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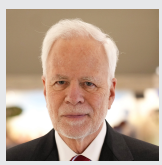

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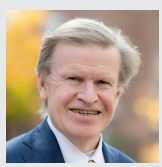

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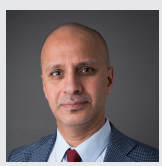

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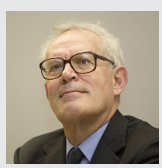

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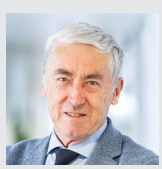

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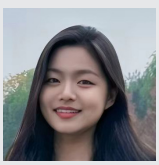

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Foreword

In modern states, the joint work of a number of institutions helps to ensure that the welfare of a given community or society is enhanced. Economic policy actors are characterised by both unity and diversity, because – while they share a common purpose – these actors, by their very nature, all have different mandates and different ways and means of achieving common social goals. In this complex system of goals and instruments, independent central banks played and play a particularly important historical role, having been created with the specific aim of supporting the emergence and sustainability of well-being and prosperity by ensuring the stability of money, the financial system and the economy as a whole.

In Hungary, this role of preserving stability is played by the Magyar Nemzeti Bank (the central bank of Hungary, MNB), which celebrated its centenary in 2024. This issue of the Financial and Economic Review pays tribute to this landmark anniversary with articles by renowned and respected international and domestic experts, pointing out that the values of predictability, resilience and safety are common and solid foundations across time and borders, upon which central banks' activities are based all around the world. This is in line with our belief that a central bank can do the most for long-term economic growth and thus social welfare if its decisions are guided by these values, providing a stable basis for the functioning of the economic and financial system.

The festive character of our December issue is reinforced by the opening essay by *György Matolcsy*, Governor of the Magyar Nemzeti Bank. His article is a centenary reflection on the mission of the MNB, and his analysis aims to draw on historical lessons to provide a guide to the challenges of our day and age. What emerges from the historical periods is the important requirement to preserve the independence of the central bank and to coordinate the activities of the different economic policy branches, in order to achieve and maintain price and financial stability, to support economic development and to prepare for the challenges of the future, such as the green transition.

Barry Eichengreen, Professor at the University of California, Berkeley, and Researcher at National Bureau of Economic Research and Centre for Economic Policy Research, also analyses the relationship between central bank independence and monetary stability. His essay compares monetary policy and inflation in Hungary in the first half of the 1920s and the first half of the 1990s, when economic and financial imbalances put the central bank under inflationary financing pressure. According to the author, central bank independence has proven useful, but in neither case has it been sufficient to prevent the instability that later developed

in a situation where the central bank was under the pressure of expectations to resolve problems emanating from the banking sector, the balance of payments, the budget and weakened sectors of the economy.

Harold James, Professor at Princeton University, describes the period of hyperinflation in Central Europe after the First World War, with a special focus on Germany and Poland. He points out that the peripheral countries concerned also sought to use inflation to change international and internal redistribution, so that the elimination of inflation was accompanied by the surrender of some aspect of sovereignty or the restriction of domestic policy space. As a result, many of the inflationary processes did not actually end, with premature, incautious celebrations followed by worsening inflation.

Manoj Pradhan, founder of Talking Heads Macro, and *Charles Goodhart*, Emeritus Professor at the London School of Economics, jointly discuss the correlations between demographic change, budgetary risks and monetary policy. The researchers start from the premise that there are indications that the size and persistence of future deficits and debts are being underestimated, and conclude that we are entering a new era in which the relationship between demography and fiscal and monetary policy will become even more complex than it is today.

One of the key issues still roiling the world of central banking today is discussed in the joint paper by *Paul De Grauwe*, Professor at the London School of Economics, and *Yuemei Ji*, Professor at University College London, who explore how to fight inflation without central banks providing substantial transfers to banks. On this issue, the authors propose that central banks should introduce a two-tier system for the establishment of minimum reserves, in which interest would only be paid on the amount above the minimum reserve. This would dramatically reduce allocations to banks, allow central banks to maintain the current procedure and render monetary policy more effective in the fight against inflation.

The study by *Reiner Martin*, Executive Director at the National Bank of Slovakia, and *Piroska Nagy Mohácsi*, Visiting Professor at the London School of Economics, examines the post-pandemic inflation wave through the example of the Visegrad Group (Visegrad Four) countries. They find that membership of the euro area was not only beneficial in normal economic circumstances, as the advantages of monetary sovereignty in small, open and integrated economies gradually disappeared, but was also particularly useful in times of crisis.

György Szapáry, Chief Adviser to the Governor of the MNB and Visiting Lecturer at the Budapest Metropolitan University, and *Balázs Vonnák*, Economic Adviser at the MNB and Visiting Lecturer at the Budapest Metropolitan University, examine the impact on convergence of the decisions of monetary policy institutions in Central

and Eastern European countries. Their main finding is that the convergence rate over the past decades has depended only to a small extent on the choice of the exchange rate regime or the potential adoption of the euro or inflation targeting, but much more on the establishment of central bank independence. This suggests that central bank independence significantly enhances the credibility and predictability of monetary policy and largely determines the success of each monetary regime.

István Ábel, Professor at Budapest Business University, and *Pierre L. Siklos*, Professor at Wilfrid Laurier University and Balsillie School of International Affairs, use a theoretical model in their study to assess the main elements that determine the monetary policy strategy chosen by central banks to control inflation, especially in their flexible inflation targeting regime, in which exchange rate developments play a significant role. Empirical evidence from Taylor's rules suggests that the MNB is pursuing a flexible monetary policy that contributes to the stabilisation of the economy.

The theoretical model put forward by De Grauwe and Ji is complemented by a study by *Csaba Csávás*, *Pál Péter Kolozsi* and *Ádám Banai*, Experts at the MNB, which examines the modification of the Hungarian minimum reserve system between 2022 and 2024 as a case study and concludes that there are substantial and strong constraints on the reduction of interest payments on the minimum reserve: for a given overall interest rate level, it may reduce central bank interest expenditure, but the extent of the reduction is limited by the potential consequences of the change for the overall money market environment and foreign exchange supply as an unintended cost.

The topic of the feature article in this issue looks clearly to the future. *Bin Hu*, Associate Professor and Director of Global Climate Governance Research at Tsinghua University, *Chaoyi Chen*, an Expert at the MNB and Visiting Lecturer at Budapest Metropolitan University, and *Yueran Zhang*, a Student at Renmin University of China, review past China-Hungary green bond cooperation and make suggestions for improving future cooperation. Key proposals include better communication and coordination in managing financial risks, opening the green bond market in both directions, establishing mutual recognition mechanisms for green bond standards and improving transparency.

The Financial and Economic Review has always made it a priority to contribute to Hungary's advancement by facilitating an understanding of the ever-changing economic developments and analysing the country's economic and financial situation. This issue once again serves that objective, featuring articles by exceptionally distinguished authors. The studies published and the historical experience they draw on clearly show that, while stability is often taken for granted,

it is something that both independent central banks and economic policy as a whole must consciously work to achieve and maintain.

The best way to prepare for a leap in the economy, as in sports, is to have both feet on the ground beforehand. On this note, I offer you the studies of our jubilee issue and wish you pleasant, informative reading!

Barnabás Virág
Financial and Economic Review,
Chairman of the Editorial Board
Magyar Nemzeti Bank, Deputy Governor

One Hundred Years for One Goal: Centenary Reflections on the Mission of the Magyar Nemzeti Bank*

György Matolcsy

This paper pays tribute to the history of the Magyar Nemzeti Bank, which has been working to establish and maintain price and financial stability and to support sustainable growth in the Hungarian economy for the past one hundred years. We seek to find out what the Hungarian economy has looked like from a central bank perspective over the past hundred years. The study thus covers the decisive periods since 1924, encompassing the time between the two world wars, the socialist economic system built up after World War II and the milestones of the era following the regime change. The analysis is primarily intended to draw lessons from history to offer a guideline amid the challenges currently faced. The historical periods show the importance of preserving the independence of the central bank and coordinating the activities of the branches of economic policy, in order to achieve and maintain price and financial stability, support economic development and prepare for future challenges, such as the green transition. Over the past 12 years, the Magyar Nemzeti Bank has gradually opened up opportunities that support the achievement of these goals in the present day and age.

Journal of Economics Literature (JEL) codes: N14, N24, N44, E42

Keywords: economic history, monetary policy, central bank history, Hungarian economy

1. Introduction

This year marks the centenary of the Magyar Nemzeti Bank (the central bank of Hungary, MNB), the independent central bank of Hungary. Its foundation in 1924 did not occur in a period of economic equilibrium: it took place in the midst of great political, economic and social uncertainty. As one of the losers of the 'Great War', Hungary had to integrate into a changing Europe and a new international order,

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

György Matolcsy: Magyar Nemzeti Bank, Governor.

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now as a smaller, weakly capitalised economy. One key element of this integration was the establishment of an autonomous central bank, which also guaranteed the country's financial sovereignty. According to contemporary evaluations of the situation, the foundation of the central bank was, without a doubt, the first step forward in achieving national goals, both in terms of stimulating the economic life of Hungary and building international alliances.

In his Inaugural Address at the general meeting of the Magyar Nemzeti Bank on 24 May 1924, Minister of Finance Frigyes Korányi emphasised that the central bank *"is an instrument and guarantee that our stable currency, which is the cornerstone of our economic life, shall be reinstated to its former glory and that it shall earn the honour that is necessary to restore normal production, to finally eliminate the divergences in the distribution of income and wealth and to bring it back to normal*" (*Schandl 1924:1*). The first independent central bank of the country was thus expected to support the 'health' of the fundamentals required for economic growth and social development by guaranteeing price stability. One hundred years later, this objective still functions as the basis for the MNB's day-to-day central banking operations.

Since 1920, Hungary has been integrated into the global economy as a small, open economy, which – as is the case with other economies with similar characteristics – fundamentally determines the central bank's opportunities and challenges in several dimensions (*Akkaya et al. 2023*). When a major global change – be it an economic and financial crisis or a war between states – forces the country to rebuild its economy, as was the case in 1920, 1945, 1956, 1990 and 2010 in Hungary, the central bank plays a particularly important role. There is no more obvious example of this than the story of the MNB's foundation.

The 1920s saw the creation of a central bank that is considered modern even by today's standards and its integration into the international monetary order of the time. As noted by Sándor Popovics, founding governor of the central bank, the MNB was established "*on the basis of principles that have long been elaborated by science and recognised by practice throughout the civilised world, but which must be accompanied by due consideration for the specific interests of our country*" (*Bácskai 1994*). As a result of the spillover effects of global economic problems and the challenges entailed by the reintegration of a truncated country, the 1930s were marked by a series of attempts to address trade, capital flow and later, geopolitical problems. On the central bank side, this implied measures to continue stability programmes, tackle indebtedness, achieve financial stability and guard against increased state expansion. However, the new world war and its aftermath deprived the central bank of its autonomy for a long time to come.

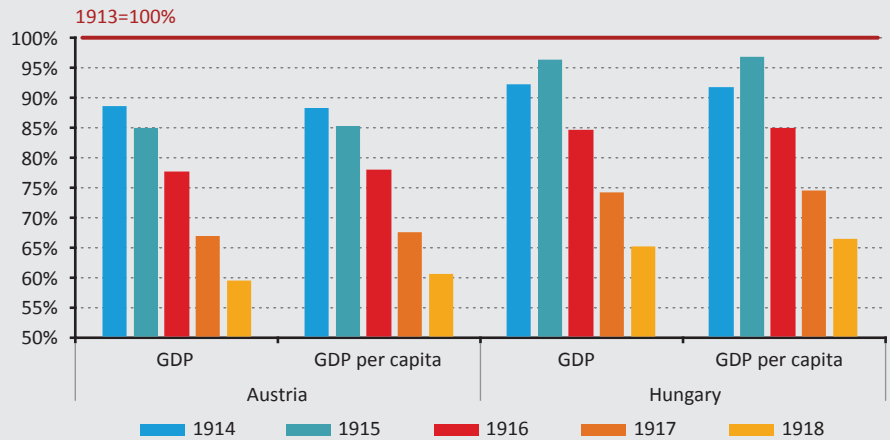
The second major phase relates to the socialist era of the Hungarian economy. By the end of the 1940s, the planned economy system and centralised economic governance had significantly limited the room for manoeuvre, not only for the country but also for the Magyar Nemzeti Bank. The nationalisation policy, which also extended to the banking sector, fundamentally altered the structure of Hungary's banking system. Between 1947 and 1987, a single-tier banking system was in place instead of a two-tier banking system, and the central bank functioned only as an executor of government decisions, primarily in matters related to financial liquidity and intergovernmental credit operations.

The third major phase in the history of the central bank covers the more than three decades since the regime change, which saw the re-establishment of the two-tier banking system and the return to independence. Although this period can be broken down into numerous sub-periods, it should be emphasised that starting from 2013 the MNB has gradually created the opportunities which allow it to support price stability and financial stability, as well as economic growth and the green transition. The period after 2013 was the first time in the last hundred years that convergence took place while equilibrium was also maintained. However, the 2020s brought extraordinary challenges in the form of a pandemic, war and unprecedented inflation. Thanks to successful crisis management by the government and the central bank, economic growth has resumed and important steps have been taken to restore balance. But the work has not stopped, and flexibility and innovation are essential in order to win the coming decades. Bearing in mind the mandate of the Magyar Nemzeti Bank – to ensure price stability, maintain financial stability and support the government's economic policy and its policy related to environmental sustainability – the central bank will continue to support the nation's prosperity through rapid and effective decision-making.

