ECONOMIC DEVELOPMENTS IN THE UNITED KINGDOM: A LONG-TERM PERSPECTIVE (2008–2024)

Birleşik Krallık'ta Ekonomik Gelişmeler: Uzun Vadeli Perspektif (2008–2024)

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Abstract

In this research, I conducted an analysis of the macroeconomic situation of the United Kingdom throughout various periods starting from the 2008 Global Financial Crisis and including topics such as Brexit, COVID-19, and the political instabilities that have affected the UK economy. I have used historical data and macroeconomics indicators, turned them into charts and also quoted from policy reports and interviews to further detail my research. Also, I have tried not to limit my analysis solely to macroeconomic data but also used political events and milestones to show how political turmoil can wreck investor confidence. The research paper also gives general information about the transformation of the UK economy from an industrial and agrarian-based economy to a huge service sector economy. This study finds that the UK had inconsistent monetary and fiscal policy coordination throughout the 2010s and 2020s. This did not happen once and in both situations, the overall economy was left in a worse position than before. One of them being the austerity policies adopted post-2008, which had affected and reduced the long-term productivity in the UK. This left the economy poorly positioned for future shocks and crises. Also, the UK economy was in a period of uncertainty for a long time, even long after the 2008 crisis, the reason being the Brexit talks and debates and also this was followed by COVID-19 and the turmoil within the UK politics. This research highlights the need for coordinated monetary and fiscal policy frameworks, sustainable economic goals and the importance of investor confidence. It also helps to understand the UK's post-crisis economic challenges and the consequences of the actions taken.

Anahtar Kelimeler:
Makroekonomik Politikalar,
Brexit,
İşgücü Verimliliği

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Öz

Bu araştırmada, 2008 Küresel Mali Krizi'nden başlayarak Brexit, COVID-19 ve Birleşik Krallık ekonomisini etkileyen siyasi istikrarsızlıklar gibi konuları da içeren çeşitli dönemler boyunca Birleşik Krallık'ın makroekonomik durumunu analiz ettim. Tarihsel verileri ve makroekonomik göstergeleri kullanarak bunları grafiklere dönüştürdüm ve araştırmamı daha da detaylandırmak için politika raporlarından ve röportajlardan alıntılar yaptım. Ayrıca, analizimi yalnızca makroekonomik verilerle sınırlamamaya çalıştım; aynı zamanda siyasi çalkantıların yatırımcı güvenini nasıl zedeleyebileceğini göstermek için siyasi olayları ve dönüm noktalarını da kullandım. Araştırma makalesi ayrıca, Birleşik Krallık ekonomisinin sanayi ve tarıma dayalı bir ekonomiden büyük bir hizmet sektörü ekonomisine dönüşümü hakkında genel bilgiler de sunmaktadır.

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	Bu çalışma, Birleşik Krallık'ın 2010'lar ve 2020'ler boyunca tutarsız bir para ve maliye politikası koordinasyonuna sahip olduğunu ortaya koymaktadır. Bu durum bir kez yaşanmamış ve her iki durumda da genel ekonomi eskisinden daha kötü bir durumda kalmıştır. Bunlardan biri, Birleşik Krallık'taki uzun vadeli verimliliği etkilemiş ve azaltmış olan 2008 sonrası kemer sıkma politikalarıydı. Bu durum, ekonomiyi gelecekteki şoklar ve krizlere karşı zayıf bir konumda bıraktı. Ayrıca, Birleşik Krallık ekonomisi, 2008 krizinden çok sonra bile uzun bir süre belirsizlik içindeydi. Bunun nedeni, Brexit görüşmeleri ve tartışmaları ile bunu takip eden COVID-19 ve Birleşik Krallık siyasetindeki çalkantılardı. Bu araştırma, koordineli para ve maliye politikası çerçevelerine, sürdürülebilir ekonomik hedeflere ve yatırımcı güveninin önemine vurgu yapmaktadır. Ayrıca, Birleşik Krallık'ın kriz sonrası ekonomik zorluklarını ve alınan önlemlerin sonuçlarını anlamaya da yardımcı olmaktadır.

1.INTRODUCTION

The economy of the United Kingdom has always played an important and crucial role in the global economic system. It has transformed and changed over the centuries from its agrarian roots to become one of the most service sector-based economies in the world. In order to understand the effects and the aftermath of the crucial events the Kingdom has seen in the last few decades such as the 2008 global financial crisis, Brexit and the COVID-19 pandemic, which put an end to the steady GDP growth of 2.4% between the years 1992-2007(Office for National Statistics [ONS], 2024), crucially we have to first understand the history and structural characteristics of the United Kingdom's economic identity.

The UK economy moved on from feudalism and the agrarian economic systems, but after the mid 18th century, it was later transferred to an industrial economy with the Industrial Revolution. The first impacts of this revolution brought rapid industrialization, urbanization, and technological innovation within the UK economy. The UK became a global industrial leader in few sectors that had a boost with the massive industrialization such as coal, textiles, and steel. These were the building blocks of mass production and global trade.

By the mid 20th century, the UK experienced significant deindustrialization due to the ever-increasing global competition and domestic policy reforms of Prime Minister Margaret Thatcher, such as the privatization of state-owned industries(Centre for Public Impact [CPI]), deregulation measures, particularly in London. The effects of the reforms implemented by the Prime Minister to deregulate the markets and move to a more neoliberal approach, the manufacturing sector has lose its importance, and the economy has started an accelerated shift towards the service sector. We can see the results of this in the current economic situation of the UK economy because The UK is a predominantly services economy, with services accounting for roughly four-fifths of output and employment (House of Commons Library; ONS). London emerged as a global financial hub in finance, insurance and professional services. The UK's economy was reshaped after the deregulation and reduced government intervention, this meant lower transfer payments and less government spending to maintain a higher proportion of resources in the financial markets for firms and individuals.

Even though the service led economic model has brought dynamism and increased the FDI relative to GDP(IndexMundi, 2020), particularly from the late 1980s, it has also brought vulnerability and left the UK heavily exposed to global financial market shocks. The 2008 global financial crisis showed the fragile nature of the UK economy, with the UK entering a deep recession due to its heavy reliance on global capital flows with the addition of the service and financial sectors making up the most of the UK economy this made it a more complex problem to solve for the UK government. The response

included monetary easing and austerity measures, which were the basis of the post-crisis recovery, but this led to weakened public investment.

The following years were not easier for the UK government either. The expected economic bounce back from the 2008 financial crisis significantly slowed down after further political and economic complexities. This slow down also effected the productivity growth and since the Global Financial Crisis, productivity growth has been unusually weak by historical standards (BoE; IFS; Crafts et al.) This process began with the Brexit referendum of 2016. The decision to leave the EU started a period of uncertainty. Since the EU was first formed as an economic union, getting out of this agreement was going to disturb trade relationships, investment flows and labor mobility. Especially the small businesses were going to be affected since their sales were also happening mainly with the EU member states. Also the additional cost of exporting affected the profit margins of the small businesses. The decision to leave the European Union deepened the economic struggles of the post-2008 crisis and it was a challenge for sectors deeply tied to European markets. Just as the UK's economic expectations were adapting to the post-EU era, the COVID-19 pandemic disrupted economic activity and crushed the economy with a huge strain of needs in government financing. The nature of the UK's heavy service sector-based economy caused a deeper effect compared to other G-7 countries because the lockdowns prevented face to face sales and interactions, which is the main element in a service sector. This has increased the length of the economic recovery.

It can clearly be seen in the table1 that the UK economy suffered for a long time even after the 2008 period. Between 2016-2020 the UK had a low interest rate (0,6%) but the GDP growth rate was negative during this period and. This is a key element to show how the economic mismatch between the Bank of England and the government fiscal policy and also the political uncertainties such as the BREXIT effected the whole economy. This uncertainties of households can be seen in the figures of Consumption Expenditure and the credit flow rates. Both did slow down during this period. This low interest rate lasted for a long term which can be a beneficial element after slowdowns but in 2019 and 2020 with covid there was low interest rate to help businesses and also the government help such as the 'Eat out to help out Scheme' These schemes created excess demand and shoot up the inflation in a rapid way after the COVID period especially in 2022 all around the globe with the UK having inflation figures up to 7.9% in 2022. Still up to this date UK is not able to achieve its 2% inflation target and still having to deal with the results of excess inflationary measures. But the inflation is slowing down and getting closer to the target.

In addition to the economic shocks, there were also various political instabilities that had affected the UK economy. These instabilities also delayed, slowed down the economic recovery and even deepened the crisis in some areas. Especially what happened in the beginning of the 2020s, the frequent changes in the number 10, such as Liz Truss, who had the residency at number 10 as a PM only for fifteen days, making her the shortest serving PM in British history.

This study was organized by using historic data and was not just only limited with economic indicators, but rather also focused on the political side of the UK economics. This was done to achieve a more representative analysis which can help to identify the problems that United Kingdom suffers from. Also another key element was unlike many single event studies by having multiple periods in recent history mentioned it was aimed to creat a link between political and economic developments. This study also aims to be a bridge between macroeconomic analysis and forward looking recommendation in areas such as fiscal and monetary coordination, regional disparity and taxation system.

Table 1. British Historical Economic Parameters

Parameters	2000–2008	2008–2016	2016–2020	2020–2024
GDP Growth Rate	2.2%	1.2%	–1.2%	3.7%
Disposable for final expenditure Total (C+I+G) – average growth	2.0%	1.2%	–0.2%	1.0%
• Government Expenditure (mean annual growth)	3.3%	1.1%	1.1%	2.5%
• Consumption Expenditure (mean growth)	1.7%	1.3%	–1.0%	0.6%
• Gross Fixed Capital Formation (mean growth)	1.9%	1.3%	0.9%	1.0%
M3 Growth (%)*	6%	4%	7%	5%
Interest Rate (Bank Rate)	5.3%	1.8%	0.6%	4.0%
Consumer Prices (HICP/CPI)	2.5%	2.5%	0.8%	5.1%
Private Sector Credit Flow				
• Credit flow (% of GDP)	9.5%	6.0%	–1.0%	3.5%
• Household credit flow	3.0%	2.5%	–0.5%	1.0%
• Non-financial corporations' credit flow	6.5%	3.5%	–0.5%	2.5%
Private Sector Debt				
• Net lending to private sector (% GDP)	9.5%	6.0%	–1.0%	3.5%
• Private sector debt (% GDP)	255%	240%	220%	230%
• Household sector debt (% GDP)	115%	110%	90%	95%
• NFCs sector debt (% GDP)	140%	130%	130%	135%
• Unemployment rate (3-yr avg)	5,2	6,95	4,2	4,1
Exports and Imports (%)				
• Exports (total growth)	3.0%	1.5%	–1.5%	2.0%
– of goods	3.5%	1.0%	–2.0%	1.5%
– of services	2.5%	2.0%	–1.0%	2.5%
• Imports (total growth)	4.0%	2.0%	–2.5%	2.5%
– of goods	4.5%	2.5%	–3.0%	3.0%
– of services	3.5%	1.5%	–2.0%	2.0%
Net Exports				
• Net exports (growth)	–1.0%	–0.5%	1.0%	0.5%
• Net exports share (% GDP)	–2.0%	–1.5%	–0.5%	–1.0%
Non-Financial Corporations				
• Profit Ratio (% value added)	50%	55%	60%	65%
• Capital Formation Ratio (% value added)	20%	22%	23%	25%
Financial Corporations				
• Property income received (% total assets)	1.0%	0.8%	0.7%	1.0%
• Property income paid (% total liabilities)	0.8%	0.7%	0.6%	0.8%
General Government (consolidated % GDP)				
• Total revenue	41%	43%	41%	42%
• Taxes and social security contributions	35%	36%	34%	35%
• Total expenditure	43%	44%	47%	45%
• Government debt	40%	60%	90%	100%

2.2008 CRISIS AND MACROECONOMIC EFFECTS ON THE UK'S ECONOMY

The 2008 global financial crisis was one of the most significant economic events in modern economic history. It first began in the United States but quickly escalated and spread worldwide due to a lack of risk management in the financial institutions (Financial Crisis Inquiry Commission, 2011). With the loss of confidence, the crisis spread to other countries worldwide. At its core, the crisis was the widespread usage/injection of subprime mortgages. High-risk loans were given to borrowers with poor credit histories. At some point, people were not even asked for their income statements when getting a mortgage, income verification was bypassed altogether (Mian & Sufi, 2014). Then the loans were bundled into complex financial instruments such as mortgage-backed securities.

These instruments were like bets on other people's mortgages. When a person takes out a home loan, investors buy a financial product that earns money as long as that homeowner keeps up with his/her mortgage payments. These are like bets on whether that new homeowner (owner of the loan) can pay

the installments of the loan or not. However, other people started to create new financial products based not on the original loan but on whether the first group of investors would make or lose money on their bets. As this cycle goes on, as housing prices in the U.S began to fall and mortgage defaults surged, the value of these securities declined drastically and triggered enormous losses for financial institutions.

