the United States and Germany, and other international organizations. This assistance has played a key role in economic recovery and stabilization, contributing to infrastructure development, support for small and medium-sized businesses, financial sector reform, raising social standards, and strengthening environmental sustainability. The interaction between domestic economic performance and foreign investment provided the conditions for Serbia's economic growth in the postwar period.

To summarize, based on our research for Georgia and Serbia, we have determined that in the postwar period it is important for Ukraine to focus on three wedges: monetary, governmental, and investment. Ukraine should develop an adapted monetary policy, taking into account the experience of other countries, to stabilize the national currency, control inflation, and support economic development. The government wedge is important to maintain trust in the regulator, which helps to avoid hyperinflation and bank runs. However, communication strategies and the institutional framework need to be improved to respond effectively to post-war realities. In addition, it is necessary to attract foreign investment to rebuild the country, defining the main tasks and controlling the use of funds. One option for post-war reconstruction could be

to develop a Marshall Plan for Ukraine, which would include large-scale financial and technical assistance from Western countries and international organizations. This plan could include financial support to rebuild infrastructure, reconstruct damaged facilities, develop the social sphere, and stimulate economic growth.

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