2. Between the two world wars

After the devastation of World War I, the disintegration of the Austro-Hungarian Empire with an internal market of more than 50 million people gave rise to a new situation in Central and Eastern Europe. This process also resulted in fundamental structural changes in the case of Hungary, which, as one of the losers of the war, was reduced to a small and open economy: this implied a new position both in respect of the real economy and the financial sector. By 1918, the volume of gross domestic product (GDP) produced by Hungary had fallen by nearly 35 percentage points compared to 1913, the last year of peace before the war (*Figure 1*). In addition to the war losses, the shackles of the 1920 Trianon peace treaty made recovery even more difficult, increasing the country's international isolation. According to estimates, it was only in 1925 that GDP approached its 1913 level (*Romsics 2017: 388*).

Figure 1
Gross domestic product in Hungary and Austria compared to 1913



Source: Schulze (2009:83)

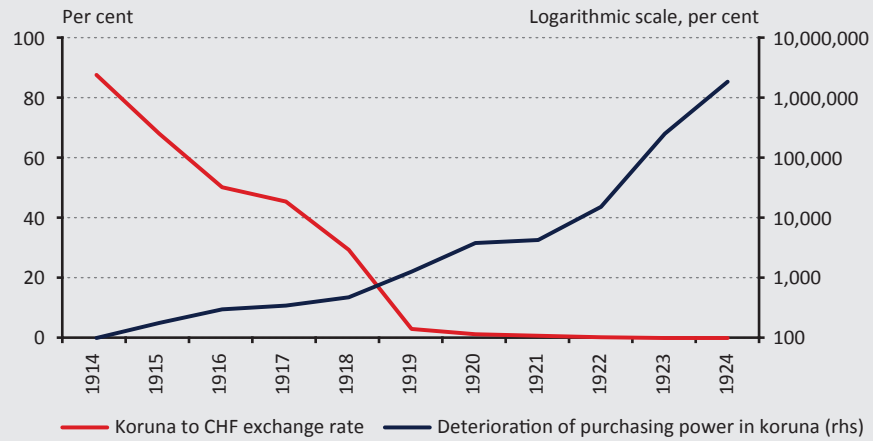
As a consequence of the Trianon peace treaty, Hungary retained only 40 per cent of its former national income and around 55 per cent of its industrial capacity (*Fellner 1930*). While a significant part of the manufacturing sector remained in the truncated part of the country, the raw material base was trapped in the severed parts. More than 60 per cent of the railway and public road network, more than one half of the domestic manufacturing industry and a major part of arable lands for agricultural crops ended up outside the borders of the country (*Virág 2020*). After the collapse of the Monarchy, Hungary not only faced the loss of a smoothly functioning economic and monetary union, it was also excluded from international capital flows.

For Hungarian economic policy, the problem of the rising cost of living and the financing needs of the structural change simultaneously became pressing issues. As uncertainties surrounding reparation obligations made foreign credit impossible to obtain, policymakers relied on internal resources (mainly tax increases) to plan for stabilisation.

However, the persistent rise in price levels worked against stabilisation. This was a direct result of the fact that the Austro-Hungarian Bank's war-financing policy had already triggered inflation during World War I. By October 1918, the cost of living in the Monarchy had surged to 1,589 per cent of the level recorded in July 1914. The amount of money in circulation rose by 1,167 per cent between the two periods. At the same time, in October 1918 the ore reserve was only 24 per cent of its level recorded in July 1914, while by the autumn of 1918, the exchange rate of the koruna against the Swiss franc had fallen to 42 per cent of its summer 1914 value (*Schulze 2009:100*).

The situation inherited was subsequently aggravated in Hungary by the aggressive, highly inflationary credit policy of the early 1920s, which was intended to get the country back on its feet and support the necessary economic restructuring. This led to hyperinflation and the complete depreciation of the koruna by the summer of 1923 (*Figure 2*). In view of the continuing rise in prices, restoring the balance of public finances became the most urgent priority (*Pogány 2023*).

Figure 2
Changes in the exchange rate and purchasing power of the Hungarian koruna



Note: Changes in the purchasing value of the koruna based on food prices (based on the weekly food requirements of a working family of five) (Pogány 2023:84)

Source: Pogány (2023) and relevant data from the Statistical Yearbook of Hungary

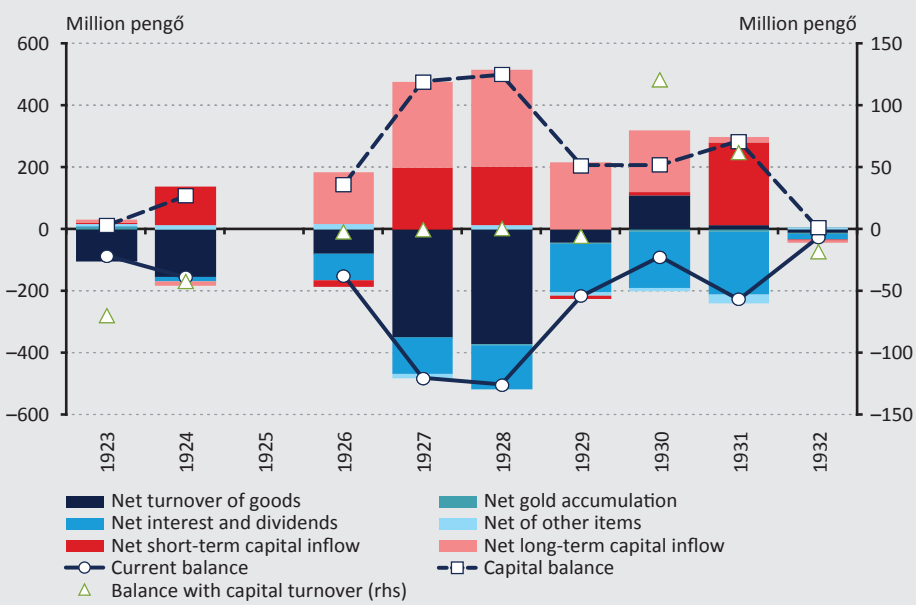
Attempts at stabilisation based purely on internal resources failed. Hyperinflation led to a desperate economic situation, and it soon became clear to the Bethlen government that Hungary needed help from the international community (*Radnóti 1926*). Eventually, thanks to the substantial support of the Bank of England secured through the personal intervention of central bank governor Sándor Popovics, the League of Nations Loan Agreement laid the foundations for successful stabilisation (*Péteri 1985*). The resolution programme called for stringent monetary, fiscal and currency reforms. One of the most important conditions of the programme was the operation of an autonomous, independent central bank, which in practice commenced on 24 June 1924 (*Popovics 1924*).

Thanks to the monetary and fiscal consolidation that followed the MNB's foundation and the inflow of foreign currency resources into the country under the League of Nations Loan Agreement, stabilisation was extremely rapid. Due to budgetary adjustments, the general government was in surplus by 1925, the trade balance

improved and the rapid increase in consumer prices quickly dropped off (*Botos 1999*). The exchange rate of the koruna stabilised, and in parallel, a currency reform was conducted, which resulted in the introduction of the new Hungarian currency, the pengő, on 1 January 1927. Like the koruna, the pengő was pegged to the exchange rate of the pound sterling (*Popovics 1929*).

However, in addition to replacing the old currency, central bank governor Sándor Popovics also wanted to put an end to the practice of taking recourse to central bank credit as a means of replacing the working capital lost during the war. Popovics saw this as inflationary and hence extremely damaging for the economy. Early on, he warned the government to be cautious about relying on foreign loans in consideration of their purpose (*Schlett 2014*). The MNB's main concern in this regard was that the majority of foreign loans was being used for consumption rather than for investment to increase competitiveness (*Ferber 1983*). This was confirmed by the capital and current account data, which indicated that the latter's persistent deficit was covered by the inflows of loans at the time (*Figure 3*).

Figure 3
Hungarian balance of payments, 1923–1932



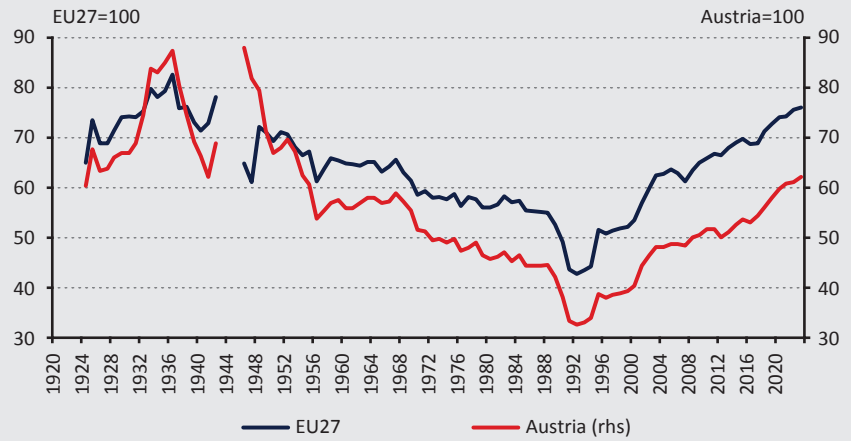
Note: No data are available for 1925.
Source: HCSO

Indeed, in the second half of the 1920s, the Hungarian market opened up to the inflow of Western credit, as aptly demonstrated by the balance sheet total of commercial banks. Data from the relevant yearbooks of the Hungarian Central Statistical Office (HCSO) show that between 1925 and 1929 the assets of the credit institution sector more than tripled from 1.9 billion pengő to 6.1 billion pengő. Credit expansion was significant, while the process of internal capital accumulation remained well below its potential, with the Hungarian economy mainly fuelled by short-term foreign loans (*Réti 2011*). MNB officials expressed concern about the growing portfolio of loans with a maturity of less than a year, recognising early on that a strengthening of domestic lending flows would be desirable. Although the interest rate level was gradually lowered at the time, the tight exchange rate policy in place due to the gold standard regime in effect limited the monetary authority's room for manoeuvre (*Pogány 2003*).

The negative consequences of adverse lending developments, the global fall in agricultural prices and the drastic decline in capital flows were amplified amid the pass-through of the global economic crisis. The period of the three-day bank holiday, temporary capital restrictions, the suspension of the stock market, prolonged deflation and a substantial slump in international trade changed the leeway of economic and financial policy. Through the Financial Institute Center, domestic supervision and control provided a higher degree of prudence compared to regional trading partners (*Varga 2016*), but in the first half of the 1930s the central bank had its plate full cleaning up the balance sheets of credit institutions overwhelmed by defaulting liabilities, managing insolvency and restoring the confidence of depositors who had fled the sector. That notwithstanding, based on the yearbooks of the HCSO, the volume of lending and deposit-taking recovered only slowly over the decade as a whole.

The Hungarian economy was thus in a desperate situation on several fronts. The traditional buyers of Hungarian grain began to adopt protectionist policies, and in the meantime cheap US grain appeared on the global market as a competitor. Due to global economic conditions, international banks withdrew their loans to Hungary, and the central bank's reserves had to be used to repay the earlier loans. Falling domestic incomes and rising unemployment resulted in a sharp fall in domestic consumption (*Virág 2020*). Nominal GDP per capita continued to rise, but while it had grown at an annual rate of four per cent on average in the 1920s, it only grew by an average of 1.5 per cent annually in the 1930s. Hungary's level of development relative to Austria also rose gradually until the outbreak of World War II (*Figure 4*).

Figure 4
Change in GDP per capita in Hungary compared to Austria and the EU27



Note: EU27 based on consolidated data from Member States available in the Maddison database.
Source: Maddison Database, Eurostat

From the second half of the 1930s, the pre-World War II arms race and the recovery of global trade chains led to renewed strengthening of the national economy, but the gradual erosion of the international gold standard regime and the relative scarcity of resources for fiscal policy created the need for the central bank to provide financing for government investment by increasing the central bank's turnover of treasury notes. This was despite the fact that the MNB was protected from the purchase of government debt by strict rules in its Memorandum of Association, in compliance with the idea of central bank independence. As a result, by 1937 the level of internal debt had doubled relative to 1931 (*Botos 1999*).

Thus, from the second half of the 1930s, industrial development came to the forefront of the government's economic policy (*Germuska 2012*). The best-known financing scheme of the era was the Győr Armaments Programme for armaments and infrastructure development. However, this also marked the beginning of a gradual merging of fiscal and monetary policy powers and as a result, the issuing of banknotes became nearly the exclusive privilege of government will. The financial burden of the armaments programme, followed by the unsecured financing of World War II, together with the massive destruction of national wealth and the collapse of the financial system resulted in the second largest hyperinflation in the world (*Siklos 1991*).

3. Suspension of central bank independence under socialism

The material losses in World War II amounted to around 22 billion pengő calculated at 1938 values (*Virág 2016:12*). Including human and social sacrifices, Hungary's war losses were more than four times the gross domestic product of 1938–1939 (*Virág 2020:74*). The balance between the supply and demand for goods collapsed, public debt ballooned again, government revenues fell and were once again substituted by unsecured banknote issuance. All of this led to a considerable depreciation of the currency from July 1945 for 13 months.

The Hungarian hyperinflation finally broke the world record on 10 July 1946 when, despite the application of regulated prices, the daily money depreciation reached 349 per cent, which meant that prices practically doubled every 11 hours (*Virág 2016:20*). Consequently, a new currency, the forint was introduced on 1 August 1946, which was an important component in the reconstruction of the country. In addition to the new currency, inflation also needed to be contained through price and wage reforms, adequate stockholding and effective implementation of the general government resolution programme. Indeed, the introduction of the forint did not automatically mean that price level increases were fully contained: prices continued to rise because of the size of the general government deficit and the shortage of goods. In mid-1948, average food prices were almost 60 per cent higher than two years earlier (*Marton 2012:379*).