The excessive leverage used by the major banks and financial firms made them highly vulnerable to even a small decline in asset values. With the addition of the lack of regulations on mortgages and financial instruments created around the mortgages, this allowed risk to accumulate unnoticed until it was too big to ignore. It began in 2007 and reached its peak in September 2008 when Lehman Brothers, one of the largest investment banks globally, filed for bankruptcy(Norada Real Estate, n.d.). It started a chain reaction in the global financial system. The fragility of the banks and institutions filled with CDOs and MBS was shown to investors and the public. This wrecked the confidence of investors and froze credit markets.

The crisis struck the United Kingdom most severely. Some of the major UK banks include the Royal Bank of Scotland (RBS), Lloyds TSB, and HBOS. The banks were at risk of bankruptcy because their portfolios were filled with risky holdings such as CDOs and MBS (Bank of England, 2011). The UK government had to intervene and prevent the banking system from collapsing by starting a bailout process. With the Global Financial Crisis of 2008, the UK economy fell into a period of structural weakness and underperformance. This was contrary to pre-crisis expectations for the growth of the kingdom's economy. There were several reasons why this underperformance arose, and one of the foremost issues started with how the crisis was handled. The government at the time was led by Prime Minister David Cameron. They have adopted a fiscal strategy to reduce the rising budget deficit that the UK was facing. The strategy involved severe cuts in government spending on an unprecedented scale since World War II (Institute for Fiscal Studies [IFS], 2015). The size of the budget reductions between 2010 and 2019 can be seen from the given figure 1.

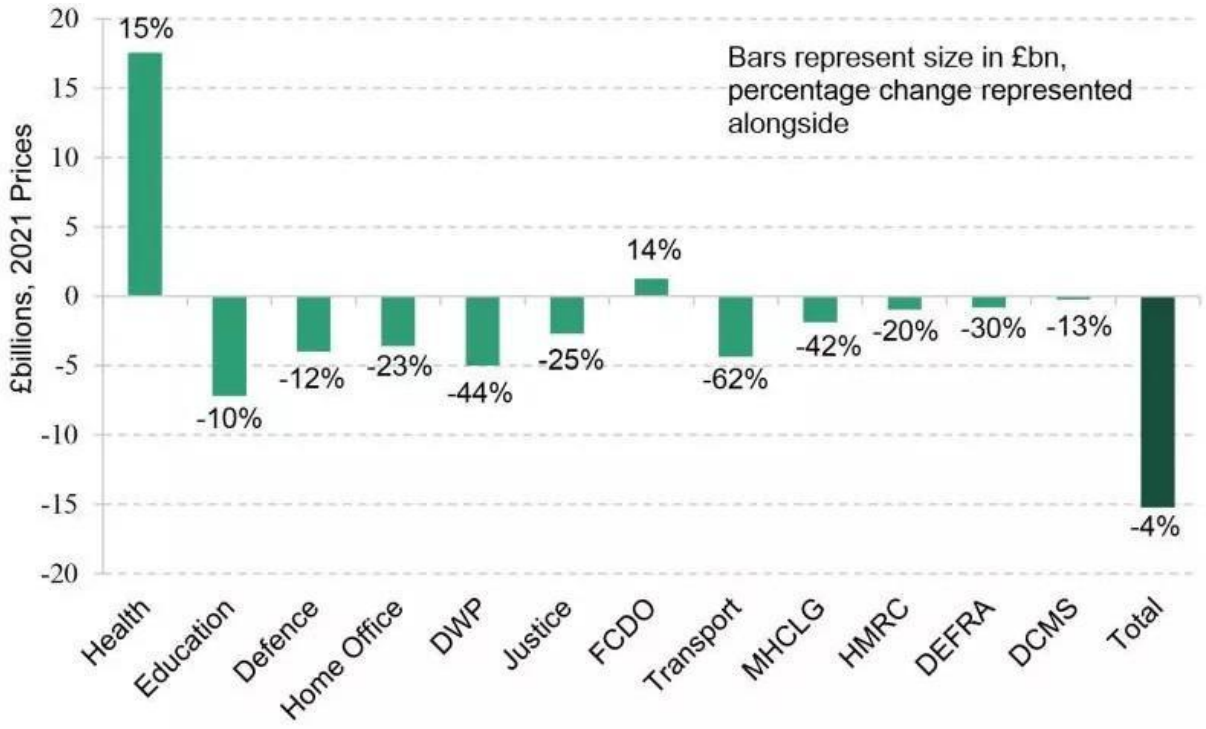

Figure 1. Size of the Budget Reductions Between 2010-2019

Source: IFSSpending changes by department, 2010-2019 Source: (IFS Working Paper W24/15). Institute for Fiscal Studies.

These spending cuts had a snowball effect on the general economy. The step back from the government with their spending triggered uncertainty among the households and the firms. As stated, the UK has a service sector based economy, and this makes the whole economy of the UK more fragile against economic crises like the 2008 Global Financial Crisis. Households faced job insecurity because less funding meant layoffs, and the fear of losing their jobs and benefits also reduced their expenditures. So, the consumption growth dropped in line with government spending, falling from 3,3% between 2000 and 2008 to 1,1% between 2008-2016, which we can say resulted in a crowding out because the steps taken by the government plunged the confidence among the general public and the aggregate demand rather than encouraging household consumption. At the same time, the firms operating in the UK were afraid of this decline in the domestic demand and the drastic changes in the fiscal policy; they were hesitant in their future investments, which also put a pause on the investment spending of the private firms. Since investment spending is the leading factor in increasing production, efficiency, and profitability, a disruption of investment spending means a slowdown in economic growth and a loss of productivity growth rates. Investor confidence was similarly affected. Public investment, primarily in sectors as housing, infrastructure, and local government services, was reduced. These reductions hampered the decent productivity growth the UK had for a long time, and the effects of this lost productivity haven't been recovered since, as seen in the figure below. As of Q4 of 2017, the productivity would have been 20% higher if it had continued the growth trend between 2000 and 2008(Haldane, 2018). The same can be seen in the GDP figures. After 2008, with the austerity measures and loss of confidence, the period of uncertainty regarding the growth rates of the Kingdom began. GDP growth rate fell from 2.2% (2000-2008) to 1.2% annually between 2009 and 2016 (World Bank, 2020), which followed the labor productivity trend.

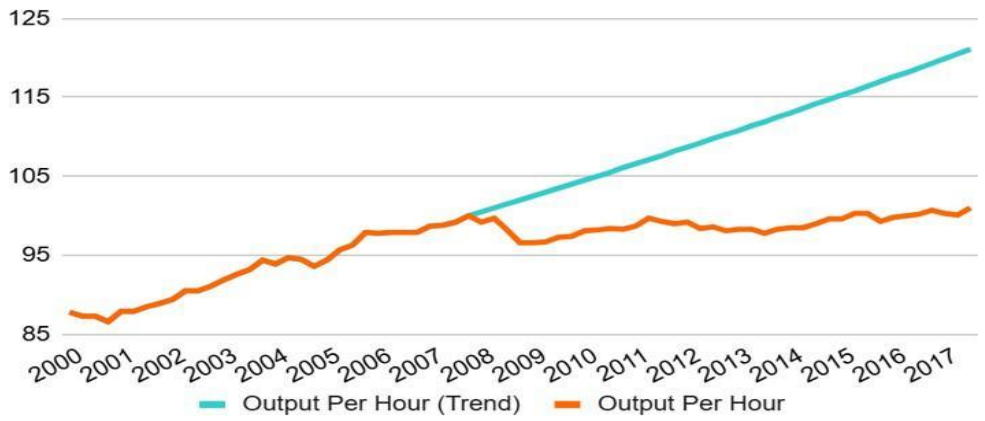

Figure 2. Labour Productivity: Output Per Hour, Seasonally Adjusted

Source: OECD

As seen in the figure2 above, after the 2008 crisis, the labour productivity dramatically flattened and hasn't recovered since. It has only grown at 0.2% annually between 2009 and 2016. By 2019, the result of this slowdown in productivity was also seen when we compare the UK with other developed economies. For instance, the productivity levels of the UK was 13% lower than Germany's and 8% below France's. This can be seen as the result of the Austerity measures taken by the UK government drove the economy into stagnation caused by an underinvestment on both from public and private sides. Low investment spending on innovation and R&D from the private side decelerated the essential elements of long-term growth. In addition to this, cuts in public investments disturbed progress in infrastructure, education, and local development. This loss of investment in both sectors (Public & Private) had a long lasting impact on the supply side.

On the monetary policy side, the Bank of England responded with low interest rates, and this further complicated the economic recovery situation of the UK economy. Starting from 2009, as seen in the

chart below, the Bank of England kept its base rate below the 1% level, which at the time was a record low level in over 300 years.

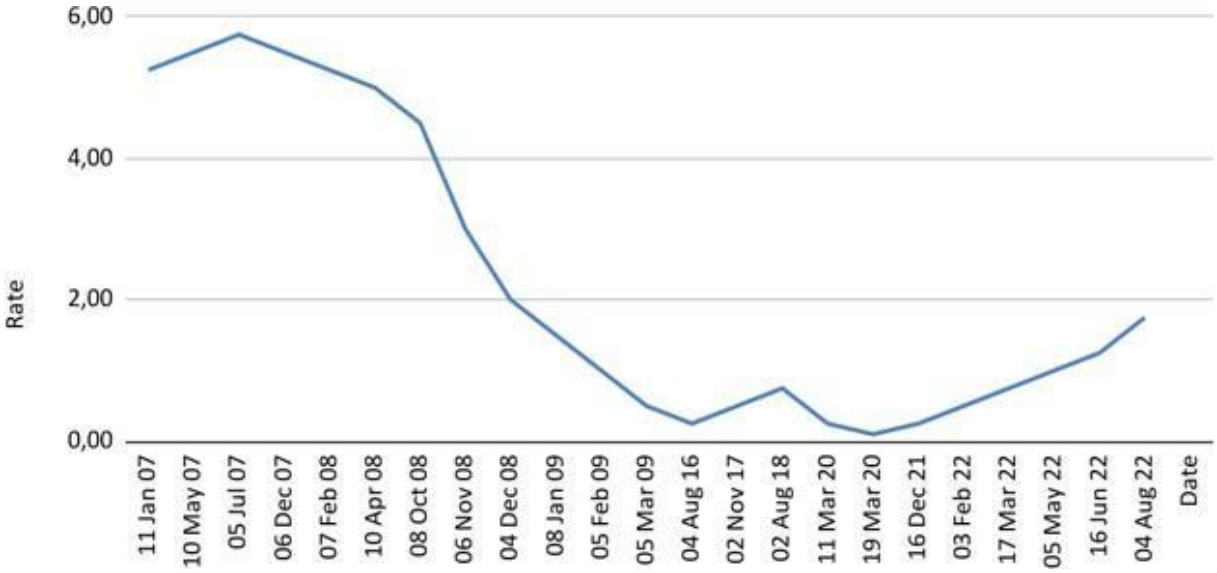

Figure 3. Bank Rate History and Data

Source: Bank Rate History and Data: Bank of England Database

This policy was aimed at boosting economic activity and stimulating consumer demand, but the effects of this low interest rate policy were hindered because the Bank of England and the UK government implemented two completely opposite policies. Attempts to stimulate demand were undercut by the government spending cuts. In addition to this confusion, the low interest rates had some distribution in the economy, and asset prices soared, which disproportionately benefited the households with higher income, property, and investment holdings.

Also, from a fiscal standpoint, the government was planning to close the current budget deficit with higher taxes and lower government expenditure. This plan partially succeeded in the short term by reducing the budget deficit from 10% of GDP in 2010 to just over 2% by 2016. However, this came with a cost of long-term growth. Even though the government cut its spending substantially the GDP growth was weak and slowed down even more. So in conclusion, the public debt to GDP ratio continued to rise.

Figure 4. Budget Deficit, % of GDP Year on Year 1970-2025

Source: OBR. Economic and fiscal outlook – December 2024

On the other hand, younger workers in the UK faced stagnant wages and job insecurity. The massive spending cuts by the government also limited the available jobs for the younger generations, and the lack of investment in various sectors by the government, as shown in Figure 2, had a huge impact on the long-term job opportunities for the youth as well. These policies together have deepened the intergenerational inequality and consolidated wealth among asset holders even further. Also, for the general workforce, the unemployment levels did not recover to pre-2008 levels until the end of 2015. High and consistent unemployment levels over a long period also restricted the aggregate demand in a spiral of low demand, less production, and more unemployment. Expectation will also shape around this sentiment, and firms and foreign capital can be hesitant about newer investments, which damages growth potential and can affect the structural weakness in the economy.