One important difference relative to the post-World War I stabilisation programme was that the post-World War II reconstruction was carried out without major foreign borrowing. The first stage of the reconstruction involved a three-year plan launched in the year following the introduction of the forint, the main achievements of which were higher wages and lower unemployment. It should be noted, however, that a major contributor to the stabilisation was the fact that during the World War II, as the Soviet Red Army was approaching, in January 1945 the staff of the Magyar Nemzeti Bank evacuated 30 tonnes of gold, the central bank's substantial amount of foreign currency reserves and many other valuables to Austria by train. Once in the US zone of occupation, the US army seized the gold, the return of which in June 1946 established social confidence in monetary stabilisation.

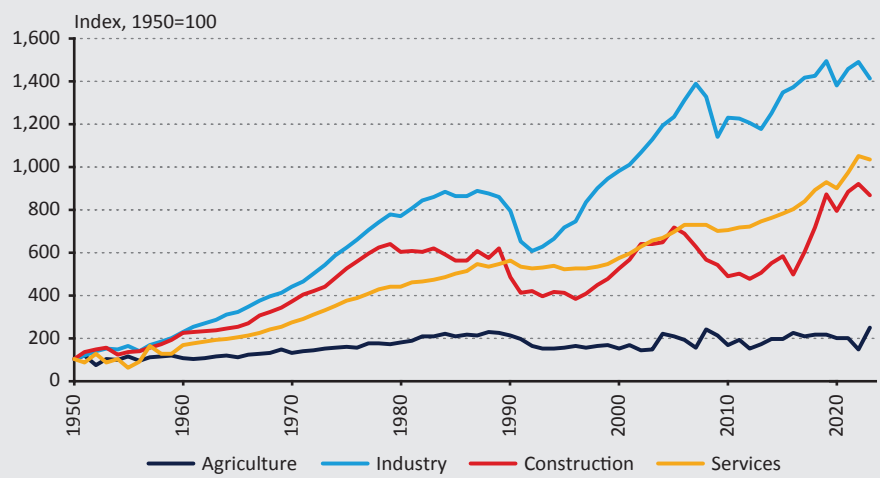
Destabilising state control after the loss of World War II led to the establishment of a single-party communist dictatorship in 1949. At the end of 1947 the nationalisation process, which had begun earlier, reached financial institutions and as part of this process the Magyar Nemzeti Bank was also taken over by the state. With nationalisation, the classical central banking era in the history of the MNB came to an end in the first half of 1948. Within the framework of the one-tier banking system established by the 1947 legislation, the MNB assumed the function of commercial

banks as well, although specialised financial institutions were also set up for the purpose of profile cleaning.

The socialist period was characterised by a centralised credit policy, the centralisation of payment transactions and planned foreign exchange management (*Botos – Botos 2004*). The MNB's monetary policy was expected to support investment, the Cold War-era forced military development and agricultural restructuring. The central bank's role in implementing all of this was purely administrative. During these years, central and commercial banking functions were supplemented by powers of an official nature. This triple intertwining was most evident in the management of foreign exchange (*Bozó 2000*).

By the early 1950s, the liquidation of the capitalist economy was complete. Under the socialist economic arrangements, given state ownership and total state control, the real needs of the market were completely relegated to the background. The government embarked on massive industrial and military projects. The main purpose of the first five-year plan launched in 1950 was to transform Hungary from an agricultural into an industrial economy. The results were soon visible on the production side (*Figure 5*).

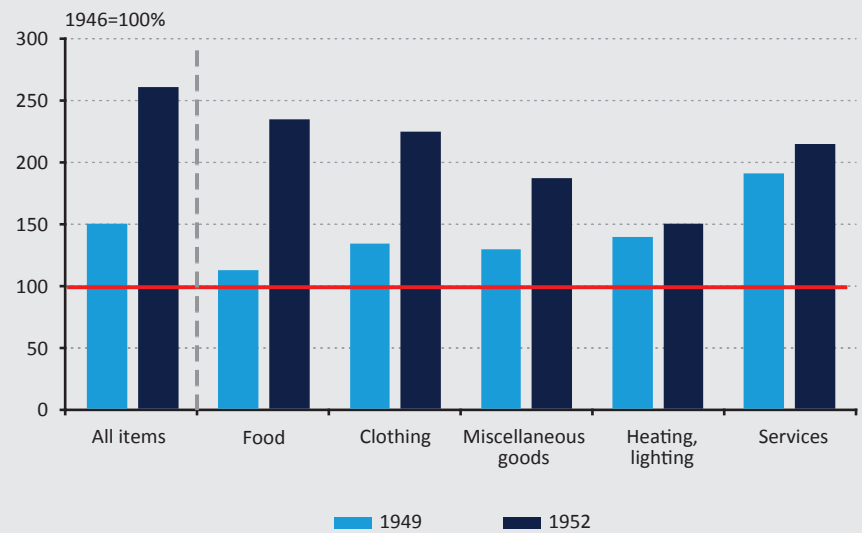
Figure 5
Evolution of gross value added in each sector (base year: 1950)



Source: Virág 2020, MNB

During the industrialisation process, however, price levels rose again (*Figure 6*), while real wages declined. The problem was addressed by the centralised system of socialist planned economy, introduced in 1952, which ensured the stability of consumer prices until 1968 (*Marton 2012*).

Figure 6
Consumer price indices in 1949 and 1952



Source: Marton (2012:381)

Overall, the economy's performance doubled in real terms during the 1950s, but growth was subject to continuous and extreme fluctuations due to a series of policy shifts, investment cycles, fluctuations in agricultural production and the 1956 revolution and its aftermath (*Virág 2020*).

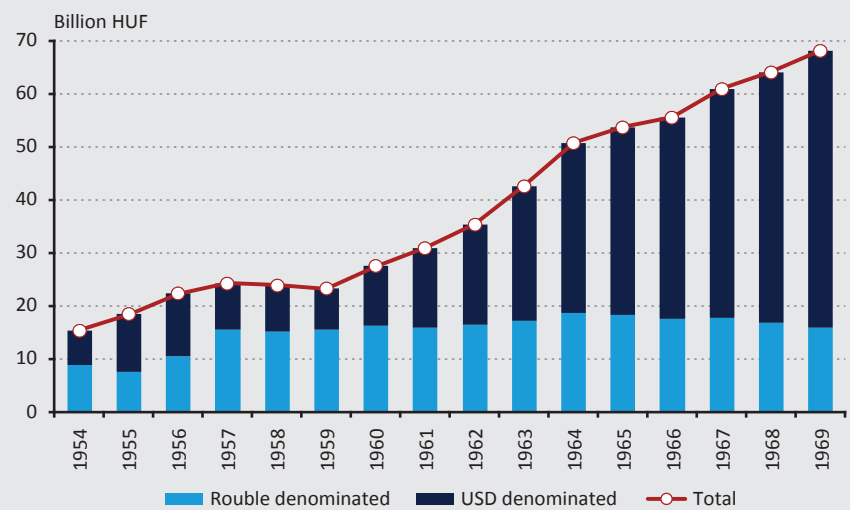
After the revolution, the socialist regime's main declared goal was to raise living standards and develop infrastructure to meet the needs of the population (*Berényi 1974*). To this end, in the 1960s the regime relaxed its rigid restrictions, which first had an impact on agriculture. Agriculture was re-collectivised with backyard farming connected to large farming operations. There was also a change in the market of industrial goods: after the developments in heavy industry, there was a shift to light industry and the food industry. For the central bank, the centrally planned socialist

economy was characterised by the preparation of a national credit plan, which the MNB outlined on the basis of quarterly management plans reflecting working capital needs (*Botos – Botos 2004*).

In the period between the 1956 revolution and the economic reform of 1968, the MNB was able to carry out its tasks with greater autonomy than in the initial socialist system. In parallel, the retrenchment of administrative functions commenced, and there was a shift towards commercial banking. As regards foreign exchange management, there was a significant increase in turnover, coupled with the commencement of the country's indebtedness, the gradual depletion of gold reserves and the introduction of the dual exchange rate regime – trade and non-trade (*Virág 2020*).

The rise in living standards was accompanied by an increase in the share of dollar imports, including short-term loans (*Figure 7*). Despite the high level of industrialisation, the surge in imports caused specifically by the rise in living standards could not be covered by exports due to structural problems, and consequently the trade balance was also in deficit (*Földes 1995*). It became obvious that, in spite of the forced investment projects, the economic expansion and consumption boom did not proceed according to plan: from 1957, borrowing became a permanent item in other government revenue. Since foreign loans were exclusively injected into the economy by the MNB from the 1960s, the central bank balance sheet also transformed (*Virág 2020*).

Figure 7
External debt denominated in dollars and roubles



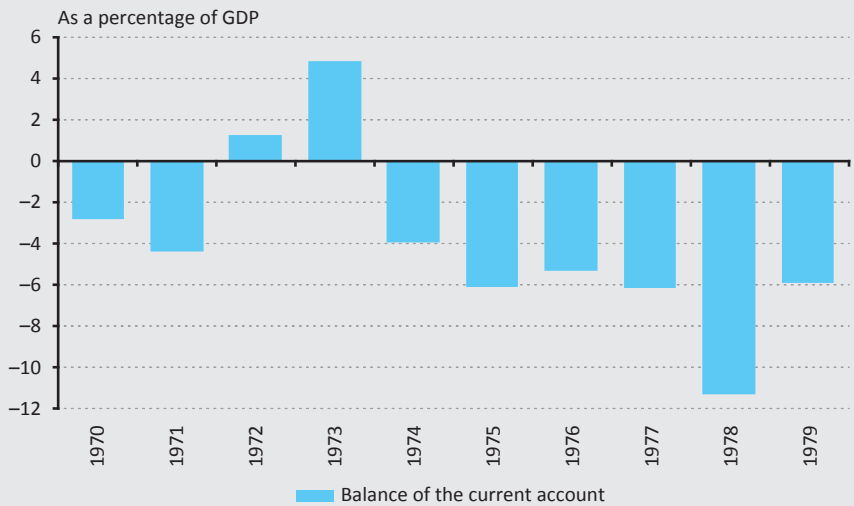
Source: Virág (2020), MNB

The political leadership came to a difficult decision point: should it continue the strict centrally planned economy or implement a turnaround that promised to be more effective. The introduction of the New Economic Mechanism (NEM) on 1 January 1968 made planned management more flexible and ushered in the era of indirect regulators. As regards the Magyar Nemzeti Bank, it was proposed the year before to separate the central banking, foreign exchange, lending and account management activities of the central bank. The draft also included bringing the central bank under the direct supervision of the government and giving it the power to mint coins. Under the proposal, the first legal requirement for the central bank was to ensure the stability of the value of the forint. Overall, the reforms of the NEM did not change the structure of the banking system or the role of the MNB (*Botos – Botos 2004*).

The measures introduced in 1968 were not sufficient to maintain the policy of raising living standards financed by credit. This was brought into sharp focus in the wake of the oil crises of the 1970s. The 1970s brought extraordinary and lasting changes at the global level, which also affected the Hungarian economy. The decade began with the collapse of the international financial system established at Bretton Woods in 1944, when the United States suspended the convertibility of the dollar into gold in 1971. Two years later, the fourth Arab–Israeli (Yom Kippur) war broke out and the Arab states of OPEC imposed an oil embargo on countries supporting Israel, leading to a massive surge in energy prices. The first oil crisis was followed by a period of stagflation in Western economies, and in 1979 the Iranian revolution led to a sharp, renewed rise in oil prices. The post-World War II boom period was over.

Hungary's external market opportunities deteriorated amid rising commodity and energy prices. Its important trading partner, the Federal Republic of Germany, sold its products at a higher price, whereas the Soviet leadership refused to accept the planned price increase in Hungary (*Botos – Botos 2004*). Deteriorating terms of trade gave rise to a significant external imbalance from the middle of the decade (*Figure 8*).

Figure 8
Evolution of the current account balance, 1970–1979



Source: HCSO

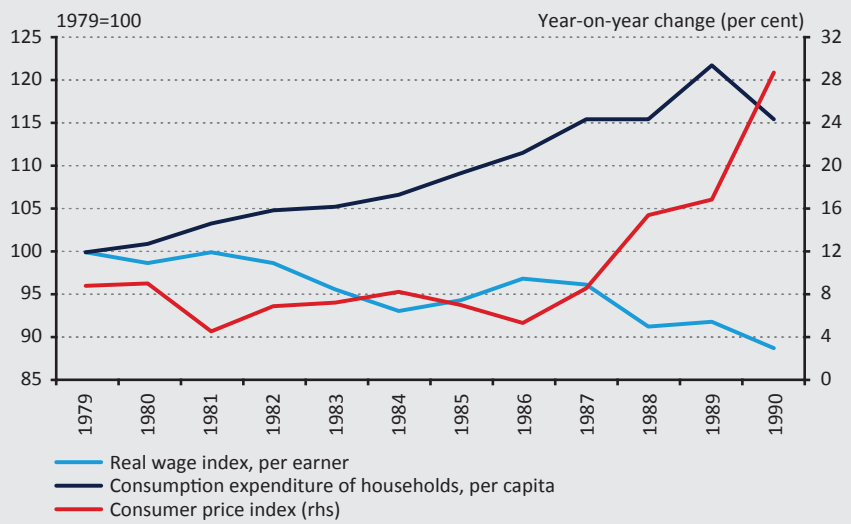
In the 1970s, economic policy was faced with the dilemma that in order to increase production, investment was needed and had to be financed, but this diverted resources away from raising living standards, which was also an important objective, since this was essentially where the political system derived its legitimacy. Thus, borrowing and the country's indebtedness in foreign currency commenced. By 1979, Hungary found itself in a debt trap: the only way to cover the interest on its loans outstanding was to borrow again (*Mong 2012*). The currency composition of external debt itself raised the debt, as Hungary borrowed in currencies the interest rates of which were initially low but later increased, while their exchange rates also appreciated (e.g. Swiss franc or Japanese yen); therefore, Hungary's debt service also increased (*Szalai 2024*).