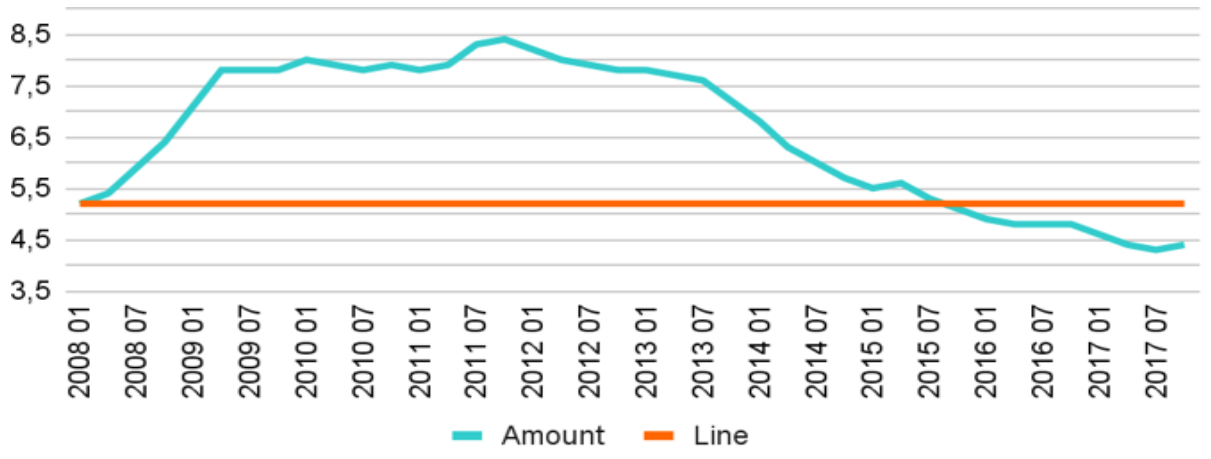

Figure 5. Unemployment Rate (aged 16 and over, seasonally adjusted)

Source: Office for National Statistics (ONS), 2025

The 2008-2016 period exposed the existing vulnerabilities and the lack of joint response from the fiscal and monetary points, amplifying these weaknesses. The government spending cuts lowered and put pressure on the demand, discouraged investment and slowed down productivity. The economy

became increasingly leaning on the service sector while both industrial and agricultural sectors stagnated. What began as a necessary effort led to a structurally imbalanced recovery.

3.2016-2020-BREXIT AND PRE-COVID

Another important year and period was 2016 for the UK economy. The country was dealing with the problems and slowdowns in various segments of the economy it had after the 2008 crisis. The UK's recovery period has been much bumpier and slower compared to the other developed economies. This slowdown in the economy was partially blamed on the ties with the European Union (EU). Not only from an economic perspective, but the EU was also counted as it interfered too much in national affairs among the public. Anti-immigration sentiment played a large role in the Leave campaign since the EU allowed a free movement of people within the EU member countries. Many Brits had questionable thoughts about the EU, and the rise of UKIP (UK Independence Party) led by Nigel Farage increased the pressure on a possible referendum. Even though Brexit is more known for its political significance, its economic impacts, both immediate and persistent, have reshaped the UK economic system. The period between 2016-2020 included further uncertainty after the 2008 crisis, and also declining business confidence and reorientation in trade relations were the highlights of this period. The disruptions caused by Brexit and the COVID-19 pandemic have created uncertainty and upheaval for both businesses and individuals.

With the referendum, the immediate effect on the economic side was seen just after the results were announced. The pound lost nearly 10% of its value against the dollar in the days following the vote. This loss in value made the UK exports more attractive abroad and helped to boost the volume of exports, but this effect was shortly lived. Over the longer period, UK exports did not hold up as much as the loss in the value of the currency. Also, with Brexit, there were newly arisen regulatory and logistical barriers between the UK and the EU. This has ramped up the cost for especially the exporter firms within the UK, shipments got delayed, and firms' credibilities were affected. Not only the big firms but also small to medium-sized businesses were widely affected by these changes. (ONS)

According to the Office for National Statistics (ONS), UK goods exports to the EU declined. The share of exports to the EU dropped from 45% to 41% by 2020. More importantly, these newly added regulations in the trade operations and the loss of EU free pass benefits for the UK have led some firms to relocate staff or headquarters to other EU financial hubs. This affected the nonfinancial investment in the UK. Firms relocating their resources are moving outside of the economy, and the job opportunities in these companies are lost in this process as well. This further puts pressure on unemployment and consumption.

Foreign Direct Investment (FDI) also got hit hard. The UK, before Brexit, was one of the best-performing countries in Europe, but the country saw a sharp decline in FDI following the referendum. According to UNCTAD and ONS, FDI inflows declined from $190 billion in 2016 to $20 billion in 2017. This figure clearly shows that all extra regulatory costs that are going to be added with Brexit have created a huge amount of uncertainty in the UK, discouraging investment even before the official date of getting out of the EU, and firms have started to exit the UK markets after the referandum result eventhough there were no additional costs or regulatory steps required at that time since there was a uncertainty of how this processes will be taken care of, and unknown additional costs that firms can face they have opted for a strategy to leave the UK market and go for a more stable market. This mainly shows how much expectations affect the investor confidence and how easily companies can take actions in a volatile environment to move their HQ's to other countries. FDI numbers are important because this shows that investors believe in the growth potential and the opportunities in a country. But the uncertainty around the UK's future market access and regulatory environment resulted in hesitation when it came to foreign investment. Sectors that use parts and raw materials from other countries in production, such as automotive manufacturing and technology-related firms benefited from the perks of the single market in the EU until the brexit but now all firms faced with the difficult question of whether to mantain, scale back or relocate operations because of the lost of single market benefits. This affected the trade intensity in the UK compared to the rest of the G7 as seen in the figure 6 below;

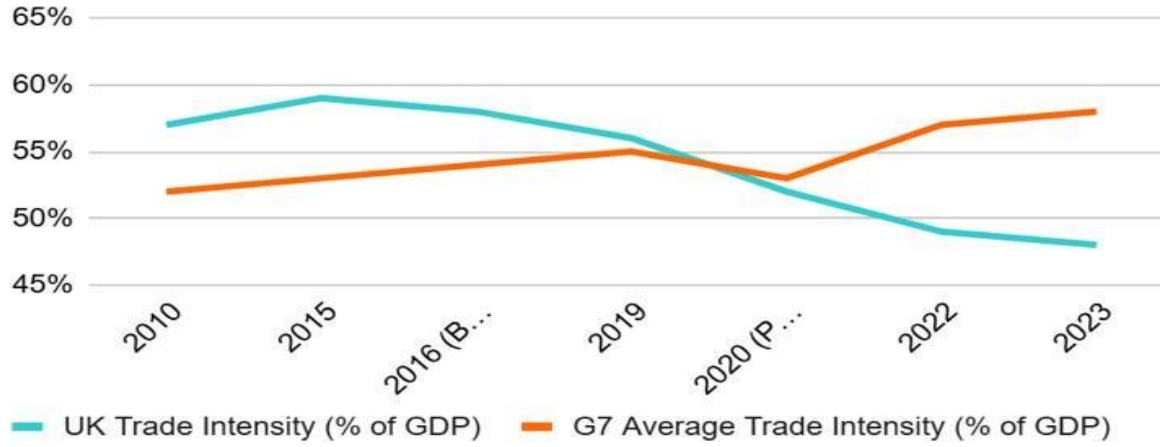

Figure 6. Trade Intensity In the UK and Rest of the GY

Source: OECD

As mentioned before, Brexit affected not only the bigger firms. Small and medium-sized enterprises (SMEs), which make up more than half of the private sector GDP in the UK, also had difficulties. Especially the ones that export to the EU countries did not have the legal capacities to overcome the newly added processes they had to pass before exporting a product. Research conducted by the Federation of Small Businesses (FSB) shows that 14% of the SMEs that had already been exporting to the EU stopped their exports by 2019 due to increased paperwork, customs declarations and costs. This resulted in many SMEs crumbling down under the pressure of additional costs, and they had to stop their exports. SME turnover growth declined from an average of 4.3% annually between 2013-2016 to just 1,1% between 2017-2019. This meant that investments and R&D spending are the main elements for the creation of sustainable long-term growth for the general economy, is now reduced because small to medium-sized businesses are having financial difficulties, which are reshaping their investment ideas.

One other key topic that the UK was benefiting from was the strong labour market within the EU. This was allowing the UK firms to use the flexible European workforce, but after Brexit net migration from the EU declined sharply, which led to worker shortages in labour intensive sectors such as agriculture, construction, and hospitality. The lower number of available workforce for the jobs means that there are fewer options to choose from for the employers and this puts an upward pressure on wages in some sectors. It also put a constraint on the capacity and output in a few sectors because of the worker shortages

When looked into Brexit, the main effects can be seen in the areas of productivity and investments. The UK already had a slow bounce back from the 2008 Global Financial Crisis which affected the investor confidence. When the Brexit process was added on top of the economic struggles, it created a huge drag on these areas of the economy. The Bank of England kept its base rate at really low levels (0.25% to 0.75%) between the period of 2016-2020. This low base rate provided easier access to credits and aimed to stimulate private investment. But the results were far from planned, and because of the politically unstable nature of the 2016-2020 period, households were hesitant about their spending even in a time of low interest rates. Many firms were also in the same situation with their investment spending, given concerns over market access, regulation, and currency volatility.

Also, it must be noted that fully getting out of the EU for the UK happened on 31 January 2020. Up until this point, the period of negotiation had taken place, but this had also brought uncertainty. Many of the firms with headquarters in the UK decided to move their HQ to other financial hubs across Europe, which meant that the UK lost available jobs and also the knowledge that can be learn from the firms. But there is a catch. The UK suffered its first COVID-19 case on British soil around the same time as the formal departure from the EU. This makes it harder to understand the real effects of Brexit

on the UK economy. But it can be seen that the combination of both COVID-19 and Brexit hit hard, and this can be seen in how deep was the economic slowdown and GDP shrinkage.

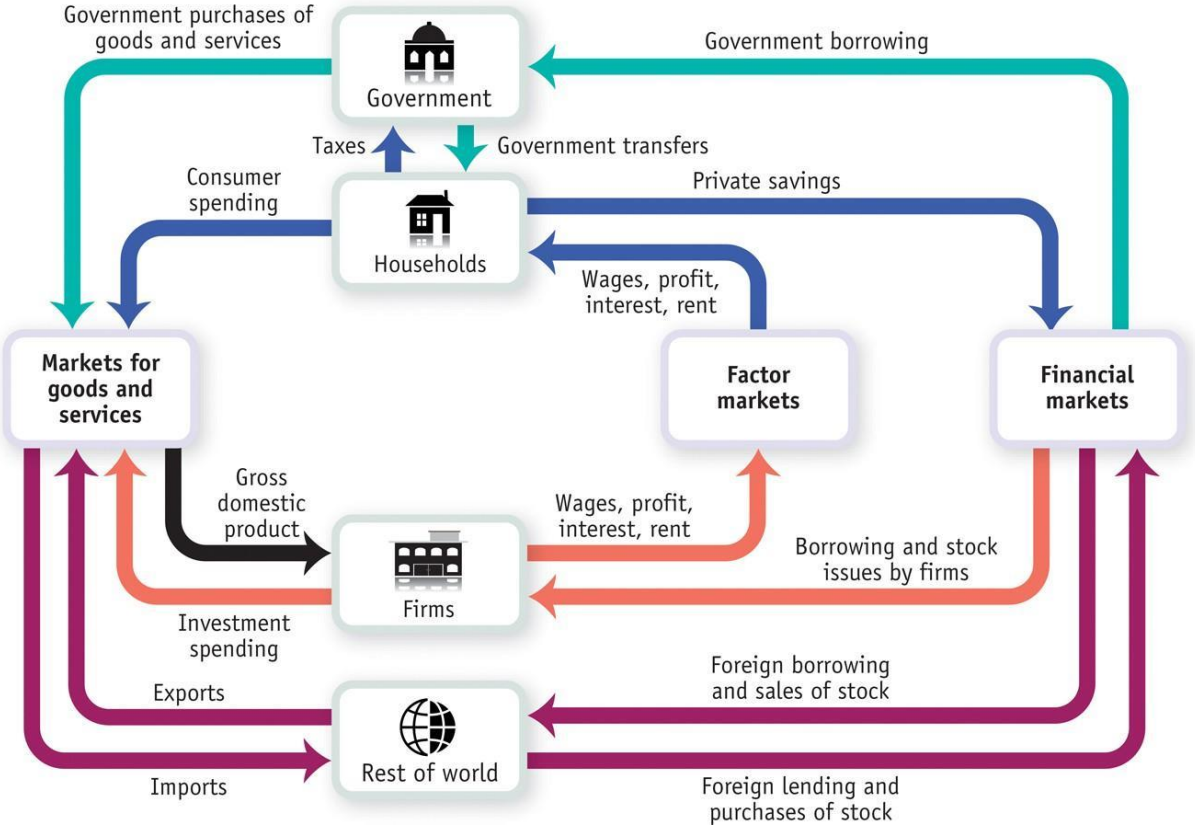

Figure 8. The Macroeconomic Cycle: Income, Spending, and Savings Flows

At this point, it is important to look into how the macroeconomic view and dynamics have changed between 2016 and 2020. Using a circular flow diagram helps us to understand how the income and expenditure move around the main actors of the economy, which are households, firms, the government, and the foreign sector. As mentioned before, after the 2016 referendum, there was a period of uncertainty. According to the OECD data, this resulted in a pretty big slide in the Gross Fixed Capital Formation (% of GDP) ratio. Through the 2010s, the investment ratio was around 18% of the GDP, which was slowly picking up after having low levels because of the 2008 global financial crisis but after the referendum, this ratio fell behind the persistent growth and plateaued around the rate of 18%, which is below the average in OECD. This slowdown in Gross Fixed Capital Formation meant that the firms postponed their projects. These projects are important to develop the infrastructure in the UK which is the backbone of economic growth and labour productivity and also for the new jobs and the reduction of unemployment. Also if there are no constant improvements in the infrastructure, this can increase the costs of production and distribution for businesses.

When we look into the flow diagram less creation of jobs and less innovation because of the lack of investment spending can result in lower production, which can result in less jobs and less income for households. Higher unemployment will decrease the aggregate demand.

4.2020–2024 – COVID-19

Even the COVID-19 was an unprecedented challenge for each and every country, the timing for the UK was even worse because Brexit was happening officially and just in a matter of days they also

suffered from the first reported COVID-19 case. While the UK economy was trying to adapt to the structural changes that came with Brexit, now the economy had to suffer from the consequences of the pandemic. Also unlike most of the previous crises, covid was something unseen and also the economic shock was not only on the supply side but also on the demand side with all lockdowns and pandemic restrictions that slowed down the economic activities of the people. Also, the UK's service sector accounts for around 80% of Gross Value Added (GVA), it made the UK even more vulnerable to the restrictions. Since the service sector is reliant on face-to-face interactions, this explains why it is unique that it has been the service industries that have experienced the largest impacts (Office for National Statistics [ONS], 2021).

The UK implemented various expansive fiscal policies to respond to the bottlenecks that can happen with the lockdowns. These policies include the Coronavirus Job Retention Scheme (CJRS), bounce-back loans, VAT deferrals, and cash grants for SMEs. However, these policies also increased the government borrowing substantially and the UK's public sector debt to GDP ratio rose to over 100% in 2021, which was unseen since the 1960s. For example, with the CJRS government covered up to 80% of workers' wages for firms facing temporary shutdowns. These steps were important because firms do have their portfolios and their reputations that they created over the years of active participation in markets. If a company shuts down and loses the existing buyers to another company getting the same customers back is way harder to do because they might have signed a long-term contract with another supplier. This means that by supporting the companies, the government plays an important role in stabilizing the corporate sector's volatility. Also, when the companies see that the government is helping them in a time of uncertainty, this becomes an incentive to keep the production levels high. Although this is a good step towards preserving stability the efforts of the UK government fell short in various ways.

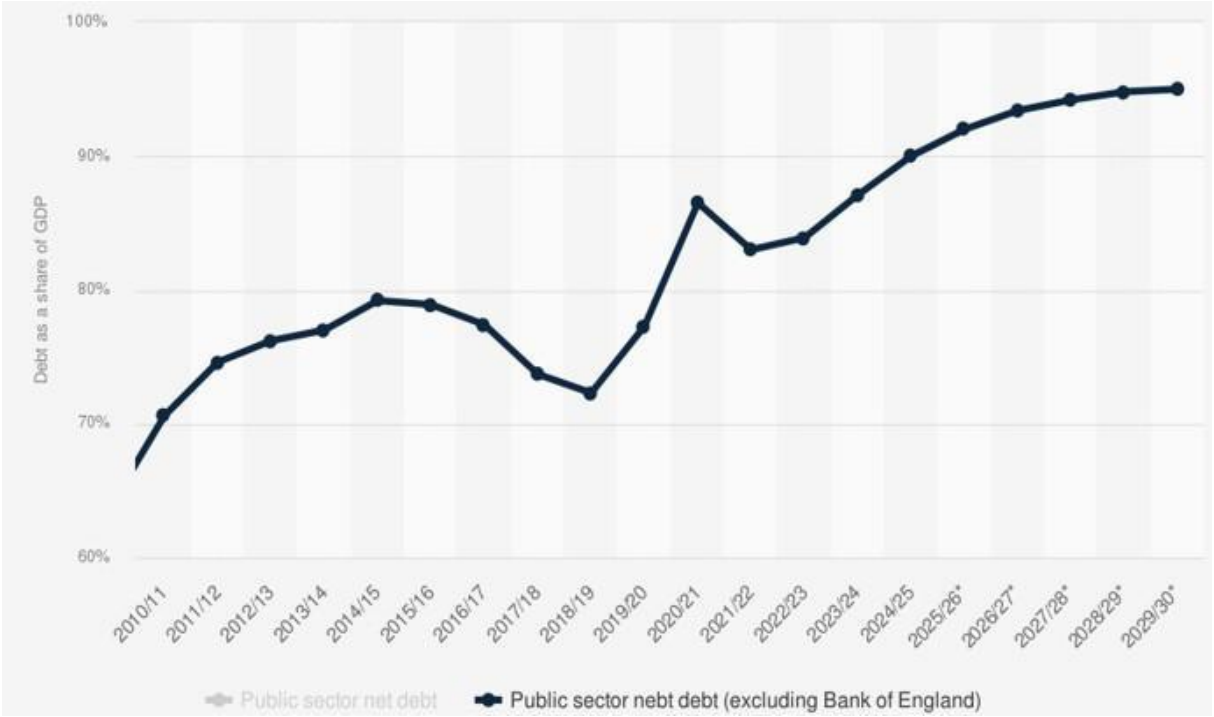

Figure 9. Public Sector Net Dept Expressed as a Percentage of GDP in the UK from 1990 to 2029

The main problem started with the austerity measures taken by George Osborne, who was in charge of the austerity program. He believed in cutting the size of the government and the austerity measures taken in the period of the David Cameron government tried to achieve this by cutting government

spending. Yes, this has resulted in lower government debt to GDP but also made the UK economy less productive and the UK started to fall behind especially in the areas of innovation and infrastructure. This added more vulnerability to the UK economy and when we come to the beginning of COVID-19, we can see that government debt that had been reduced at the time with the austerity measures is now all lost and the debt ratios are back to the pre-austerity levels. The only difference is, now the UK economy is less productive and the labour market suffered and it took much longer to reduce the high levels of unemployment after the 2008 crisis. As seen in the figure 9 above the UK managed to decrease its public sector net debt to GDP ratio from nearly 80% to 72% by 2018/2019 (Statista, 2024)

. But as seen from the table, this was not sustainable for the UK economy. Lowering the government spending and trying to reduce the debt resulted in many structural problems and the debt that was paid off was not gone for a long time because it was replaced with the stimulus that was necessary to be given in the lockdown period.

Also the UK government implemented a fiscal support amounting to 5.9% of the UK's GDP but at the same time, the German government decided to introduce a fiscal intervention reaching to a level of 13.5% of GDP (Emmerson & Stockton, 2020). This information and also with the addition of the graph below, we can say that the steps that the UK government took were in the right direction but it fell short in general and it was limited. Between Quarter 4 2019 to Quarter 3 2020 UK government spending decreased by 1.7% and the UK had the biggest GDP decrease among the countries given in the graph. We can see that for the countries that increased government spending, such as Germany and Japan, they were affected much less. This can be the result of government intervention boosting confidence in the markets and also those countries are less reliant on the service sector. So the decreasing government consumption with the addition of high reliance on face-to-face markets, had deepened the UK's economic struggles.

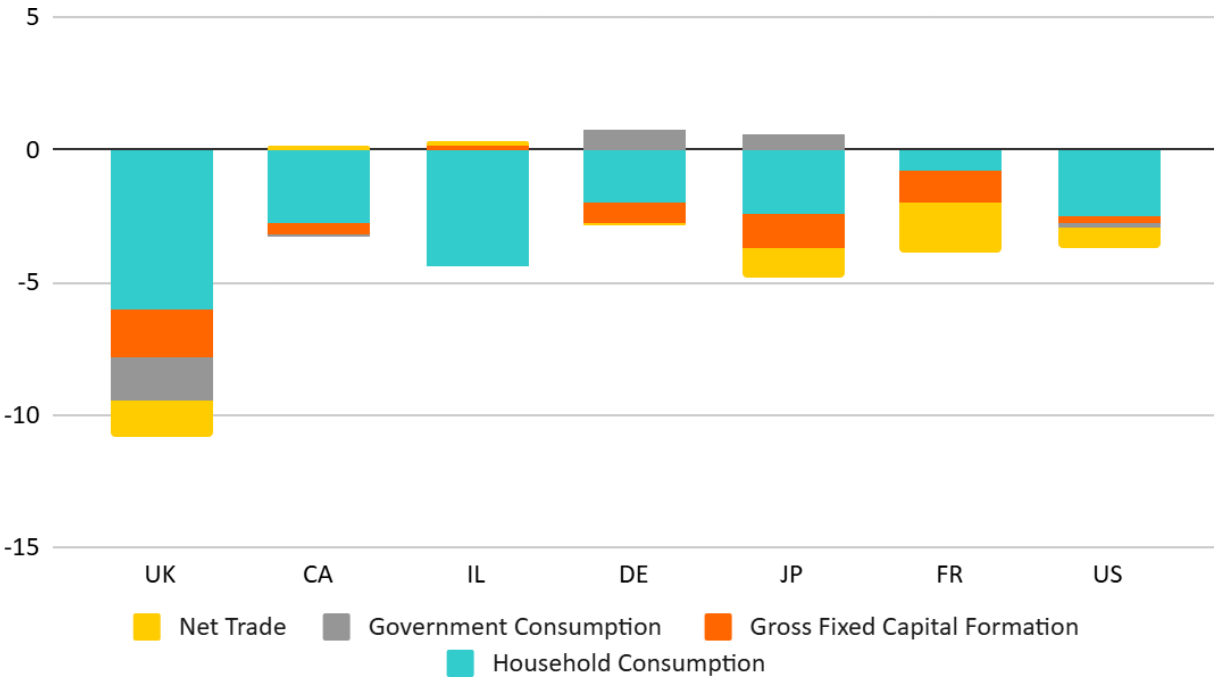

Figure 10. Performance Comparison of Countries' Economic Components During the COVID-19 Period

Source: Office for National Statistics. (2021, February 1). International comparisons of GDP during the coronavirus (COVID-19) pandemic.

Another problem can be seen when we look into the GDP calculation of:

$$Y=C+I+G+(X-M) \quad (1)$$

Y: GDP

C: Consumption I: Investment

G: Government Spending (X-M): Net Exports

When we compare each metric for the UK and other countries, as seen in the table below, we can see that the household consumption in the UK collapsed with a decline of -6.07% which shows us two things. Firstly, this can be the reason of lockdowns and the uncertainty. The UK was one of the first countries to implement the lockdown procedures so this might have affected the consumption of households even more. And, when people do not know about their future especially if there is a risk of losing their jobs, getting sick, all these add up to fear. And with the fear, they have the households tend to hold onto their cash. We can see this in the statistics published by the ONS, households' saving ratio. It had jumped from 5.1% to 27.5% by the Q2 of 2020 (Office for National Statistics [ONS], 2025). This clearly shows that the individuals were skeptical about their consumption and this kind of shock was the main element of why the GDP decline was this big. Because as we saw in the "Flow Diagram" if the households are not buying/demanding the companies will reduce their production and lower production means fewer jobs for profitability. because when there is less output, there are also fewer workers needed and the marginal cost of a worker becomes much higher so this can also cause unemployment in a spiral effect. Another main problem can be seen in the (G) part of the equation. The lower government expenditure in a time of crisis and especially in a time of uncertainty like COVID-19, needs an intervention from the government to assure the households and firms to keep the economic factors all intact and working.

Table 2. International Comparisons of GDP During the Coronavirus (COVID-19) Pandemic.