Hungary wanted to join the International Monetary Fund (IMF) as early as during the reform efforts of the late 1960s, and the growing debt burden in the 1970s strengthened the need for membership even more. Membership would have provided the means for the convertibility of the currency and thus open management, as well as credit opportunities. The application for membership was finally submitted in 1981 and Hungary became a member of the IMF a year later. However, by this time, insolvency was the primary thing to avoid and accordingly, the Hungarian leadership borrowed from the German government and a consortium of the Bank for International Settlements (BIS) and US banks even before accession (*Botos – Botos 2004; Mong 2012*).

In the 1980s, the neoliberal political and economic trend strengthened, particularly in the United States and the United Kingdom, and called for interest rate rises and austerity to curb inflation. In 1979, Paul Volcker took over the leadership of the Federal Reserve and substantial monetary tightening took place, leading to falling inflation in the United States. At the same time, high interest rates resulted in an increase in debt servicing; consequently, the 'Volcker shock' at the beginning of the decade contributed to debt crises in numerous emerging countries.

In Hungary, economic policy was aimed at restoring the external balance, but maintaining living standards also remained important. Another priority was to maintain economic openness and accordingly, the goal was to restore the external balance by stimulating exports rather than restricting imports. At the same time, the export structure was outdated; thus, in order to correct the trade deficit, domestic demand had to be restrained. Investment decreased, while, even with declining real wages, consumption had remained stable thanks to public transfers, then started to increase again (*Figure 9*; *P. Kiss 2020a*).

Figure 9
Real wage index of households, real consumption and the consumer price index



Source: HCSO

Although the IMF loan in 1982 was only a temporary solution to the financing problems, it reduced the need for radical reforms: consequently, indebtedness continued in the second half of the decade and Hungary had to rely on the IMF's assistance again in 1987 (*Mong 2012*). The external indebtedness process that had commenced during the socialist period left a disastrous legacy, and continued to be a problem even after regime change.

Unusually for the Central and Eastern European conditions of the time, the MNB financed attempts to restore the economic balance by borrowing abroad and issuing bonds. In parallel with its international borrowing, the central bank built up a network of representative offices in major financial hubs around the world. Through the MNB, there was constant communication with the economic and financial leadership of developed countries, and it was partly thanks to this circumstance that Hungary became a member of the International Monetary Fund and the World Bank Group in 1982. From the second half of the 1980s, the Magyar Nemzeti Bank gradually returned to classical central banking activities. This process was supported by the political decision in December 1984 to separate the central bank and commercial banking functions within the MNB and to start preparations for the establishment of a two-tier banking system. The banking system was eventually transformed on 1 January 1987. However, this did not mean that the MNB regained its full independence: it became the bank of the state, subject to the control of the Chairman of the Council of Ministers. The MNB's tasks were defined as controlling the money supply and facilitating the achievement of the government's economic policy goals (*Bozó 2000*).

4. Transition to a market economy

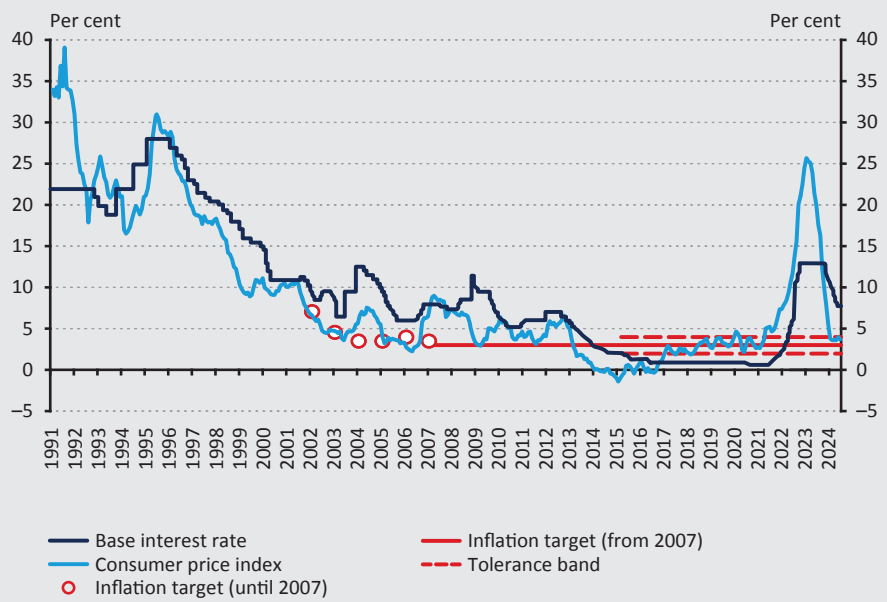
By the 1980s, the Soviet Union also found itself in a predicament. Party General Secretary Mikhail Gorbachev announced *perestroika*, marking the commencement of economic and social reforms, which ultimately contributed to the downfall of the communist system and the break-up of the Soviet Union. The transition to a market economy became inevitable in the countries of the Eastern Bloc. Although preparations for the reforms had started even earlier in Hungary, the transition period brought extraordinary difficulties. One of the most serious problems was the erosion of reserves as foreign investors withdrew their deposits. In 1990, the amount of reserves barely exceeded two months of Hungary's import requirements (*MNB 1991*). In the early 1990s, the transformation of the economic structure led to a sharp fall in GDP, accompanied by an increase in inflation, unemployment and public debt. The collapse of the CMEA markets was yet another difficulty. By opening up to the West, some domestic exports were redirected, but the orientation also had negative side effects, as the first Gulf War temporarily increased the price of oil, and the inflationary impact of German reunification necessitated an interest

rate increase. As a consequence, by 1993 a recession took hold in Hungary's new export markets (*P. Kiss 2020b*).

Adopted in 1991, the Act on the Magyar Nemzeti Bank restored the independence of the MNB, defined the place of the monetary authority in the market economy system, and declared that the MNB was accountable to Parliament and not subordinate to the government. At the same time, the Act also stated that one of the MNB's tasks was to support the government's economic policy using monetary policy instruments and to protect the internal and external purchasing power of the national currency, thus implicitly pursuing the objective of price stability.

The Magyar Nemzeti Bank took action to alleviate the current account deficit and increase competitiveness through its exchange rate policy measures. The exchange rate was fixed within a narrow band and was periodically devalued against a predetermined basket of currencies (*Jakab – Szapáry 1998*). As time went on, exchange rate adjustments became increasingly more frequent, and by 1995 the 80-per cent devaluation gave rise to considerable unpredictability and a surge in inflation. Other determinants of price level developments included the abandonment of previously applied regulated prices and the lifting of price caps on food, energy, alcohol and tobacco. In order to reduce inflation, the Magyar Nemzeti Bank raised its key policy rate to 28 per cent (*Figure 10*).

Figure 10
Developments in the base rate, inflation and the inflation target



Source: HCSO, MNB

By the middle of the decade, financing the public debt resulting from the persistent government deficit had become increasingly expensive. Thus, under pressure from the International Monetary Fund and the markets, economic policy introduced a programme of rapid expenditure cuts and tax increases ('Bokros package').[1] As part of its exchange rate policy, the central bank switched to a crawling peg regime from 1995. This implied a pre-announced pace of the depreciation of the forint, with the central bank and the government setting the pace of the depreciation. This provided a predictable nominal exchange rate, adjusted to the expected inflation rate, and the currency was allowed to float freely within a certain band (±2.25 per cent). The exchange rate band determined the short-term interest rate level expected by investors, and the central bank reacted flexibly to changes in the foreign exchange market in order to increase the room for manoeuvre of the interest rate policy, as indeed, under the crawling peg regime the central bank intervenes only at the two edges of the band and does not alter the exchange rate when it moves within the band (*Jakab – Szapáry 1998*). This enabled the economy to avoid an immediate change in the forint interest rates expected by foreign investors and helped to maintain economic equilibrium. The crawling peg exchange rate regime proved to be effective in reducing inflation.

The change in the exchange rate policy was the only appropriate element of the Bokros programme. The convergence that had started after the regime change came to a halt during the shock therapy. The fiscal austerity measures gave rise to high unemployment, falling real incomes, a considerable restraint of domestic demand and a spike in inflation (*Matolcsy 1997*). Economic policy struggled to address the crisis as it was faced with high public debt and reduced fiscal revenues. While the Bokros programme reduced the deficit, lowering inflation was a more protracted process. It was only in 1999 that the consumer price index fell to 10 per cent (*Figure 10*). It was only later, after the introduction of inflation targeting, that it was successfully reduced to lower levels. At heavy social costs, the economic crisis ended by 1997, and by the end of the decade, the convergence expected from the transition to a market economy began, thanks to growth-stimulating economic policy measures.

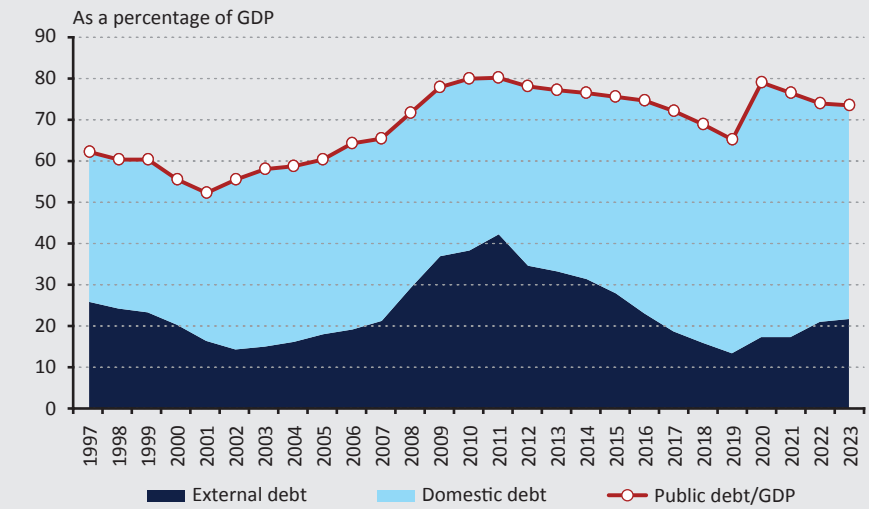
In 2001, the main objective of the MNB was to maintain price stability rather than the external balance: inflation targeting was introduced, while the central bank also maintained the widened intervention band (±15 per cent). With the introduction of the new monetary system, the forint became an internationally convertible currency,

[1] The programme was named after Lajos Bokros, Minister of Finance at the time.

and the pegged foreign exchange regime that had been in place consistently since July 1931 was discontinued; in other words, the independent central bank abolished the longest-standing state-controlled exchange rate regime in the world. However, the new monetary regime was far from operating seamlessly. On the one hand, following the change of government in 2002, irresponsible fiscal policy gave rise to supply and demand-side inflationary pressures (*Szapáry 2006*), and attempts to reduce the growing fiscal deficit proved ineffective. On the other hand, the inflation target was often in conflict with the intervention band as monetary policy focused on the exchange rate rather than the inflation target when the edge of the band was breached. In addition, foreign currency-denominated loans to households hampered the effective functioning of monetary transmission. The major interest rate differentials between forint and foreign currency loans, fierce competition between banks, an inadequate regulatory environment and limited financial literacy all contributed to the rise in foreign currency lending to households.

Although economic growth continued, substantial imbalances had built up, rendering convergence unsustainable. Public debt began to increase rapidly after 2002 (*Figure 11*), the current account deficit widened, the unemployment rate rose and the MNB had to keep interest rates high in order to reduce inflation, which encouraged borrowing in foreign currencies, primarily in Swiss francs. All of these factors contributed to the predicament that Hungary faced even before the global financial crisis of 2008. Although the government attempted to carry out a fiscal adjustment in 2006, this was unsuccessful as the package was essentially composed of revenue-based austerity measures that did not address structural problems. Therefore, the crisis hit Hungary in a very vulnerable state. The government bond market and the foreign currency liquidity of the banking sector were also on the verge of collapse. In response, the MNB raised its key policy rate by 300 basis points, buying time until a credit agreement with the International Monetary Fund was reached, which eased the crisis. As a result of policy mistakes in the years preceding the crisis, both fiscal policy and monetary policy had little room for manoeuvre, and accordingly, the crisis was not properly managed. Hungary needed external assistance from the IMF and the European Commission, which reduced the sovereignty of Hungary's economic policy.