	Household Consumption	Gross Fixed Capital Formation	Government Consumption	Net Trade	**GDP**
United Kingdom	-6,07	-1,73	-1,7	-1,32	**-8,60**
Canada	-2,81	-0,36	-0,1	0,14	**-5,3**
Israel	-4,37	0,14	-0,01	0,14	**-4,7**
Germany	-1,99	-0,77	0,79	-0,13	**-4**
Japan	-2,43	-1,27	0,57	-1,11	**-3,9**
France	-0,81	-1,22	0,02	-1,83	**-3,7**
United States	-2,49	-0,31	-0,12	-0,82	**-3,4**

Source: Office for National Statistics. (2021, February 1).

We can also see that the UK has suffered a deeper GDP decline, especially in 2020-2021 but managed to close down the massive gap opened to more moderate levels. But still, when we look starting from 2019 G7 countries (excluding the UK) and the OECD average has outperformed the UK's economic performance.

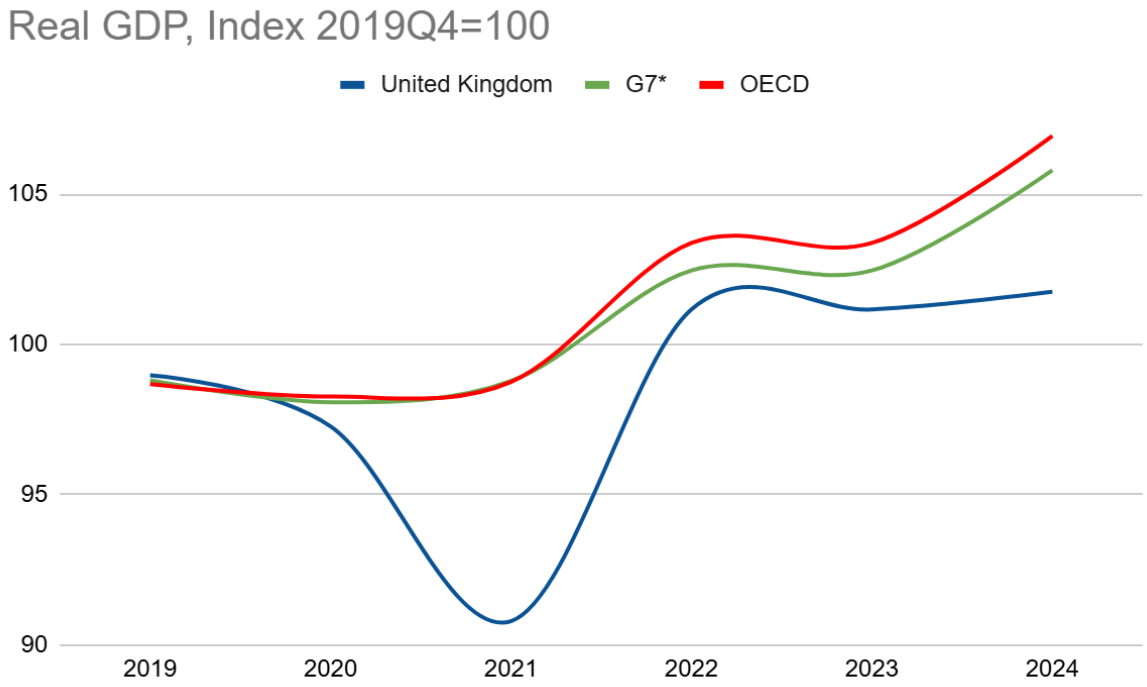

Figure 11. Economic Impacts of the Pandemic: GDP Change in G7 and OECD Countries

Source: OECD Economic Outlook Database

As discussed before, the UK's reliance on the service sector made it harder to get over the harsh economic conditions of the COVID period. Especially after the first lockdown period the government wanted to implement a plan that would help to increase the aggregate demand. So, Rishi Sunak, who was the Chancellor of the Exchequer at that time under the Boris Johnson government, implemented a new scheme called the "Eat Out to Help Out Scheme." In favor of getting things back to normal, the restrictions were abandoned. This scheme aimed to support businesses reopening and to protect jobs in the hospitality sector by encouraging consumers to return to eating out (House of Commons Library, 2020). Under the Eat Out to Help Out Scheme the Government provided 50% off the cost of food and/or non-alcoholic drinks eaten in at participating businesses UK-wide, Monday to Wednesday from 3–31 August 2020.1 The discount was capped at £10 per person. (Fetzer, T. (2021)

When we look into the results of this scheme there were 49,353 businesses that took part and 161,934,000 meals were subsidised by the government. The downside of this was; yes, this scheme helped people to get out and spend their money on meals with the help of the government but it also meant that in a time where COVID was still a problem, social distancing was ignored. This resulted in an exponential increase in the reported cases of COVID-19 in the UK and because of this the UK had to implement 2 more lockdowns in the upcoming months.

In conclusion, we can use the graphs below to evaluate how the COVID-19 pandemic affected the UK economy. The effects of the restrictions made themselves clear, especially in the volatility of household spending. Since many businesses were shut down and people couldn't go outside to consume goods and services, this has affected the aggregate consumption. Which has affected the GDP because lower demand meant there was lower production and this has also spiked the unemployment rate. Also, since the UK economy is mostly reliant on the service sector, this has deepened the initial shock because of the reliance on face-to-face operations in the service sector. Uncertainties and bottlenecks in the production periods were driving the production and distribution costs of the goods produced by the firms. The effects of this was visible in the CPIH inflation levels.

Not only the restrictions, but the new additional legal steps and costs that came with the official leaving the EU and the rising fuel costs, the war in Ukraine was also a huge factor (Office for National Statistics [ONS], 2022). There was already a markup in prices because of the COVID restrictions and now Brexit has also become an additional cost, which has driven the prices of goods higher and this has also increased the living costs. Also, it can be seen that the inflation figure has gone parabolic and the reason for that can be the schemes and incentives that were mentioned in the previous paragraphs. With the reduction in the lockdown restrictions and the incentives from the government, the unemployment levels were diverted from the increasing trend with the help of increased household spending.

Figure 12. Household final consumption expenditure, HM Land Registry – UK House Price Index.

Source: Office for National Statistics - GDP first quarterly estimate, CPIH inflation, Unemployment rate (age 16 and over, seasonally adjusted)

Another important factor to note was the situation of the National Health Service. The UK was under the management of various Conservative Party governments in the 2010s. As mentioned before, conservative party governments usually went for a reduction in government spending and this also included the NHS to some extent. And when the time of COVID-19 struck, the NHS was already lacking many staff and equipment, which slowed down the response capabilities and at this time for the first time since the creation of the NHS the life expectancy in the UK has declined.

After the combination of Brexit and the COVID-19 pandemic, just as the global economy and the UK were getting back to their pre-COVID figures, there were numerous political crises waiting for the UK, which put a strain on the UK's economy.

There were also the socioeconomic consequences after the COVID-19 pandemic which we can say were mainly caused by the stimulus responses by the governments all around the world. Even though the stimulus programs were aimed to support the low or middle income households during the lockdowns, we can see that the distribution of wealth moved further to the rich from the middle class and the poor and this can be explained by a few examples and by a few anecdotes. One of the examples can be seen in the real estate sector. First of all during the pandemic since most of the luxury sectors were affected because of the lockdowns; the more essential sectors such as housing, basic foods were in higher demand and they were starting to take a higher percentage of the household expenses. Since many firms and small businesses were not able to produce their income fell, the incomes shrunk and housing became much more important. The United Kingdom House Price Index was around 400 points at the end of 2019 but just 2 years later this index was at above 500 which means of a 25% increase(Halifax and Bank of Scotland). This meant that the people who owns land and property had a massive rise in their total wealth. Also since the luxury sectors were mainly restricted the rich had even lower consumptions and higher savings.

A possible solution to solve this wealth flowing to the rich can be solved by a newly regulated taxation system in which there is a more fair taxation regulations and which takes into account that there is a shrinking middle class. One example can be given as having land value taxation. With having this taxation system instead of the council tax, the UK will tax the landowners based on the value of their lands. This can help to encourage to have more efficient use of available land and also if an individual has a land in a higher value neighborhood their tax will also be higher which can help the government to collect its funds and also it can help to address the systemic wealth imbalance and it will prevent the further erosion of the middle class in the society.

5.POLITICAL SITUATION AND THE EFFECTS ON THE ECONOMY

When we look into what happened in the previous sections, we can see that the last 15 years have been quite a bumpy road for the UK economy and politics. Some of the reasons for this volatility were because of global problems that the UK had no part in the beginning, such as the COVID-19 but a global pandemic, and the US housing crisis had a huge impact and was able to show the weak point the the UK (Starritt, 2025). These weaknesses were visible and even though COVID of the housing crisis wasn't an outcome of UK politics, the reason why the UK was affected much deeper than other countries is the core topic we are going to be discussing in this part.

In the last 15 years, the main problem of bottlenecks in the UK economy is the result of clashing monetary and fiscal policy. The BoE (Bank of England) and the UK government had communication and a unified target problem in continuous periods. This had started with the David Cameron government. While the BoE was trying to boost economic activity and restore confidence in the market with a spark that they can create with monetary easing, the government was opting for massive government spending cuts. Yes, these cuts were able to lower the budget deficit but the long term results of lowering growth and especially the productivity or the R&D spending left the UK's progress behind other G7 countries (Evgenidis & Fasianos, 2019; Oxfam, 2013). This resulted in a slower recovery period and when around 2015-2016 the economy was starting to catch up to the pre 2008 trend levels in unemployment and in other areas the Brexit referendum took place and the government moved to Borris johnson (Lacey, 2022).

The period of Borris Johnson had two important political events. One being Brexit and the other being how he dealt with the COVID period. We have talked about Brexit and how it created uncertainty so we will be jumping to the COVID-19 period. The UK government was criticized for not implementing lockdown measures, but at the same time the early decision to give up on these lockdowns, especially with "Eat Out to Help Out Scheme," put the UK in a path where they needed two additional lockdown periods and this was a huge strain on the economy. Also, when it was leaked to the public

that Borris Jhonson and his government were having Christmas parties (more than once). These gatherings were held when the country was in lockdown and there was a massive death rate from COVID cases. The PM first denied all the accusations, but as video and photo evidence were shown to the public and leaked to the media, there was no room to escape.(HM Revenue &Customs/GOV.UK)

After Boris Johnson, there was the period of Liz Truss. Even though her time as a PM was the shortest in the history of the United Kingdom, her impact on the economy has to be discussed. When Liz Truss became the PM after the resignation of Boris Johnson, She and her Chancellor of the Exchequer, Kwasi Kwarteng, had a new economic plan. At that time, as seen in the figure below, the UK economy was under the threat of high inflationary pressures, and the Bank of England at that time had just increased the interest rates to cool down the economy (Financial Times, 2023).

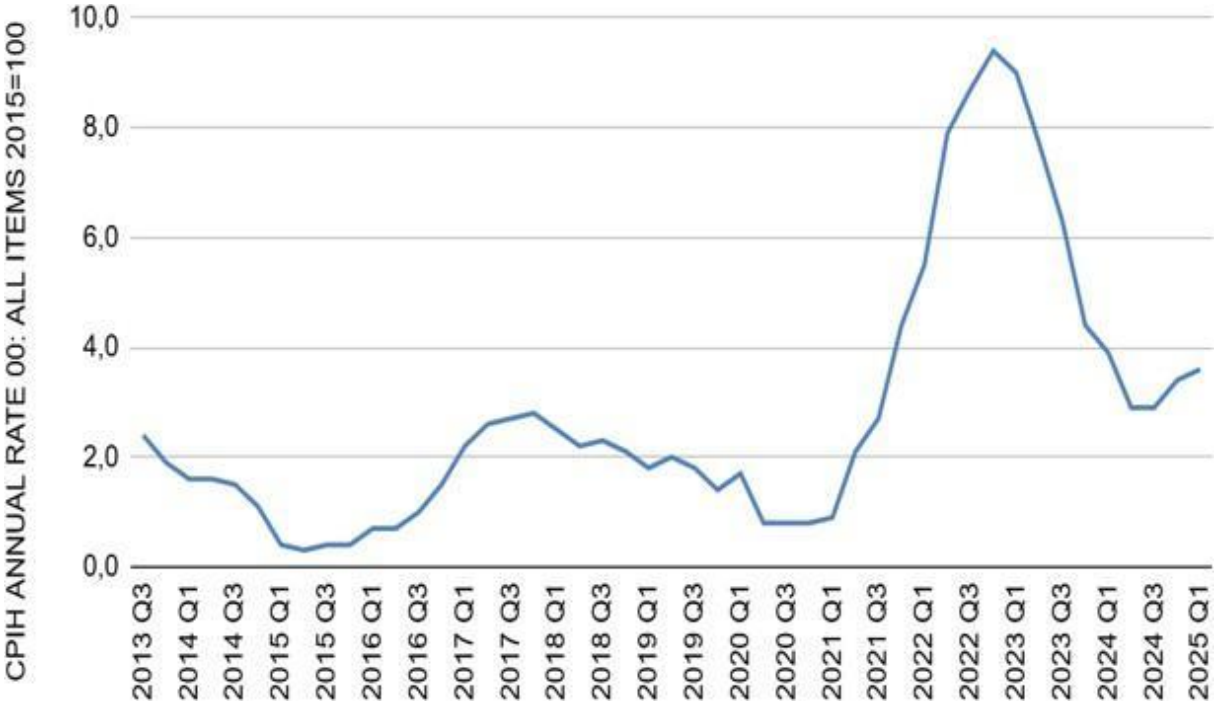

Figure 13. UK's Consumer Price Index (CPIH) Trends: Annual Inflation Analysis

Source: ONS

Just after 1 day of the Bank of England's interest rate hike, Kwasi Kwarteng announced a "mini budget" in parliament. This budget included massive unfunded tax cuts adding up to £45bn (BBC News, 2022), such as decreasing the basic income tax from 20% to 19%, the removal of the highest income tax bracket of 45%, which in theory only helped the richest 10% of the people of the UK. The plan was estimated to cost the government £190bn in total. These policies might have encouraged additional investments but it would not cover the total costs of this extensive borrowing (7.5% of the GDP).

Injecting demand into a high inflation economy left the government in a situation where they were pulling in the exact opposite direction to the Bank of England, who are likely needed to increase the interest rates even higher because of this mini budget. The additional increase in the rates would have made it harder to borrow for companies and households and also slow down the expected growth. Also this contradiction in policy affects the market confidence and the first signs were seen in the forex markets, where the British Pound lost value against the dollar. This market reaction resulted in guild yields skyrocketing as seen in the table below:

Figure 14. UK Borrowing Costs (30 year gilt yield %)

Source: ONS

This shows that the trust in the government is decreasing and now there is a higher interest payment on the government borrowings which would be an additional pressure on the budget. In this budget the Liz Truss government did not only adopted tax cuts. They have also scraped all the planned tax hikes and regulations that was planed by the previous governments. This direct and sudden change in a period when the Bank of England was trying to stabilize and cool down the economy was out of control because of the unfinanced tax cuts.

This has also increased the mortgage interest rates and since mortgage payments usually take a huge part of household's budget this meant that there is now less money left for households to spend and the planned 1% decrease in the income tax is not enough to cover the results of these policies. Even the chief economist of the Bank of England, Huw Pill said "I think it's hard not to draw the conclusion that all this will require a significant monetary policy response."

After seeing the reactions from the markets the government first made a U-turn by cancelling the idea of abolishing the highest level of income tax of 45%. After this other cancellations followed and then Kwasi Kwarteng was replaced by Jerremy Hunt, who is on the other side when it comes to the ideas on massive tax cuts. He nearly cancelled all the clauses in the mini budget and at the end only after 49 days Liz Truss had resigned.

6. CONCLUSION

In the last 15 years, the UK has had many challenging problems, varying from economic or political problems all had some consequences on the economic overview. This clearly shows how any movement in politics is also directly linked with the economy, and there surely will be a response from the markets. That is also why it is important to manage the expectations and create a credible cabinet and come up with a sustainable plan. The UK has shown, if there is no sustainable plan, even if there are short-term gains, there will be harsh consequences in the long term. We have seen this in the 2008 period, which was dominated by austerity measures, which had delivered short term deficit reduction, but it had also sacrificed the long term productivity and investment. This loss of productivity and investment limited the potential growth and also took away many opportunities from the future of the UK.

When looked into the past it is clear that in most of the crises UK always had the longest-lasting effects on its economy compared to other G7 countries. One of the main reasons for this can be the inconsistencies between the fiscal and monetary policy. As stated in the first paragraph of this conclusion part, if the UK can create a credible and committed economic program that is in line with the views and comments of the BoE, this could be the first step to restore investor confidence. Because

it is seen in the Liz Truss government that the misalignment of fiscal and monetary policy shows how fragile it can make the market confidence, and also how hard it is to restore once the confidence is crushed. This can be done by creating a economic coordination committee in which there can be regular reports and comments to the government. If this committee consists of independent and known economists who are unlinked with political parties with the sole reason being evaluating the coordination of fiscal and monetary policy it can help the government to understand what is the outlook of Bank of England in regards of the general economic view. This can also help the government to come up with better fiscal policies that can both help to reduce the inflation and the inequality which can increase the living standards of low-middle income households as mentioned in the part 5.

The UK still lacks development equality within its borders, and most of the investment and business activities are located in or around London. A planned economic recovery and growth can be achieved by also boosting the industry and creating diversity among different sectors. Addressing these long standing regional disparities requires more committed and solution oriented approaches. This can be done by regional devolution which can include having multi year plans and budgets for regions and each region should address its weaknesses and the opportunities with their infrastructure projects. Setting long term public investment target as %of GDP for each region and distributing these funds according to the needs of the region. If this can be done with a commitment and also a long term plan, the North-South production and productivity gap can be closed and the reliance on London can be reduced which can create a more balanced economic geography, reducing the vulnerability of the UK economy to regionally concentrated shocks.

The Uk has suffered extensively from having a service sector based economy because in a situation like the COVID-19 pandemic service sector took a huge hit with the restrictions on face-to-face operations and vacations. The UK's path forward depends on balancing fiscal discipline with strategic investment, which, of course needs to be backed by political stability.

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HARMONY MOVE IN AIR TRAFFIC: COORDINATION OF SESAR AND NEXTGEN

Hava Trafiğinde Uyum Hareketi: Sesar ve Nextgen'in Koordinasyonu

Mutlu Can SOYDAN* & Hakan RODOPLU**

Anahtar Kelimeler:

Havacılık,
Hava Trafik,
NextGen

JEL Codes:

L10, L90, L91, L93.

Öz

Avrupa ve Amerika Birleşik Devletleri arasındaki Açık Semalar Anlaşması, dünya çapında iki büyük havacılık pazarını bir araya getirerek Atlantik'in her iki yakasındaki milyonlarca insanı hava yolu ile birbirine bağlamakta ve son yıllarda havayolu endüstrisinin seyrini değiştirmektedir. Bu anlaşma, canlı ve büyüyen bir transatlantik havacılık pazarı yaratmıştır. Bu büyümeyi destekleyen temel unsurlardan biri olan Avrupa-Amerika Birleşik Devletleri İş Birliği Mutabakatı, ABD'nin "NextGen" ve Avrupa'nın "SESAR" olarak bilinen iki büyük hava trafik modernizasyon girişimini uyumlaştırmayı hedeflemektedir. Bu çerçevede yürütülen ortak çalışmalar, günümüzde hava trafik sistemlerinin küresel ölçekte birlikte çalışabilirliğini teşvik etme açısından önemli sonuçlar doğurmuştur. Böylece, hava trafik modernizasyonunun tüm yaşam döngüsünü kapsayan bir düzenleme ortaya çıkmıştır. Bu düzenleme, Avrupa ve ABD İş Birliği Mutabakatı'nın kapsamını geniş bir şekilde yansıtmakta ve dağıtım faaliyetlerine ilişkin iş birliği aşamalarını ortaya koymaktadır. Çalışmada ayrıca, veri iletişimi ve "SWIM" gibi güncel odak alanlarındaki önemli gelişmelere de yer verilmektedir. Bu bağlamda, havacılık alanında önde gelen iki bölgenin güçlerini birleştirmesi durumunda nelerin başarılabileceği genel anlamda ortaya konulacaktır. Çalışma aynı zamanda "NextGen" ile "SESAR" arasında gerekli uyum düzeyinin ve küresel iş birliğinin sağlanmasına yönelik ilerlemeyi de gözler önüne serecektir. Nitekim, hava sahası kullanıcılarının bu modernizasyon girişimlerinden tam anlamıyla faydalanabilmesi için Avrupa ve ABD'de kurulan bu tür yeni sistemlerin uyumlu ve birlikte çalışabilir olması gerekmektedir. Bu çalışmayı önceki çalışmalardan ayıran en önemli fark, literatüre ilk kez girecek olan "CACAVU Modeli"nin bu çalışma kapsamında ortaya konulacak olmasıdır. Söz konusu modelin küresel uyuma katkı sağlaması beklenmektedir. Gerçekten de, küresel uyum ve birlikte çalışabilirlik hedeflerinin karşılanamaması, hava sahası kullanıcıları için maliyetleri artıracak ve genel hava trafik sistemi açısından verimsizliklere yol açacaktır.

Abstract

The Open Skies Agreement between Europe and the United States, which brings together two major aviation markets worldwide and connects millions of people on both sides of the Atlantic via air travel, has changed

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the course of the airline industry in recent years. This agreement has created a thriving transatlantic aviation market. The European-American Memorandum of Cooperation is a key element supporting this growth and aims to align the two major air traffic modernization initiatives, the US's ''NextGen'' and the European ''SESAR''. The joint efforts within this framework have yielded significant results in terms of promoting global interoperability of air traffic systems today. Thus, a regulation has emerged that will address the entire life cycle of air traffic modernization. Broadly reflects the scope of the European and US Cooperation Memorandum and reveals the stages of cooperation regarding distribution activities. The study also includes important developments in current focus areas such as data communication and ''SWIM''. The study aims to reveal what can be achieved when two leading regions in the aviation field combine their strengths in the most general sense. In this context, the study will also reveal the progress towards achieving the necessary level of harmony and global cooperation between ''NextGen '' and ''SESAR''. Indeed, in order for airspace users to fully benefit from these modernization initiatives, these types of new systems established in Europe and the US must be compatible and interoperable. The most important difference that distinguishes the study from previous studies is that the ''CACAVU Model'', which will enter the literature for the first time, will be revealed in the study. It is expected that the model will contribute to global harmony. Indeed, Failure to meet global compliance and interoperability goals will increase costs for airspace users and lead to inefficiency in the overall air traffic system.

1. INTRODUCTION

In order to increase the effectiveness, safety and efficiency of the air navigation system and to reduce flight costs and environmental impact in the face of the increasing density of air traffic globally, important projects such as SESAR, NextGEN, CARATS etc. are being developed within the framework of actors such as ICAO, Eurocontrol, FAA, Japan for the purpose of restructuring Air Traffic Management (ATM). Within the scope of these projects, the transition process from the paper-based, product-oriented Aeronautical Information Service (AIS) approach to the digital data-oriented, system-based Aeronautical Information Management (AIM) has been initiated in order to create Digital Aeronautical Information Management and SWIM (Extended Information Management System) Systems (Kokpit, 2024).

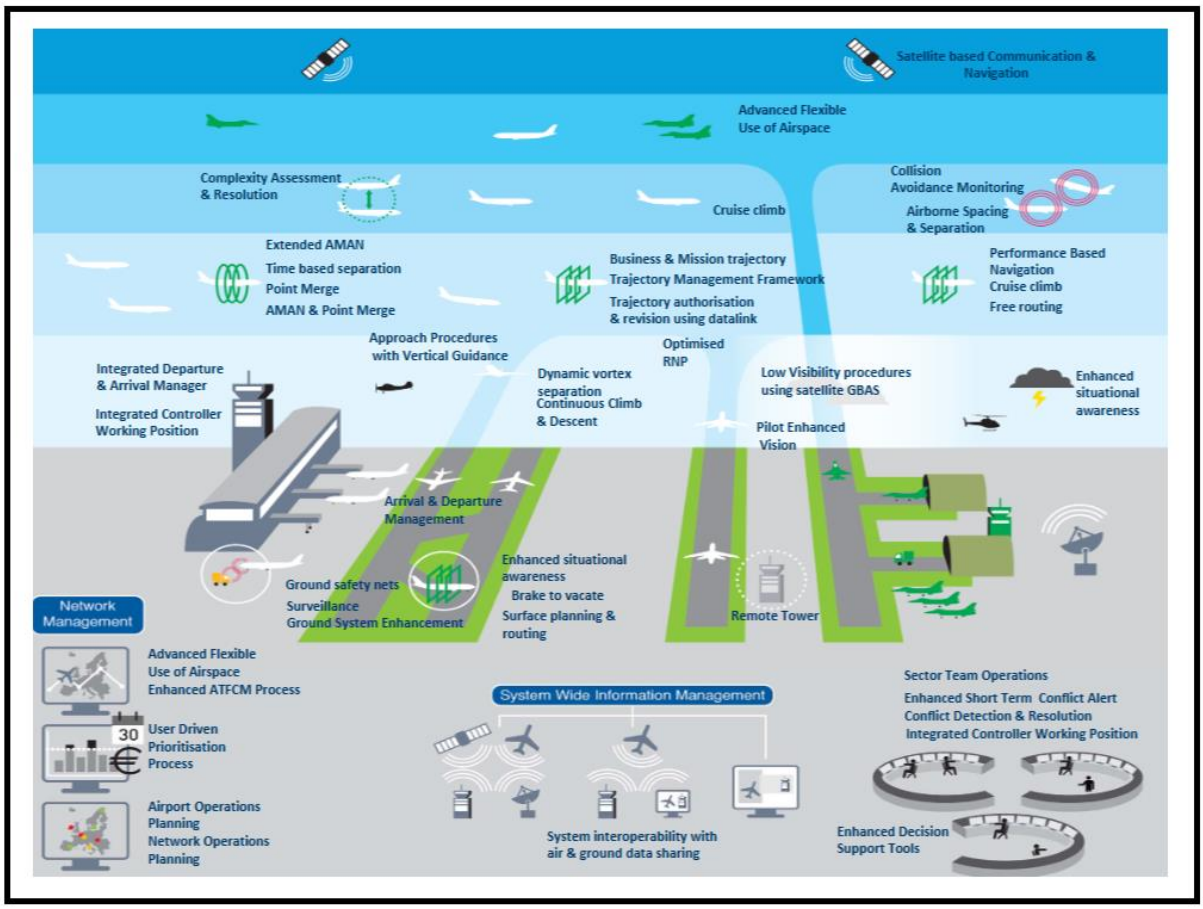

Figure 1. NextGen, SESAR and SWIM Concept

Source: (SESAR Joint Undertaking, 2024)