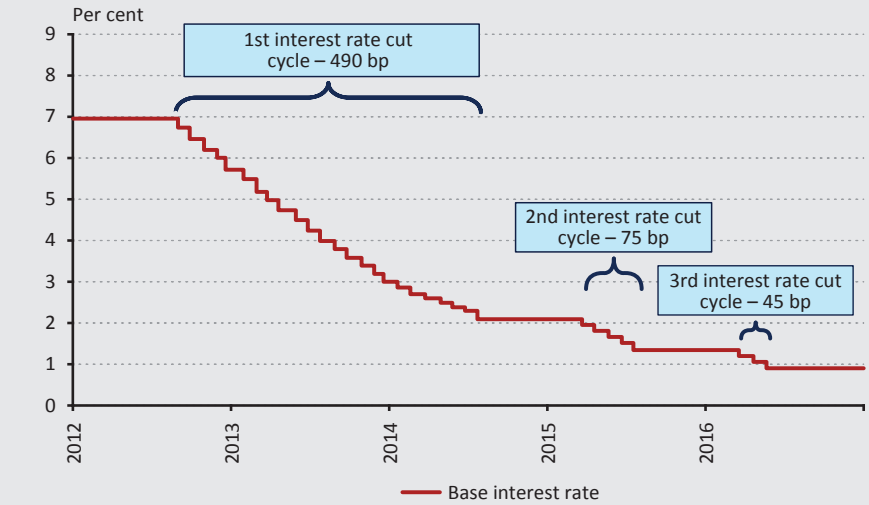
Figure 11
Developments in public debt



Source: MNB

Having addressed the acute phase of the crisis, monetary policy should have implemented a strong easing cycle. However, this was hindered by a number of factors, such as the banking and debt crises in southern European countries in 2010–2011, and widespread foreign currency lending. Besides financial instability, the latter implied that a strong easing cycle and the resulting weakening of the forint would have negatively affected the income of foreign currency borrowers. The solution to the problem, the conversion of foreign currency loans to forint, was only implemented years later, after the monetary policy changeover in 2013. Thus, during the crisis, the MNB's ability to help the real economy recover was limited. The turning point came with the 2012 'whatever it takes' speech by then European Central Bank (ECB) President Mario Draghi (*Draghi 2012*), the ECB's new Outright Monetary Transactions (OMT) asset purchase instrument and the Fed's new round of quantitative easing, which together calmed markets and also reduced the Hungarian risk premium. As a result, the Monetary Council, together with its new members, was able to start its cycle of interest rate cuts in August 2012, which lasted for almost four years (*Figure 12*).

Figure 12
Easing cycle in 2012–2016



Source: MNB

5. A stable and independent central bank in a changing world

2013 brought a radical change both in the independence of the central bank and the unfolding of the central bank's set of objectives. The central bank was given a macroprudential mandate, and the new Act on the Magyar Nemzeti Bank added financial stability to the central bank's objectives. This brought the MNB's competence in line with the global trend of increasing central bank involvement in ensuring the stability of the financial system following the great financial crisis of 2007. In 2013, the Hungarian Financial Supervisory Authority (HFSA) was merged into the MNB, which enabled the central bank to manage risks faster and more effectively, strengthening the resilience of the financial system.

Following the recovery from the crisis, economic policy took a new direction. The previous unsustainable growth model, which was based on external debt, was replaced by reforms that supported employment, investment and export growth. The era of irresponsible fiscal spending was over, and the tax regime was restructured to encourage employment and entrepreneurship (*Matolcsy 2015*). Outstanding debt was on the decline. Household real income and savings started to grow. The formula for success was achieving equilibrium and growth simultaneously, underpinned by an economic policy vision of labour as the primary source of income. Most of the structural reforms were implemented at the beginning of the decade, between 2010 and 2013. Restoring the fiscal balance was supported by a complete overhaul of the revenue structure of the general government, shifting

the tax regime from taxes on labour and capital to taxes on consumption, and introducing sectoral special taxes to achieve a more proportionate distribution of tax burdens. The reforms of the Széll Kálmán plans reduced fiscal expenditure while supporting an increase in labour market activity. The adoption of the 'work not aid' principle not only helped to balance the budget but also to raise employment to historically high levels, creating nearly 1 million new jobs. Successful budgetary consolidation and labour-based economic policies put the Hungarian economy on the path of convergence, laying the foundations for the monetary policy and credit turnaround of 2013 (*Matolcsy – Palotai 2016*).

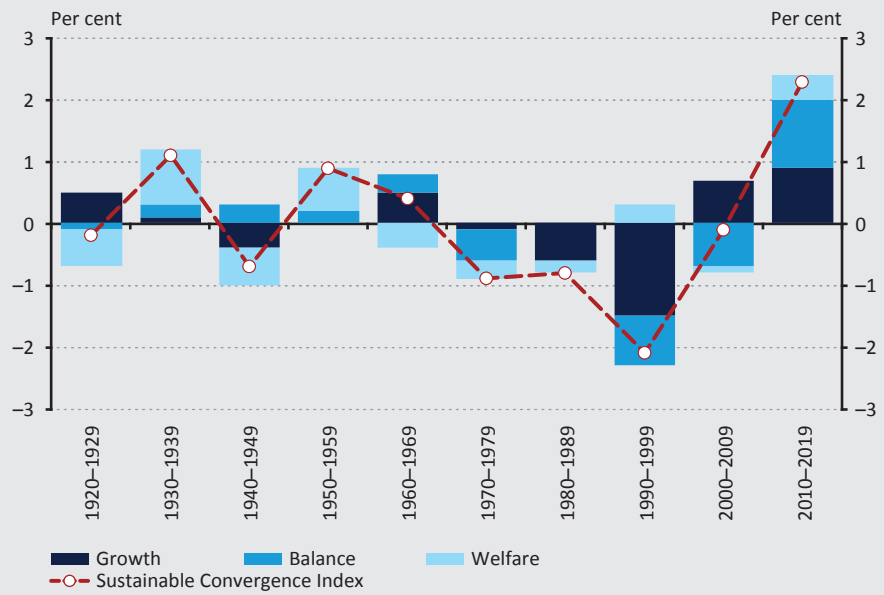
Drawing the lessons from the crisis, the MNB also launched a number of programmes to stabilise the financial system and stimulate economic growth. The Funding for Growth Scheme was intended to stimulate lending to the small and medium-sized enterprise (SME) sector. The Self-Financing Programme encouraged the banking sector to hold long-term liquid securities instead of central bank deposits by changing the monetary policy toolkit. The increased demand for forint-denominated securities by domestic banking participants enabled the Government Debt Management Agency (ÁKK) to convert foreign currency debt into forints, thus helping to reduce Hungary's external financial vulnerability (*Matolcsy – Palotai 2019*). Implemented jointly with the government, the conversion of foreign currency household loans into forint strengthened the domestic financial system and monetary transmission, while the cycles of interest rate cuts provided strong support to the real economy without jeopardising price stability. The measures contributed to the fact that growth was accompanied by the normalisation of financial intermediation and a remarkable decline in external vulnerabilities; moreover, price stability also proved to be enduring. For the first time since the regime change, the MNB achieved its primary objective of ensuring price stability on a sustained basis in the second half of the 2010s. While European countries were threatened by the emergence of a deflationary environment in the post-2008 crisis period of balance sheet adjustments, the MNB kept average inflation at the 3-per cent target with great precision between the beginning of 2017 and the end of 2020. During the period, inflation was within the ±1 per cent tolerance band for 44 out of 48 months. This was also an exceptional result by international standards (*Matolcsy 2022*).

Moreover, the MNB developed a competitiveness package to support the country's sustainable convergence. The economic policy turnaround has paid off, with convergence resuming, this time while maintaining balance. During the period, economic growth consistently exceeded the EU average. Between 2013 and 2019, Hungary's GDP grew by 3.8 per cent annually on average, 2 percentage points higher than the average growth rate in the European Union. The accelerating economic growth was achieved in a balanced structure. The investment rate in Hungary also rose at an outstanding pace compared to the EU; in addition, the country's export

market share also increased. Meanwhile, the current account was in surplus or close to balance. Growth was supported by a favourable financing environment. Thanks to the Self-Financing Programme, the conversion of foreign currency loans to forint and macroprudential measures, the banking system's exposure to foreign funding was reduced significantly, shifting the financing of the economy towards domestic funds (*Kuti – Simon 2024*).

The Hungarian economy's performance reached historical heights in the 2010s. Although the country had experienced periods of growth from time to time in the previous century, they typically came at the expense of the financial balance, and only in a few cases did they represent progress towards reaching the level of development of Western European countries. By contrast, for the first time in the turbulent century following the Trianon peace treaty, Hungary embarked on a path of balance, growth and convergence simultaneously between 2010 and 2019 (*Figure 13*). Thus, the economic policy turnaround carried out with the MNB performing a key role brought about the most successful decade of the Hungarian economy in the last hundred years (*Balázs – Soós 2020*).

Figure 13
Changes in the sustainable convergence index

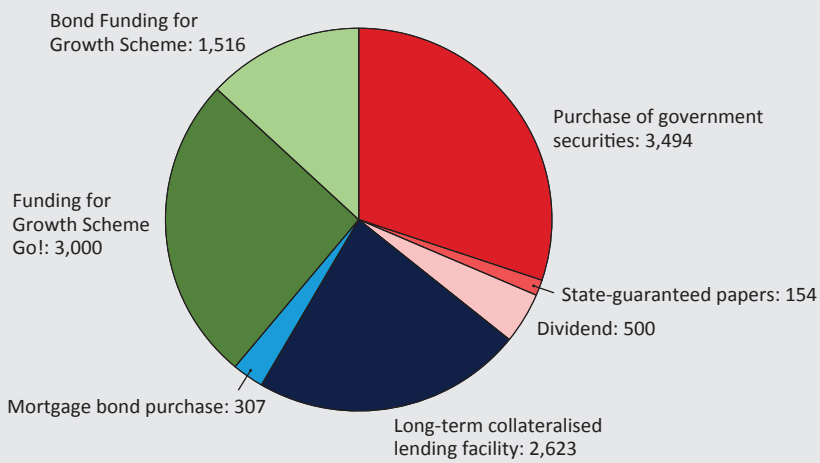


Note: The sustainable convergence index is obtained as the sum of growth, balance and welfare components. Each time series is standardised. Growth: difference between the average change in domestic GDP and the average change in GDP per capita relative to Austria. Balance: the absolute distance of inflation from the target, change in the current account balance and the change in the debt-to-GDP ratio. (The change in inflation and the debt ratio have opposite signs.) Welfare: life expectancy and change in the number of rooms per person.

Source: MNB based on Eurostat, HCSO, Maddison and Faragó (2011)

The 2020s presented the central bank with unprecedented challenges in the form of a pandemic, a drastic rise in energy prices and global inflation materialising in the wake of the Russia–Ukraine war. The years preceding the outbreak of the coronavirus pandemic were characterised by a period of growth with balance maintained. Hungary had robust resilience, stable fundamentals and sufficient room for policy manoeuvre to successfully manage the crisis (*Matolcsy 2021*). In order to stop the spread of the virus, governments around the world decided to suspend or restrict a significant part of economic activity. In this exceptional situation, businesses and the public both needed support. The central bank had to ensure, first and foremost, financial market stability and liquidity of adequate maturity for economic participants (*Matolcsy 2021*). The MNB provided more than HUF 11,000 billion in targeted measures to support crisis management (*Figure 14*), which may have increased domestic GDP by 10 percentage points between 2020 and 2024 (*Kuti – Balogh 2023*).

Figure 14
Liquidity impact of central bank crisis management programmes, in HUF bn



Source: MNB

The success of the period preceding the pandemic is underlined by the fact that Hungary managed to reach its pre-crisis performance in only six quarters after the crisis, whereas this took six years after 2008. Pre-pandemic successes are also reflected in the increased resilience of the banking system. The financial sector remained stable throughout the challenging early years of the 2020s. Banks have sufficient lending capacity and thus the country was able to avoid a long, creditless recovery period (*Matolcsy 2021*).

The government bond market remained stable despite rising deficits and public debt, with the MNB's measures playing an important role in this achievement. The central bank launched a government bond purchase programme and provided the banking system with a fixed-rate credit facility. This ensured stability and enabled the state to raise funds at low interest rates for a long period of time (*Kuti – Simon 2024*).

The global economy had barely recovered from the crisis arising from the COVID-19 pandemic when inflation started to rise suddenly and sharply, and central banks had to react. The MNB was one of the first central banks in the world to start monetary tightening, which was later justified not only by inflationary developments but also by external imbalances and adverse financial market developments. By September 2022, the market environment exhibited a considerable improvement; consequently, the central bank decided to end its largest consecutive cycle of base rate hikes since 1990. However, this was followed by a series of negative events that put domestic assets under almost unprecedented pressure for a period of two weeks. There was news of gas supplies through Ukraine being cut off, the Nord Stream pipeline was blown up, gas prices skyrocketed, capital flight from emerging markets commenced, the risk environment deteriorated and turbulence in foreign exchange markets led to a steep depreciation of the forint. In order to restore financial stability, the Magyar Nemzeti Bank took extraordinary measures on 14 October 2022. In a single step, it raised the effective policy rate by 500 basis points and announced that it was ready to provide energy trading companies the foreign currency liquidity needed to cover the energy balance from its own foreign exchange reserves *(Kuti 2023*). As a result of the MNB's measures in autumn 2022, the stability of domestic financial markets and the risk perception of Hungary improved on a sustained basis. The stable market environment created an adequate basis for sustained disinflation, which is an essential condition for sustainable growth.

At present, it appears that the interest rate hikes by the world's central banks have broken the upward trend in inflation, and the MNB's well-timed tightening and successful handling of the October 2022 crisis enabled inflation to return to the tolerance band around the inflation target in 2024; restoring price stability was now within reach. However, it cannot be said that the fight against inflation is over; cautious and patient monetary policy is still needed to achieve the inflation target in a sustainable manner.

Today, economic systems around the world are being reshaped by numerous megatrends. The digital and green transition creates extraordinary opportunities for all participants of the economy, but also poses significant challenges. Climate change is an increasingly serious problem, threatening the fulfilment of the central bank's mandate for price stability and financial stability through inflationary impacts on food and energy prices and damage from extreme weather (*Kolozsi et al. 2022*).

Recognising the importance of these risks, in May 2021 Hungary's Parliament gave the Magyar Nemzeti Bank a green mandate to support the government's environmental sustainability policy, complementing the scope of its tasks secondary to achieving and maintaining price stability. The amendment was followed shortly afterwards by a revision of the MNB's toolkit to take into consideration the aspects of green transition and thus sustainable growth. The benefits of artificial intelligence are being exploited in a growing number of areas, but its widespread use makes it inevitable to pay greater attention to cybersecurity. Unfavourable demographic trends pose serious challenges to labour markets, as well as health and social care systems. During the coronavirus pandemic, debts increased, also limiting the room for manoeuvre in fiscal and monetary policy. Recent years have seen the escalation of geopolitical tensions and the outbreak of wars, which may generate difficulties for a small, open economy through supply chain effects. The functioning of the economy cannot be isolated from political and social processes; it is therefore essential to monitor events, assess them properly and react effectively (*Balogh et al. 2024*).