The primary objective of this study is to demonstrate the nature of the collaboration between the US's "NextGen" and Europe's "SESAR" air traffic modernization projects and to assess their contributions to the interoperability of global air traffic management systems. The integration level of these two major players in global air traffic modernization will be assessed, particularly by analyzing how these partnerships have guided technological transformation processes and the advances they have made in critical areas such as data communications and SWIM. The CACAVU Model, developed within the scope of this study and introduced to the literature for the first time, offers an innovative framework for ensuring harmonization between air traffic systems and is expected to make a significant contribution to the literature. Considering the potential systemic cost increases and efficiency losses that may arise from a lack of harmonization, the significance of this study in both academic and practical areas becomes even greater.

The study consists of six main sections. The first section, the introduction, outlines the general framework of the study and introduces the research topic, problem statement, and conceptual framework. This section also highlights the study's uniqueness and potential contribution.

The second section examines the NextGen system, the US air traffic modernization program, in detail, explaining the system's objectives, technological infrastructure, impact on users, and implementation stages. The innovations NextGen has introduced in air traffic management and its level of interaction with the global system are evaluated in this section.

The third section examines the SESAR system, Europe's parallel modernization project. SESAR's structure, objectives, technological solution proposals, and applications in European airspace are detailed, and comparative analyses are conducted with NextGen.

The fourth section describes the SWIM (System Wide Information Management) system in the context of data sharing, communication systems, and network-based management approaches, and outlines its role in the transatlantic cooperation process.

The fifth section covers the study's problem statement, purpose, significance, assumptions, limitations, literature review, methodological approach, data collection process, and analysis techniques. This section explains the scientific justification for the research methodology used and details the study design.

The sixth and final section interprets the findings, provides general assessments based on the analysis results, and offers concrete recommendations for practitioners. Furthermore, the innovative contributions offered by the CACAVU Model, its applicability, and its potential for future research are discussed.

2. Next Generation Air Transportation System (NextGen)

In the United States, the Next Generation Air Transportation System (NextGen) is a complete modernization of the national airspace system. It offers a comprehensive suite of upgrades, technologies and procedures that improve every phase of flight and enable aircraft to operate more efficiently from departure to arrival.

NextGen uses satellite technology for navigation and surveillance, deploys digital systems for communication, and improves information management. By renewing automation systems, NextGen will also add extensive operational capacity to the national airspace system.

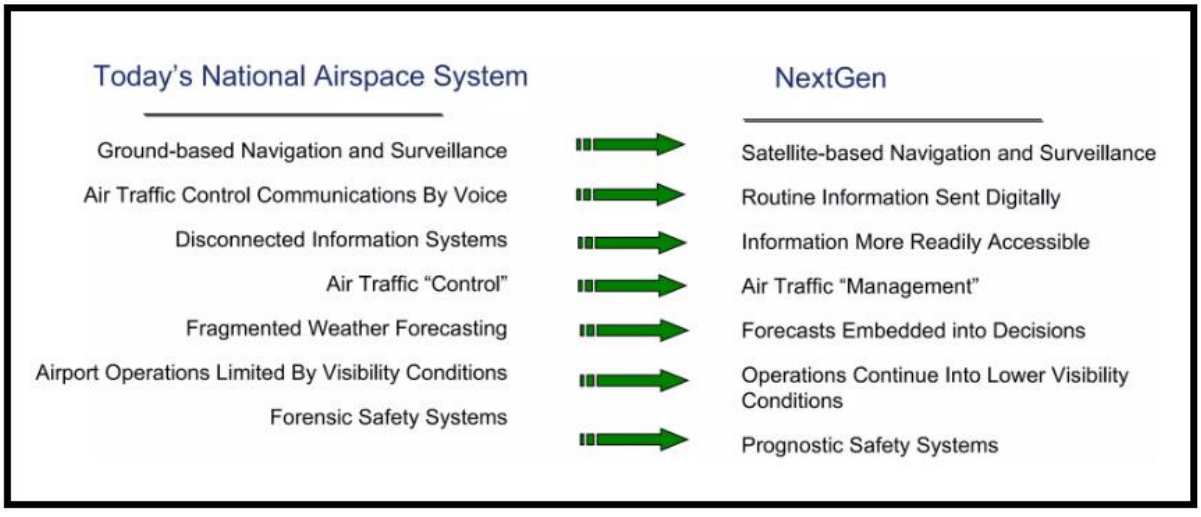

Figure 2. NextGen Concept

Source: (FAA, 2008)

3. Single European Sky Air Traffic Management Research (SESAR)

SESAR is the technological reflection of the broader ''Single European Sky'' initiative, which aims to modernise and harmonise Europe's air traffic management system. SESAR's aim is to identify, develop and implement operational solutions and technology enablers needed to improve the performance of Europe's air traffic system.

The SESAR Joint Undertaking (SESAR JU), established in 2007, is responsible for coordinating and bringing together all air traffic-related research and development efforts in Europe. SESAR JU also represents a public-private partnership between Eurocontrol, Europe's main public stakeholder [‡], and the European aviation service and manufacturing industry. SESAR JU is also responsible for setting SESAR's objectives and priorities.

The ''SESAR Application Manager'' (SESAR DM), established in 2014, is responsible for the implementation of SESAR solutions. SESAR DM plans, coordinates, synchronizes and reports the implementation of such joint projects. In this sense, SESAR DM acts as a project manager (Skybrary, 2024).

4. Extended Aeronautical Information Management (SWIM)

Extended Aeronautical Information Management [§]represents an understanding that will complement human-human communication with machine-machine communication and increase the data distribution and accessibility regarding the quality of the exchanged data. SWIM is implemented to promote information-based air traffic integration. This understanding consists of standards, infrastructure and management that enable the management of information related to air traffic management and the exchange of information between the parties.

SWIM provides seamless access and exchange of information between all air traffic information and service providers and their users. It takes the use of web technologies as an example in general and applies these examples to air traffic systems. In this sense, it reduces compliance costs and makes the aviation data market more competitive. Thus, it also allows users to choose a new provider without a major impact on their systems.

Figure 3. SWIM Concept

Source: (AAI Aero, 2024)

[‡] An international organization that aims to increase the safety of flights and manage airspace congestion by providing coordination between air traffic control centers.

[§] From now on, this expression will be referred to as "SWIM" in this study.

Eurocontrol supports the development and implementation of SWIM in the areas of information services, technical infrastructure, development of standards and supporting materials, management and civil-military cooperation (Eurocontrol, 2024).

5. Expanding Air Traffic to the Modern Life Cycle

5.1. Problem, Purpose, Importance, Assumption and Limitations

The main purpose of this study is to comprehensively understand the benefits of the implementation of the said cooperation and to prioritize appropriate actions regarding this benefit. The purpose of the study is to enable the interpretation of the benefits in this area by addressing the air traffic area.

The study is important in terms of shedding light on the future of air traffic. A new model will be highlighted in the field in question. In this respect, the study, which is examined for the first time in Turkey, is expected to fill an important gap in the relevant field in terms of its contributions to the scientific literature.

Within the scope of the study, the research is based on the assumption that the sampled projects will be able to sustain their activities for at least the next 50 years. The study will be limited by accepting 2025 as a milestone. In this sense, the study will be able to easily provide a perspective to the beneficiary for the coming years.

5.2. Literature

All academic studies to be examined in this section are limited to the aspects of ‘‘directly addressing both technical and operational aspects of SESAR and NextGen; examining the similarities and differences of the two systems by focusing on issues such as decision processes, digitalization and technological integration’’. The studies below reflect the studies that have passed through this filter and are directly related to the research.

Table 1. Literature

Year	Name of the Study	Author(s)	Subject/Examination	Source(s)
1997	Flight to the Future: Human Factors in Air Traffic Control	National Research Council (Wickens, Mavor, McGee - Eds.)	Examines human factors in air traffic control, focusing on the impact of automation and future system design.	National Academies Press
2008	SESAR R&D and Project Portfolios for Airline Business Needs	Peter Brooker	SESAR's R&D projects designed to meet airline needs.	Journal of Navigation, Vol. 62(2), Cambridge University Press
2009	Human Factors Measurement for Future Air Traffic Control Systems	Janice Langan Fox, Michael J. Sankey, James M. Canty	SESAR and NextGen. Aimed at improving human–machine interaction in future systems.	Human Factors (Human Factors Society)
2009	Human–Automation Teams and Adaptable Control for Future ATM	Janice Langan-Fox, James M. Canty, Michael J. Sankey	Proposes adaptable control models for effective teamwork between humans and automated systems in ATM.	International Journal of Industrial Ergonomics, Vol. 39(5)
2010	SESAR Safety Decision-Making: Lessons from Environmental, Nuclear, and Defense Modeling	Peter Brooker	Lessons from environmental, nuclear, and defense modeling applied to SESAR security decision-making processes.	Safety Science
2012	Situation Awareness in the NextGen Air Traffic Management System	Dan Vu Chiappe, Kim-Phuong L. Vu, Tom Strybel	NextGen systems: operations, information management, pilot–ATC interactions.	International Journal of Human–Computer Interaction, Vol. 28(1–3), pp. 140–151
2013	Tracking of Non-Cooperative Airborne Targets Using ADS-B Signal and Radar Sensing	Ming-Shih Huang, Ram M. Narayanan, Yan Zhang, Arthur Feinberg	Aircraft tracking tech with ADS-B and radar in NextGen infrastructure.	International Journal of Aerospace Engineering, Wiley / OALib
2025	SESAR Innovation Pipeline: Air Traffic Management Research and Innovation: 2024 Highlights	SESAR 3 Joint Undertaking	Highlights from SESAR R&D activities in 2023 and strategic innovation priorities for 2024–25 under SESAR Innovation Pipeline	SESAR Innovation Pipeline report (2025 publication)

Source: (Created by the researcher)

5.3. Method, Data Collection and Analysis

The document analysis method was used in the study. This method is a method of examination conducted especially on texts and written documents. In this context, the method was used to understand the content of the documents examined, collect data, obtain in-depth information on a specific subject and seek answers to the research question of this study. The form of the method was chosen as context analysis. This analysis helped to place the documents examined within a broader framework of meaning. In this sense, the documents were read carefully, thematic categories were created and how these categories were processed in the text of the study was examined. In the study, since the phenomena examined throughout the study consisted of interrelated information, the data was collected by examining the documents. The interpretation of this data was presented with a systematic approach. Within the scope of the method and qualitative data in question, the research has reached findings in line with two separate premises. The findings in the first part are the findings obtained from SESARJU documents. In the second of these findings, the ''CACAVU Model''that will reveal the uniqueness of the research will be put forward for the first time in the literature. In the first part, operational activities will be explained and the harmonization of these activities will be justified. In the second part, a new generation model that will facilitate this harmonization will be proposed.

5.4. Findings and Interpretation

5.4.1. Operational Activities and Reasons for Harmonization

GANP is a global aviation management plan developed by ICAO (SESAR Joint Undertaking, 2024). The aim is to improve air traffic management and enhance aviation safety worldwide. GANP provides a roadmap to make air transportation more efficient, safe, and environmentally friendly. Establishing and maintaining GANP is a tool that allows the United States and Europe to promote and support modernization by aligning their plans and global approaches with those of other parts of the world. The primary goal of the United States and Europe is to ensure that the language of GANP is broad enough to encompass the needs of NextGen and SESAR, while also allowing for regional and national implementation (Federal Aviation Administration, 2024).

''Aviation System Blocking/Limiting Updates'' (ASBU) are a series of innovative measures developed as part of GANP , which progressively provide modernization in air traffic management (SESAR Joint Undertaking, 2024). ASBUs provide targets organized in blocks aimed at improving specific areas in air traffic management. These blocks can be implemented according to the needs, resources and capabilities of each state and region. ASBUs provide measurable operational performance improvements organized as flexible and scalable building blocks, modules and elements. These elements can be introduced as needed and implemented by each state and/or region based on their own needs, capabilities and resources.

In addition, standards development organizations in the USA and Europe are jointly carrying out standard development work for the aviation telecommunication network using the internet protocol suite (SESAR Joint Undertaking, 2024).

Discussions are ongoing between the two parties to develop a joint strategy that will provide a holistic view of surveillance infrastructure needs and capabilities. Strategies to meet surveillance infrastructure needs could coordinate potential new surveillance technological capabilities and related applications between NextGen and SESAR.

Again, for both parties, the application of ''Automatic Dependent Surveillance-Broadcast'' (ADS-B) [**]may be the focal point of a new cooperation (SESAR Joint Undertaking, 2024).

One of these strategies is ICAO's ''Information Management Panel'' (IMP). This strategy will provide a US-EU harmonization and interoperability perspective on issues such as roles, required standards, and service management requirements within the global SWIM community.

Today, aviation infrastructures around the world connect major airports, secondary airports, vertiports and heliports to a multimodal transportation network. Passenger and cargo infrastructure, services, operators, aircraft, airports, ground handling and military units are integrated into relatively coherent multimodal networks. Shared information platforms and new information technology concepts have facilitated planning and decision-making processes. Passenger access to airports and uninterrupted door-to-door services have increased. Airport design, processes and services are based on new and efficient concepts and are carried out with operations that are resistant to possible disruptions. Similarly, automation levels are enabling unmanned flights to become widespread and paving the way for new aviation applications. Air traffic management has also benefited from these developments.

Another notable breakthrough is trajectory management. Trajectory management aims to improve air traffic operations and, in particular, increase capacity predictability for airline users and all users of the air traffic management system.

Four-dimensional (4D) trajectory management is a precise definition of the aircraft's route, including the current flight path obtained from the flight plan (latitude, longitude, altitude) as well as the time element. 4D trajectory management allows the planning of a selected route to be flown in a specific

[**] An advanced surveillance technology that combines an aircraft's positioning source, aircraft avionics, and ground infrastructure to create an accurate surveillance interface between the aircraft and the air traffic tower.

time period, while ensuring a certain level of safety for airspace users and taking into account weather conditions (SESAR Joint Undertaking, 2024).

An important element of the 4D orbit management concept is FF- ICE . This element ensures the exchange and distribution of information. This is where NextGen and SESAR coordinate work in this area by collaborating with global partners in the field of 4D orbit management and FF- ICE.

The common navigation systems roadmap is also being updated to align with the current capabilities and future strategies of NextGen and SESAR. This roadmap describes planned developments regarding the sustainability and evolution of ground-based and satellite-based navigation infrastructure to support ''performance-based navigation'' (PBN) and precision approaches in both regions (SESAR Joint Undertaking, 2024).

Finally, after the operational activities and the reasons for harmonization are explained, the issues that will ensure harmonization will be emphasized. Before explaining this new model, it is essential to introduce the ''concept of interoperability'' (Chiappe vd., 2012). The concept of interoperability†† is the ability of different systems, organizations or technologies to work effectively with each other. This means that data and information can be shared seamlessly and function in a harmonious way to achieve common goals. In aviation, this understanding (interoperability) is vital to ensure that air traffic management systems, aircraft, ground services and technologies in different regions or countries can communicate and work in a unified manner. This helps to increase efficiency, safety and performance in air transportation operations (SESAR Joint Undertaking, 2024). The main elements of interoperability in aviation are:

I. Communications: The ability of systems to exchange data, for example air-ground communication or data sharing between aircraft through air traffic control.

II. Navigation: Compatibility of different navigation systems, for example global navigation satellite systems (GNSS) and performance-based navigation (PBN).

III. Surveillance: Integration of systems such as ADS-B (Automatic Dependent Surveillance Broadcast) and radar allows for common situational awareness.

IV. Procedures: Harmonization of operational procedures across regions ensures smooth operation of air traffic flow and standardized responses in various situations.

5.4.2. ''Is Rational Interoperability Possible?'': CACAVU Model

According to the research; a series of innovation portfolios are required for the USA and Europe to offer the world a digital and compatible sky in air traffic. A new model created from the initials of the elements in this portfolio in English will be examined in this part of the research. The model presented is '' Connected Air Traffic Management'', '' Autonomy in Air-Ground Integration'', '' Capacity -on-Demand '', ''AI in Aviation '', '' Virtualisation and It consists of the elements of ''Cyber-Secure Data Sharing '' and ''Urban Mobility ''.

†† The concept is frequently used in the literature as " interoperability ".

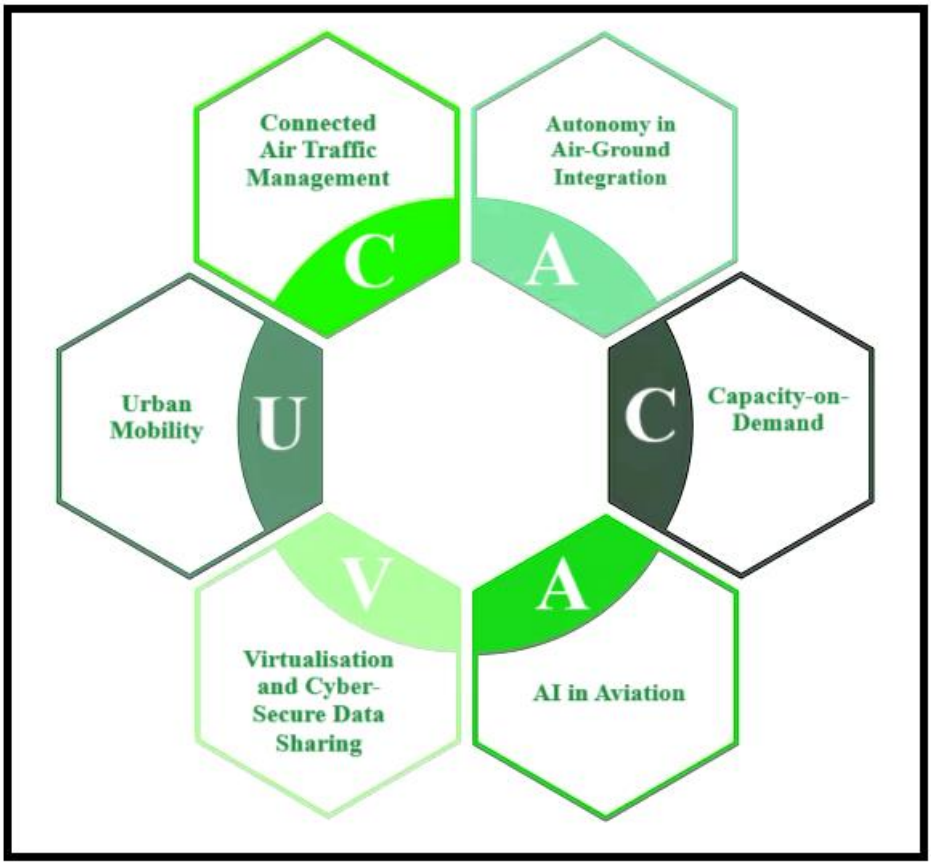

Figure 4. ''CACAVU'' Model

Source: (Created by the researcher)

The elements of the model can be expressed in our language as; ''Connected Air Traffic Management, Independence in Air-Ground Integration, Capacity on Demand, Virtualization and Cyber Secure Data Sharing, Artificial Intelligence in Aviation, Urban Mobility''. In this section, it is useful to explain the details of these elements. The air traffic management system of the future will undoubtedly provide hyper-connectivity between all stakeholders via fixed and/or mobile networks with high bandwidth and low latency. Highly automated systems with multiple actors will interact seamlessly with each other, making the system both scalable and more secure than today. The second element is ''Autonomy in Air-Ground Integration''. A progressive transition to autonomous flight supported by autopilot technologies requires more advanced integration of the infrastructures. This integration will enable the infrastructure to function as a digital twin of the aircraft.

Another element is ''Capacity on Demand''. Here, technology will enable dynamic configuration of capacity services on demand to ensure that air traffic services continue smoothly at pick times. The element ' Virtualization and Cyber Secure Data Sharing' concerns the flawlessness of the service provided in air traffic. Service provision will be made independent of the physical infrastructure, and thus air traffic and data service providers will be able to integrate their operations securely to the places needed beyond national borders. While explaining the ''Artificial Intelligence in Aviation'' element, it is necessary to explain the concept that expresses many computer technologies. In fact, this element has already entered our lives with its applications that are in the infancy stage. In this context, the aviation infrastructure of the future will be more data-oriented. Thanks to the application of machine learning, deep learning and big data analytics in air traffic, it will be possible to design a smarter and safer system that constantly analyzes the air traffic management environment and even learns from this environment. The last element is the ''Urban Mobility'' element. In the digital sense,

the domestic traffic management systems of countries will provide safe and secure integration of aircraft in the airspace (especially in urban areas). This system understanding should consider existing aircraft, new aircraft and autonomous operations. One of the most challenging usage scenarios of this element is the concept of ''urban air mobility'', which is expected to provide development of autonomous technologies in many areas. The development of this mobility depends on the development of vehicles with vertical take-off and landing (VTOL) capabilities.

6. Conclusion and Recommendations

NextGen and SESAR are working together on a new effort to introduce new or updated technologies and procedures to global audiences and demonstrate the performance gains that can be achieved. The scope of these demonstrations covers all phases of flight (planning, takeoff, cruise and arrival), but today's trials are focused specifically on flights between North America and Europe. These activities include accelerating projects with shared goals, accelerating the development of certain technologies and operational procedures, and supporting the implementation of ICAO's GANP and ASBUs by contributing to global harmonization.

It is important to see the benefits that new technologies and capabilities can provide in terms of compatibility, operational and financial efficiency, and performance gains such as environmental and safety. These globally focused introductions facilitate the implementation of technologies, operational capabilities and procedures. This type of cooperation provides a consistent life cycle approach. The ''CACAVU Model'', which was first put forward in this study for the healthy execution of this life cycle, can benefit stakeholders and researchers. Thanks to the clear determination of the coordination requirements expected to be provided in the partnership , risks for stakeholders in the implementation process will be reduced. One of the meetings that will reduce these risks; ''SESAR JU Annual Conference 2025'' will be held in Brussels. Here, the launch of the ''European Air Traffic Master Plan'', which sets out the vision of making Europe the most efficient and environmentally friendly flight area in the world and indicates an important vision for European aviation, will also be held. It may be beneficial for stakeholders from both the European and US aviation ecosystems to participate in such meetings. On such days, discussions of digitalization and new technologies can be expected.

Unlike the individual studies on NextGen and SESAR in the literature, this study focuses on the integration of these two major aviation modernization initiatives, specifically addressing the operational harmonization and global cooperation perspectives in transatlantic air traffic in a holistic manner. The study's most significant innovation is its introduction of the "CACAVU Model," a previously unseen framework, providing a comprehensive framework for ensuring technological and operational harmonization in air traffic management across the lifecycle. This model aims to mitigate potential risks during implementation by clearly defining coordination needs among the parties, thus facilitating the effective use of systems by stakeholders on a global scale. Furthermore, the study comprehensively examines NextGen and SESAR's joint projects contributing to ICAO's GANP and ASBU programs, as well as practical trials specifically for transatlantic flights, thus establishing a significant bridge for translating theoretical knowledge into practice.

The significance of the study is that it provides a concrete roadmap for the harmonization and global integration of air traffic systems in light of the increasing digitalization and sustainability goals in the aviation sector. In this context, it is recommended that stakeholders be encouraged to follow and contribute to developments in innovative technologies and digitalization by emphasizing the importance of international platforms such as the "SESAR JU Annual Conference" to be held in 2025. Future studies recommend monitoring field implementations of the "CACAVU Model" and conducting performance evaluations, as well as exploring integration opportunities with other regional modernization programs. Limitations of this study include the lack of broad practical applicability of the "CACAVU Model" and the possibility that simulations based on existing data may not fully reflect actual operational conditions. Therefore, the model requires further field testing and evaluation with broader stakeholder participation.

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