6. Conclusions

While the megatrends shaping the global economy are visible, one important lesson from the early years of the 2020s is that another shock can come at any time, which means that the central bank of a small, open economy must be in a constant state of alert. This requires a great deal of ammunition. As Sándor Popovics said in December 1933, when there were lively debates not only in Hungary but also on international economic forums about how to get out of the Great Depression, "*give room for expertise and knowledge*" (*Popovics 1933:1*). The Magyar Nemzeti Bank continues to bear this in mind, with the goal of using the knowledge and experience accumulated in the institution to provide effective responses to the challenges arising in implementing the central bank's mandate. In the current era of geopolitical risks, the green and digital twin transition, demographic turnaround and rising debt ratios, ensuring price stability remains the main objective of the central bank.

This historical review gives a glimpse of the numerous challenges that the Magyar Nemzeti Bank has faced in its century-long history, be it periods of war, economic crises or the structural changes brought about by the advance of globalisation and European integration. These experiences have confirmed the MNB's ability to adapt to changing circumstances while striving to maintain and restore the stability of the Hungarian economy. The mandates of the MNB and the hierarchy thereof clearly define the central bank's tasks and the scope of action available to the MNB. Hungary's central bank will be able to make the greatest contribution to the success and sustainable convergence of the Hungarian economy if it fulfils these

mandates and achieves its objectives, and it can operate most effectively when it is independent.

Lessons from the past also underline that flexibility and the ability to innovate are essential to successfully face future challenges. These last 100 years have demonstrated that economic stability and the soundness of the financial system are the cornerstones of a nation's long-term prosperity. The central bank will continue to focus on maintaining these in the future.

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Central Bank Independence and Monetary Stability in Hungary, 1920s and 1990s*

Barry Eichengreen

This study compares monetary policy and inflation in Hungary in the first half of the 1920s and the first half of the 1990s. In both periods, economic and financial imbalances placed pressure on the central bank to provide inflationary finance. Eventually, in response to the resulting inflation, central bank independence was significantly strengthened. But while central bank independence helped, in neither case did it suffice to prevent subsequent instability. The central bank inevitably felt pressure to accommodate problems emanating from the banking sector, the balance of payments, the government budget and weakened sectors of the economy. The paper concludes by drawing out the implications for current legislation potentially affecting the independence of Hungary's central bank.

Journal of Economic Literature (JEL) codes: E42, E52, E63, N14

Keywords: central banks, central bank independence, monetary policy, stabilization, Magyar Nemzeti Bank

1. Introduction

This study compares monetary policy and inflation in Hungary in the first half of the 1920s and the first half of the 1990s. It argues that central bank independence is necessary but not sufficient for the restoration and maintenance of price stability and, more generally, for economic and financial stability. In both episodes, economic and financial imbalances inherited from the preceding period placed pressure on the central bank to provide inflationary finance to the government, the banking system and the corporate sector. In response to the resulting inflation and disruptions it entailed, central bank independence was significantly strengthened, consistent with the economic orthodoxy prevailing in both eras. But while buttressing central bank independence helped, in neither case did it suffice on its own to prevent subsequent outbreaks of instability. Notwithstanding its strengthened independence, the

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

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central bank inevitably felt pressure to accommodate problems emanating from the banking sector, the balance of payments, the government budget and weakened sectors of the economy.

The implications for present-day Hungary are direct. First, governments contemplating steps that dilute central bank independence do so at their peril. Respecting the independence of the central bank does not automatically solve all problems, but Hungary's own history in the 1920s and 1990s, and monetary history more generally, shows that compromises of that independence only make matters worse. Second, even the most independent central bank cannot be expected to deliver satisfactory outcomes in the face of imbalances in the banking sector, the external sector and the real side of the economy. These problems fall to other national policy makers to solve.

2. The 1920s

Hungary emerged from World War I much diminished in territory and population. The borders of Central Europe's new nations disrupted its industry and commerce. There was social and political turmoil at the end of the war when the government of Count Mihály Károlyi was overthrown in favour of a Soviet Republic under Béla Kun and then, following a brief Romanian invasion, when a right-wing government led by Admiral Miklós Horthy took (and retained) power. Inflation was the immediate postwar order of the day. Large-denomination notes of the Austro-Hungarian Bank (the central bank of the former Austro-Hungarian Empire) were accepted as legal tender only when stamped. But because Hungary was relatively late in stamping notes, these flooded in from other successor states (*Garber and Spencer 1994*). There as yet being little in the way of fiscal revenues, the Bolshevik government during its brief (four month) tenure used its access to the printing plates of the Austro-Hungarian Bank to issue more notes; it also issued notes of its own.

The Austro-Hungarian Bank was closed down toward the end of 1919, and its functions were assumed first by a Hungarian section of the old bank and then in August 1921 by a State Note Institute under the direct control of the finance ministry. Starting in August 1921 the Institute issued its banknotes, which it exchanged for both stamped notes of the old Austro-Hungarian Bank and notes issued by the Bolshevik regime.

While Hungary owed reparations under the provisions of the Treaty of Trianon, neither their level nor the schedule for payments were known. This obviously was a source of considerable uncertainty. All the while – that is, from 1919 through 1924 – the Hungarian government ran large budget deficits, financed by borrowing from the State Note Institute. The latter was also directed by the finance ministry to make concessionary loans to banks, firms and farms to enable them to stay up and

running. The faster inflation ran, the more government revenues lagged behind, creating a classic and ultimately disastrous inflationary spiral. But unilaterally taking steps to balance the budget, and to thereby help to bring an end to inflation, would have weakened the argument that the fiscal effort required to meet the reparations burden was impossible (*Pogány 2019: p. 49*). Hence the delay in taking those steps.

Hyperinflation accelerated until March 1924, when everyone agreed that it had already gone too far. The League of Nations, in concert with the Reparation Commission and the Hungarian government, cooperated on a fiscal consolidation, a reduction of the reparations burden and an international loan. External finance became possible when the Reparation Commission abandoned its first lien on the Hungarian government's revenues so that these could be used to service commercial obligations. The loan came in July 1924, following special help from Montagu Norman, Governor of the Bank of England and de facto arbitrator of access to the London capital market (*Péteri 2002*). It was scheduled to run for 20 years and collateralised by receipts from customs duties and sugar taxes and from the government's salt and tobacco monopolies, income from which was more than sufficient for servicing the obligation.

The League's stabilisation plan took the form of two separate but linked protocols. The first reaffirmed the sovereignty and territorial integrity of the state, while the second committed the government to balance its budget and establish an independent central bank. Importantly, not only Hungary but also Czechoslovakia, France, Great Britain, Italy and Romania signed the first protocol, making the associated commitments, and by implication the independence of the central bank, more than just a commitment of the current Hungarian government. The second protocol obliged Hungary to accept the oversight of a commissioner general, who would report to the League and to a "committee of control," made up of representatives of the creditor countries, on the government's compliance with the plan, including with its commitment to respect the independence of the central bank. The commissioner general also oversaw the special account into which earmarked revenues from the customs and sugar taxes and commodity monopolies were paid. The commissioner general ultimately chosen was an American, Jeremiah Smith, Jr. (*Peterecz 2009*). Smith was a close personal friend of the influential U.S. banker Thomas Lamont, who was intimately involved in drafting the Dawes and Young Plans. The American connection underscored that Hungary's compliance with the plan was a matter of concern not just for the European signatories but also the United States, the rising economic power and, presumably, prospective source of external finance.

The Magyar Nemzeti Bank (the Central Bank of Hungary, MNB) was duly established by a law of 26 April 1924 and commenced operations two months later. Among its seven leading shareholders were the New York-based National City Bank (the single

largest shareholder) and two British banks: Midland Bank and Anglo-Austrian Bank (*Magyarics 2019*). The MNB was prohibited from extending loans and advances to the government except when these were fully collateralised by convertible foreign exchange or gold (*De Cecco 1994*). It was further required to back its liabilities with gold in the manner of a gold-exchange-standard member in good standing. The coverage ratio was set at 20 per cent for the first five years, to then be increased by a further four percentage points every five years subsequently (*Pogány 2019: p. 51*). The MNB was required to accept an external advisor nominated by the commissioner general. This external advisor was empowered to veto any policy or decision that contravened the new central bank statute (*Garber and Spencer 1994: p. 33*). Finally, within weeks of its founding the governor of the MNB, Sándor Popovics, signed a protocol with the Bank of England committing the Magyar Nemzeti Bank to peg to the pound sterling in return for an advance of four million pounds.

Thus, the autonomy of the central bank had multiple sources. It was buttressed by understandable public aversion to inflation, given the events leading up to the stabilisation in 1924, by a new state-of-the-art central bank law, by a balanced budget, by international support and oversight, by an emergency advance that replenished its reserves, and by gold-exchange-standard rules. It is hard to imagine a stronger foundation for central bank independence.

Sargent (*1982*) suggests that this new institutional framework constituted a convincing change in regime. As a result, he contends, the subsequent inflation stabilisation was largely costless; there was no rise in unemployment. Others (*Berend and Ránki 1985*; *Domonkos and Schlett 2021*) suggest otherwise. They describe a Hungarian economy suffering from high unemployment, stagnant growth and depressed industries in the wake of the stabilisation. The balanced budgets mandated by the League of Nations teetered in 1928/1929 and turned to deficit in 1929/1930. The deficit then widened further in 1930/1931 as the government introduced subsidies and public works programmes. The agricultural sector, so important in 1920s Hungary, suffered from weak global prices and what quickly came to be seen as an overvalued currency. The banks, which had extended loans to agriculture, experienced balance-sheet problems as early as 1927 and succumbed to a full-blown banking crisis in 1931 (*Macher 2018*). The country ran current account deficits all through the period, reflecting these same unfavourable terms of trade. The dire implications of this external weakness came to a head with the curtailment of foreign lending in late 1928.

Péteri (*2024*) describes how the MNB responded to these domestic economic problems by sterilising gold outflows instead of abiding by the gold standard rules, which would have dictated contracting the money supply. It accommodated the credit needs of agriculture and industry rather than strictly prioritising the

maintenance of gold convertibility, as seemingly required by its statute. I know of no study that can be used to determine whether the MNB was responding to pressure from the government or whether its directors chose, of their own volition, to lessen the pressure on the country's banks, firms, farms and labour market. Either way, given the severity of these other economic problems, independence was evidently not enough to insulate the central bank from these pressures and allow it to disregard these imperatives.

Given unfavourable terms of trade and the sterilisation of gold outflows, the result was reserve losses, not open inflation of the sort Hungary had experienced in the early 1920s and would again experience in the early 1990s. The MNB was able to put off the day of reckoning – the inevitable currency crisis – by securing emergency assistance in 1929 from the Bank of England and a consortium of international banks (*Péteri 2002*). But the end came inevitably in 1931, with the further decline in agricultural prices, capital flight, the financial crisis and the imposition of exchange controls (*Eichengreen 1992: p. 261*).

3. The 1990s

Following the collapse of central planning, Hungary was relatively quick to reestablish the independence of the MNB. The mono-bank system had been partially reformed already in 1987 when the commercial banking functions of the MNB were hived off to other institutions (*Jung 1995*). In 1990, the then prime minister József Antall publicly announced that the government would not attempt to directly influence the monetary policy actions of the central bank (*Bod 1994*). At the end of 1991, this position was codified into law in an "Act on the National Bank of Hungary" adopted by the Parliament. A notable feature of the act was the limit placed on the amount of direct financing the central bank could provide to the government (expressed as a share of total budgetary revenues). *Dincer et al.* (*2024*) compute the *Cukierman et al.* (*1992*) measure of central bank independence for Hungary and other countries in this period. They document a sharp increase in the central bank's legal independence between 1991 and 1992. They show that the MNB's independence was stronger than the contemporaneous global average following passage of this law. The legal independence of the central bank was then fortified further by additional reforms in 1998 and 2001. An independent study by *Ainsley* (*2017*) reinforces these findings.

Yet the central bank's substantial independence did not enable Hungary to avoid chronic double-digit inflation. Consumer price inflation expressed on an annual average basis never fell below 19 per cent between 1990 and 1996. Producer price inflation never fell below 10 per cent and in most years, like consumer price inflation, hovered in the 20 to 30 per cent range. (CPI inflation tended to run higher

than PPI inflation because of subsidy reductions, real exchange rate appreciation and other miscellaneous factors; see *Surányi and Vincze* (*1998*)). To be sure, Hungary managed to avoid the kind of hyperinflations experienced elsewhere in the Central-Eastern European bloc – and for that matter in Hungary itself in the 1920s. The country had already gone further than other Eastern bloc countries to liberalise prices in the 1980s, and active use then of the inflation tax as a way of reconciling supply and demand meant that the post-planned economy did not inherit a pronounced monetary overhang. But neither was Hungary able to bring down inflation remotely close to average European Community and OECD levels, these being the advanced-economy clubs that it aspired to join.

Some will say that it is unrealistic to imagine that even the most independent, far-sighted central bank could achieve price stability in a period marked by such extensive supply shocks and structural adjustments. This, of course, is precisely the point. At the beginning of the 1990s, the Hungarian economy was battered by a combination of supply and demand shocks: on the supply side a rise in energy prices due to doubling the price of household electricity and gas and the liberalisation of retail prices of petroleum and diesel, and on the demand side the collapse of Eastern European trade. GDP fell by some 20 per cent between 1990 and 1993, with industry bearing the brunt of the contraction. The negative supply shock was inflationary, other things equal. In addition, it made sense for the central bank to support loss-making but ultimately viable firms while their competitiveness was being restored. Inflation had the beneficial effect of reducing real labour costs, given downwardly rigid nominal wages, facilitating the improvement in competitiveness and the reorientation of trade to the West, although there was also an evident tendency for the MNB to accommodate nominal wage increases to prevent competitiveness problems from reemerging. The central bank also felt compelled to attend to the problems of a weak banking system, as in the 1920s. *Sebők et al.* (*2021*) note that the banks were undercapitalised and burdened with large nonperforming loans, rendering them dependent on six-month credit lines from the MNB, which the latter felt compelled to provide.

Monetary policy thus oscillated between accommodation and consolidation. When CPI inflation surged to 35 per cent in 1991, policy was tightened: reserve requirements were raised and the rate of growth of domestic credit was curtailed. But although CPI inflation fell, it remained uncomfortably high, at 23 per cent in 1992. The general government budget was in substantial deficit, especially in the period 1992–1995, just as it had been in the early 1920s. The current account of the balance of payments fell into substantial deficit after 1992, and Hungary relied on foreign investment for balance of payments stability, much as it had in the years leading up to 1929. Both trends were indicative of strong demand relative to supply, which intensified inflationary pressures. Domestic absorption rose by as much as

10 per cent in 1993, fuelled by negative real interest rates. In response, the MNB began increasing the level of interest rates toward the end of the year. But it then reversed course in 1994, reducing reserve requirements and lending to the banking sector at preferential interest rates while helping the government to finance its now even larger budget deficit (1994 being an election year). The result was rates of consumer and producer price inflation that accelerated further, approaching 30 per cent annualised in 1995. Here we see a central bank whipsawed between the imperatives of inflation control on the one hand and the financial needs of the government and the economy (not to mention the imperatives of politics) on the other.

The year 1995 then saw fiscal consolidation and reform. The budget deficit was reduced by a combination of tax increases and subsidy reductions, but this fell only from 8.4 per cent in 1994 to 6.8 per cent in 1995 (on a cash basis). Moreover, unemployment remained in the double digits, which made competitiveness a priority. The central bank now adopted a preannounced crawling peg exchange rate, where the rate of depreciation roughly matched the rate of producer price inflation so as to prevent a squeeze on the country's export industries. This preannounced crawl replaced the earlier system of periodic, ad hoc devaluations, which were increasingly anticipated in advance and therefore excited destabilising speculation. Consumer and producer price inflation fell in 1996 relative to the preceding year, but only to the neighbourhood of 20 per cent annualised. By the end of 1997, inflation was still running at 18 per cent.

A fully independent central bank concerned with only one thing would have been fully capable of bringing inflation down faster. But the Magyar Nemzeti Bank, understandably concerned with inflation but also with competitiveness, unemployment and the public finances, all of which remained problems, had good reason to move gradually, notwithstanding its legal status. In the antiseptic terminology of the *IMF* (*1996, p. 22–24*), "*The relatively inertial character of inflation during Hungary's transition process appears to be related, inter alia, to the failure to use monetary and exchange rate policies to target a sizable or rapid reduction in inflation, to rigidities in the labour market combined with soft budget constraints which served to thwart real wage adjustment, and to ongoing increase in key relative prices.*" *Bod* (*1994: p. 424*) puts it more pithily: "*The large degree of independence provided by the [central bank] Act is but one aspect of monetary policy. The other is the constraints imposed by the economic and financial conditions of the transition, including the heritage from the former regime.*" No doubt, the central bank's strong legal independence and limits on money financing of the budget deficit were important for credibility. There is a sound argument that things would have been worse under a weaker central bank law. But in an environment of double-digit unemployment, structural imbalances and still fragile competitiveness

that legal independence did not guarantee swift convergence to a low single-digit Western European-style inflation rate.

4. Conclusion

In early 2024, the Hungarian government tabled a draft law that would have reduced the independence of the country's central bank by giving its executive board the power to direct the bank to undertake tasks not related to its basic functions. Such a step would not appear to directly affect the Monetary Council that is responsible for the conduct of monetary policy. But broadening the central bank's mandate would complicate accountability. It would make it more difficult for the monetary authorities to explain the connection between their policy instruments and policy targets. Accountability is inextricably linked to independence: the more difficult it is for a central bank to account for and justify its actions, the more likely it becomes that its status as good steward of the economy, and its independence in practice, will be jeopardised.

In addition, the proposal in question would have given the supervisory board (a majority of whose members are political appointees) the power to audit companies that are majority owned by the central bank or one of its foundations, which invest profits from its foreign exchange transactions. This is a reminder that not only should the government respect the independence of the central bank, but also that the central bank itself should exercise rigour in limiting its ancillary activities. Wherever possible, it should return its profits and their management to the fiscal authority, so that the investment of such profits does not become a political flashpoint.

This controversy came on top of pressure from the government, responding to recessionary pressures and a deteriorating budget, for the central bank to cut interest rates. Central banks regularly come under pressure to pursue a more accommodating policy when growth is weak and the budget is in deficit. But a central bank cannot ameliorate these kinds of fiscal and real-side problems without exacerbating others, such as inflation and exchange rate depreciation. This is why the conduct of monetary policy is delegated to an independent central bank that can balance these risks and objectives in an impassionate, nonpartisan way. The controversy is also a reminder that a central bank can deliver price, economic and financial stability in the long run only with support and cooperation from ministries and officials responsible for other policies.

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Hyperinflation after the First World War in Central Europe: Causes, Remedies, Consequences*

Harold James

The paper examines in detail Germany and Poland, two of the four post-First World War hyperinflations that provided the subject of Thomas Sargent's classic comparative study of the circumstances in which inflations might be ended. It counterposes the Czechoslovak case, where stabilisation occurred without prior hyperinflation. Stabilisation brought substantial costs, most obviously in terms of recession and unemployment. The peripheral inflating countries had sought to use inflation to effect an international as well as an internal redistribution of wealth. Ending the inflation was thus politically costly, and usually involved ceding some aspect of sovereignty or limiting the room for domestic political manoeuvre. Hence many inflations were not really ended, but produced premature celebrations before a relapse, accompanied by a move against external control.

Journal of Economic Literature (JEL) codes: E31, E52, E61, E63, E65, P44

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1. Introduction and Sargents's work

The story of great inflations is one of helplessness – when a political and social system is paralysed into such dysfunctionality that it is impossible to self-correct itself. In that sense, it is generally a demonstration of circumstances in which sovereignty collapses, and external assistance is desperately needed. The external action may – and usually does – bring new resources, which are needed to combat the dysfunctionality. But it also is required to effect change in the political and economic ordering of a society: an imposition which often provokes a strong backlash.

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

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The most important – and still widely influential – interpretation of the post-First World War Central European inflations in a comparative context was presented by the Nobel prize-winning economist *Thomas Sargent* at a moment in the late 20th century when uncontrolled inflation seemed to be a general phenomenon of industrial countries. Sargent wanted to draw historical lessons and presented the experience of Austria, Hungary, Germany and Poland after 1919, as "laboratory experiments in which the elemental forces that cause and can be used to stop inflation are easiest to spot" (*Sargent 1982: p. 90*). Central European hyperinflation was being used then, in the 1970s, as it had been in Great Depression Britain, to generate scare stories about what might be the outcome of bad fiscal policy. But curiously, and unremarked, the most obvious outcome of Sargent's laboratory exercise was that the experiment could only be halted by outside intervention: not a lesson that seemed relevant for the US in the 1970s.

That is – of course – not quite the usual interpretation of Sargent's work, which can also be read as giving the misleading impression that fiscal stabilisation is relatively painless. Many people wanted to keep up their economic activity, and until the devastating ends of the inflationary process, saw stabilisation as a prohibitively costly option. Costly it certainly was, as the economist *Elmus Wicker* laid out in criticising Sargent's interpretation of a nearly painless disinflation (*Wicker 1986*).

2. Post-First Word War great inflation in Central Europe

2.1. Poland

The Polish outcome was apparently unique in this group of Central European inflations, with a later stabilisation, but also one that was not imposed from the outside: the Austrian and Hungarian reconstructions in 1922 were managed through the League of Nations and have recently been presented as cases of international institutions "meddling."[1] The German stabilisation took place via a major international conference, the Paris Conference of 1924, that produced a new reparations schedule (the Dawes Plan) and a large reconstruction loan. The Poles – in particular the major figure who carried out the Polish stabilisation, *Władysław Grabski* – insisted that it could only occur "on one's own." As he wrote, "I formed in my mind my own plan to balance the budget and carry out the currency reform on our own strength, forgetting the foreign loans and forswearing British financial experts" (*Grabski 1927: p. 25*). In another of the programmatic essays that he published during the inflation period, he explained that "it is unacceptable that, under the influence of the current crisis, we should try to obtain a loan on terms that would limit our state sovereignty" - quoted by *Jeż* (*2022*).

[1] Most recently, *Martin* (*2022*). See also an older account of the same phenomenon: *Pauly* (*1998*).

All of these inflations, accelerating into hyperinflation, had their origins in a fiscal problem that followed the tremendous economic and military mobilisation of the First World War. A survey of inflationary experience, prepared by *Ragnar Nurkse* for the League of Nations, later explained that "the Polish experience is of general interest in that it shows a remarkably close correlation between the budgetary position on the one hand and the exchange value of the currency on the other" (*League of Nations 1946: p. 25*). It is a classic case of a small open economy.

Often the causes of great inflations are described in distributional terms: citizens demand more transfers from the state, especially after times of sacrifice, such as wars and pandemics. Wartime politicians had promised a postwar era in which those who had suffered and sacrificed themselves in the conflict would be rewarded. The wounded veterans, widows and orphans all required support. In addition, the defeated powers (Austria, Hungary, Germany) faced a large external burden in the form of reparations and had fewer resources to pay as they were also punished in the form of severe territorial losses. By contrast, Poland and Czechoslovakia formed part of the coalition of Allied and Associated Powers represented at the Paris Conference, and had no reparation obligations. There were thus heavy fiscal burdens and expectations everywhere, but in differing political contexts. At the same time, it is hard to get a consensus to raise taxes, and the fiscal deficit that results is monetised through borrowing from a central bank that is subordinated to the government's fiscal policy in what is now known as "fiscal dominance". As Sargent puts it, the driving cause "was the growth of fiat currency which was unbacked, or backed only by government bills, which there never was a prospect to retire through taxation" (*Sargent 1982: p. 90*).

Sargent's account is not very different from one given at the time, by the then very young – 22 year-old – Polish economist, *Oskar Lange*, in a brilliant account of the dynamics of inflation written for the *Economic Review*:

> The post-war years were in Poland as in the rest of Europe years of pseudo-reconstruction, for the reason that it was founded on inflation. Apparently, there was a great revival in industry, trade and agriculture. Factories and workshops were busy, production increased, in many branches reaching and even surpassing its pre-war level. But this revival, as in other countries which passed through a period of inflation, was artificial. There was no great taxation, the State meeting its large expenditure by the printing of paper money, and as State expenditure in such circumstances was not felt by the population to be a burden there was no limit to its growth. The Government granted to industrial firms big loans which were repaid in depreciated currency, so that they were rather a premium paid by the State to industry. Further, the inflation created an excessive demand for commodities, as holders of money spent it as quickly as possible in order to

> avoid depreciation; and this demand kept industry and trade busy. Add to this large Government orders and the lack of any sound business policy, which was made impossible by the alteration in the value of currency. People thought this feverish and unsound inflationary revival to be real economic reconstruction, the period of pauperisation caused by the war to be passed, and national wealth and welfare to be increasing. Politicians were dazzled by the delusive picture of a recovering national status, by statistical figures pointing to increased production, and by the State engaging in vast expenditure without the need of having recourse to fresh taxation. They thought to be creating by means of inflation wealth out of nothing. (*Lange 1926: p. 99*)

The Polish finance minister and central banker *Stanisław Karpiński* fundamentally concurred with that view and indeed frequently complained in bitter terms that:

> Paper money, put in circulation in huge quantities … put in circulation not for economic needs, but mainly to level the budget deficit, stops being the measure of value, and becomes the mark of a Treasury pursuing its self-destruction. The result of the lack of stable money is that all foundations of accounting get annihilated, though they are the basis of every economic activity. An industrialist then does not know, even approximately, how much money will be needed in the near future to pay for the already arranged inputs, the merchant does not know how much new merchandise will cost while there is a need to fill the empty shelves or storages, a banker does not know what value the money that have been lent today will have upon its return, a farmer does not know how much and for how much to sell the grain that has been produced so that it will allow for restocking the inventory, no entrepreneur knows how much the labour will cost not only after a few months but after a few weeks. In short, we have better and better conditions for speculations and worse and worse for productive work. (*Karpiński 1931: pp. 257–258*)

On another occasion, Karpiński pinpointed the problem: "the biggest plague (*szkodnik*) for the Polish mark is the Polish Treasury" (*Karpiński 1931: p. 261*). Each ministry had an account at the Polska Krajowa Kasa Pożyczkowa (Polish National Loan Fund, or provisional central bank, PKKP), on which it drew liberally. Society became demoralised. "It is the depositors who lose most, depositing the value of a pair of shoes, and withdrawing the value of a roll of toilet paper" (*Karpiński 1931: p. 271*).

The liberal Polish economist *Edward Taylor*, who made the quantity theory the heart of his important analysis of the Polish inflation, drew a devastating picture of political and intellectual immaturity as the root of the inflation, in which "economic management becomes an instrument of the political fight" (*Taylor 1926: p. 230*). He analysed what he termed "political inflationism":

> We also don't think that it is right to blame particular political factions or political blocs for their unwillingness to refill the coffers of the national treasure. In some circles there is a tendency to blame the political right. When one looks closely, the political right often hesitated before increasing direct taxes; but, on the other hand, the left was constantly against increasing indirect taxes, and fees and tariffs that burdened the poorer groups in the society. They were against lowering the explosively growing state expenses. (*Taylor 1926: p. 371*)

2.2. Stabilisation experience in Czechoslovakia[2]

Resisting hyperinflation would have required a heroic political act, in which the cancellation of existing claims would be accompanied by the imposition of real fiscal burdens. Only one country, the new state of Czechoslovakia, tried that – successfully, although the tax measures were unpopular and the Finance Minister responsible, the conservative liberal economist *Alois Rašín*, was assassinated in 1923. Rašín complained to Foreign Minister Edvard Beneš in January 1919 that "The people think that freedom means no taxes, and no one does anything about the implementation of tax policy, so I don't know in what way to manage it further. The state is in danger because most of society sees it as a miraculous solver of all problems. Everyone wants employment and maintenance support, in short, they want a subsistence paid by government spending" (*Kosatík 2010: pp. 131–132*). But the stabilisation exercise was easier in Czechoslovakia, as there was a substantial group of rich property-holders regarded as aliens, the aristocratic and often German-speaking landowners from the old monarchy whose land might be nationalised and used as a basis for stabilisation. There was in a nutshell an internal enemy who might pay the price for reform and stability. The Expropriation Act No. 215 of 16 April 1919, confiscated all agricultural land over 150 ha and other land (including forests) over 250 ha. By 1922 a total of 1,229,688 ha of agricultural land and 2,733,376 of non-agricultural land had been taken from 1,730 owners: that amounted to 28.2 per cent of all Czechoslovakian land. Some of this land was returned, but most was sold off by the state to small-holders in a bid to establish a prosperous Czech peasantry (*Homolac – Tomsik 2016*).

2.3. The exchange rate and the German interpretation of inflation[3]

Inflations could be justified in a way analogous to the wartime calculation: it was a way of imposing costs on someone else. That dynamic was particularly explicit in the German discussion. Germans saw their inflation as a way of wriggling out of the reparations settlement. Chancellor *Wilhelm Cuno* privately confessed in July 1923, as the German hyperinflation reached its terminal extreme phase, that "naturally the wish had been to deal with reparations first and clean up the tax

[2] Based on *James* (*2023*)
[3] Based on *James* (*2023*)

problem afterward" (*Schuker 1988: p. 22*). Even the process of inflation involved initially luring gullible foreign investors into buying German paper banknotes in the expectation that there would be a profitable recovery of the exchange rate. By October 1921, the *Wall Street Journal* was lambasting what it now called a "gigantic fraud," by which 50 billion Mark notes ended up in the possession of American investors, to whom they were worthless.[4]

Small countries – like Austria, Hungary and Poland, but also the much larger Germany, which felt itself to be a victim of the postwar settlement – developed an obsession with the exchange rate and the current account, to such an extent that they often saw the exchange rate collapse as the real driver of inflation. The focus on the exchange rate prompted a thinking in terms of gaming the system, and using the exchange rate as a way of imposing the real costs of economic misfortune on others. Hyperinflationary countries are almost by definition on the periphery of the international monetary system, while the central countries of the international monetary system certainly experienced inflationary episodes (the UK in the Napoleonic Wars and the First World War; the US in the 1970s).

The central European postwar inflations and hyperinflations had three fundamental immediate economic and political causes: 1) a low savings rate (following from wartime changes in income distribution); 2) poor monetary and fiscal policy; and 3) powerful financial and business interests who pushed policymakers. These causes could be masked by the focus of debate on the exchange rate problematic, and on trying to extract short-term advantages.

The consequence of the World War was an erosion of incomes and a dramatically reduced savings rate. But at the same time, at least for a while Germans were able to sustain their living standard and run large trade deficits. They had this luxury because investors in the rest of the world put their money into buying German assets: currency, securities and real estate. British and American investors were gambling on a German recovery. After all, before 1914, Germany had been with the United States one of the two strongest economies in the world. Only at a relatively late stage in the story of the German inflation, in the summer of 1922, did the foreigners see that Germany was unlikely to be able to pay off all the debts to foreigners (including the financial impositions that the Allies made as reparation demands under the terms of the Versailles Treaty). In the summer of 1922, a political event, the assassination of the Foreign Minister *Walther Rathenau* (24 June 1922) underlined the political instability of the republic. From that moment, foreigners no longer wanted to buy German assets. The big capital flow of the earlier period came to a sudden stop. The Mark went into free fall. A large part of the discussion

[4] This point was already noted in the contemporary US press: *Mark Inflation Seen as Gigantic Fraud: Holders in United States*. Wall Street Journal, 6 October 1921. It is developed in *Holtfrerich* (*1986*).

of inflation was couched in terms of Germany's relations with an outside world that was increasingly seen as hostile and malevolent. The capacity of the government to control price developments disappeared altogether at the beginning of 1923, after Germany failed to make a delivery of reparation coal, and France responded by a military occupation of the Ruhr valley in an attempt to seize coal and other resources. The German government then paid Ruhr workers and businesses not to work, and the fiscal gap was impossible to bridge.

The second driving force of the inflation was thus the policy of the German government and the German central bank. Both were highly sensitive to political considerations. Both worried that rising unemployment might destabilise the precarious political order. Thus, they were willing to do anything in fiscal and monetary policy to counteract any kind of economic slowdown. The government ran large budget deficits as it tried to keep up employment in the state-owned railroad and postal systems, and also to generate more purchasing power. It kept on looking for new and ingenious ways to administer repeated fiscal stimuli, which were then monetised by the central bank. Equally significantly, large industrial producers demanded continued access to cheap central bank credit, at low interest rates that became rapidly, in real terms, grotesquely negative: the central bank discount rate remained at just 5 per cent until the summer of 1922. The President of the central bank, an elderly Prussian bureaucrat called *Rudolf Havenstein*, boasted about his success in getting new printing plants (132 factories, as well as the bank's own facilities), printing plate manufacturers (29) and paper factories (30) to meet the enormous demand for new money. He found more and more ingenious ways of stimulating bank lending to large businesses on ever more dubious securities. And he kept on explaining that keeping the money presses rolling was a patriotic duty. There was in short what would now be called a "Havenstein put" in which the central bank would keep its interest rate at levels sufficiently low so that German business could continue to expand.

The third inflationary dynamic is thus a "financial dominance," in which financial institutions and businesses dependent on them argue that they need continued access to central bank resources – to monetisation – in order to continue to operate. It is defined by *Markus Brunnermeier* as:

> the ex-ante behaviour of the financial sector, which, out of fear that losses will be pushed onto it, purposely stays (or even becomes) undercapitalised. This behaviour increases volatility and might force the fiscal or the monetary authority to absorb losses… Under financial dominance few losses can be pushed onto the financial sector and even worse, it might be necessary to bail it out. A second game of chicken between the fiscal or monetary authority might arise on who has to bail out the financial sector. Instead of providing insurance for the government sector, the financial sector can be a drag for the economy and

with it for the government's tax revenue. If the fiscal side is not sound, a diabolic loop between sovereign risk and the financial sector can emerge (*Brunnermeier 2015: pp. 11–12*).

In the longer run, inflation destroyed German savings and made the economy of the unstable democracy of Weimar vulnerable to yet more shocks. It also had a dramatic effect on popular and political psychology. Attempts to compensate losers in the German inflation, by revaluing some assets but not others, set one group against another, and prompted the belief that politics was about negotiating between organised interest groups.

The constant alteration of prices, the dramatic story of fortunes made and fortunes lost as a result of speculation, made ordinary Germans, and Central Europeans, vulnerable and neurotic. Gender relations were transformed by the madness of prices. Men saw women and women saw men as fundamentally calculating, materialistic and disenchanted with any romantic illusions (*Marcus 2018: pp. 63–73*). Money was all that mattered. Because it played along with very old established clichés about Jewish dominance of finance, the inflationary uncertainty fuelled anti-Semitism. Later on, some shrewd observers such as the scientist and writer *Elias Canetti* reached the conclusion that it was the Great Inflation that made the Holocaust possible, by creating a world in which large numbers simply seemed unreal and incomprehensible (*Canetti 1960*). Bureaucrats simply wrote down impossibly big sums without thinking of the human consequences.

It is worth thinking about the precise mechanism by which unstable prices translated into destructive and ultimately murderous social behaviour. In stable times, we expect each partner in a commercial transaction to believe that the price was fair, and that both sides benefit from the exchange. I buy a meal that satisfies my hunger, and the innkeeper in return has money that can be used to satisfy their needs. When prices move, I am upset by having to pay more. The innkeeper is angry because the money I have given no longer buys so many goods. We both think that we have lost out in the transaction and that we have been manipulated by some sinister force. We also feel guilty for taking advantage of others – getting rid of our banknotes as soon as possible. We think start to think that we are behaving in a speculative and grasping way. Non-Jewish Germans after the First World War in the middle of the currency disorder thus took up activities that they associated with Jewish actions, hated themselves for their breach of traditional norms and externalised that powerful emotion by blaming the groups associated with finance and money. There was also a backlash against mobility, especially across Germany's new eastern border, and foreign Polish and Jewish traders were depicted as taking advantage of Germans; but foreign (west European and American) tourists also seemed to be living the high life in Berlin and other fleshpots on the cheap. They too provoked resentments.

The inflation destroyed ethical values, but it also corroded and undermined political structures. Germany was (and is) a federal country. Federalism depends on precise rules about the distribution of revenue and expenditure. The inflationary process, with a constant uncertainty about the real value of taxes and government payments, produces for the territorial units the same feeling of losing out that is experienced in personal life. Taxes seem to go to the centre – to Berlin, or to Moscow (for the waning Soviet Union), or to Belgrade (for Yugoslavia under stress). On the other hand, spending looks as if it is associated with proximity to the seat of the federal government. Such interpretations fuel separatism. In the year of the hyperinflation, Saxony tried to break away under a radical left-wing regime ("the red hundreds"), while Bavaria moved to the radical right (and in November 1923 Adolf Hitler staged a putsch). The Rhineland separatists wanted to reach their own arrangement with France.

Calculations about access to credit and the government printing press reinforce the push to separatism. The German central bank was extending credit at highly negative real interest rates: that amounted to a subsidy. But only firms that could assert their national importance, and their closeness to the political process in Berlin, had a chance of getting that subsidy. Everyone else though they were losing out.

As the political disintegration proceeds, tax collection becomes more difficult – especially in the further or remote regions, and spending also collapses. In consequence, regional governments have substantial incentives to invent new fiscal mechanisms.

2.3.1. A parallel with the 1990's and some consequences

The dynamic that almost led to a breakup of Germany in the late summer and fall of 1923 produced the disintegration of both the Soviet and the Yugoslav federations at the end of the Cold War. There was hoarding as the ability to make or trust cash or credit transactions broke down: thus, from 1990, Ukraine stopped supplying food to Russia. Central banks favoured well-connected enterprises. The central federal government then blamed the outside world, or the international community, for all the chaos and disorder. For Serbia, the origins of inflation lay in international sanctions. The Soviet collapse also quickly produced a narrative of Russian victimisation, as the result of the implementation of a Cold War strategy of Russia's enemies that worked together with a treasonous Soviet leadership under Mikhail Gorbachev that "sold out" to the West. The Serbian and Russian explanations of inflation and economic vulnerability look like very close echoes of the constant refrain both of Weimar's leaders and the increasingly radical opposition to the "system," namely that it was the foreign powers or the international order that had created the inflation through the impossibly large reparations bill. Inflation

led to the targeting of minorities, but also to an explosion of rage at the iniquity of the international order.

Short of the large-scale Czech-type confiscation, only a dramatic economic and political collapse, of the type that occurred in Austria and Hungary in 1922 and in Germany a year later could lay a basis for an effective monetary and financial stabilisation. There was discussion of nationalisation in all these countries, but it was rejected – in large part because of the argument that such an operation would give an easy lever to the reparations creditors to seize resources. The argument was of course put forward with exceptional vigour by existing property-holders. The whole debate left a permanent mark on politics: the idea that seizing the assets of a specific group might end every fiscal conundrum played powerfully into the growing anti-Semitic movement. It laid the basis for Nazi policies of expropriation. What began as an error in economic thinking thus ended up as a catastrophic unleashing of the politics of violence.

3. Stabilisation in Poland as an example of "premature celebration"

As a recent IMF paper demonstrates, inflationary episodes are replete with "premature celebrations". As the drivers of the initial inflationary shock (such as terms-of-trade shock) appear to fade, headline inflation may decline temporarily but underlying inflation remains sticky. In addition, the IMF paper argues, policy settings may be inconsistent, with premature policy easing in response to declining inflation (*Ari et al. 2023*). The story of the 1921 attempted stabilisation, and the associated "premature celebration," is telling.[5] The attempt, apparently successful, at a fiscal stabilisation had pushed up the exchange rate of the Polish Mark, with the quotation rising by 25 per cent in November. In turn, the higher exchange rate made conditions for business and agricultural exporters worse, and the monetary authority responded with an easing, which pushed inflation further. In November 1921, when workers and unions were asking for help because of high unemployment, industry minister Henrik Strasburger responded by demanding help from the government and the PKKP. As the PKKP credits rose, the appetite for more developed. The liberal economist *Edward Taylor* observed a:

> pursuit to increase this medicine. There was a desire to create capital by issue of the money. This is a typical advanced inflation symptom. With this typically inflationary conception showing lack of knowledge of the basic economic principles, a Sejm deputy, Father *Stanisław Adamski*, told parliament that 'the current high prices of the money are not natural, they are caused by the shortage of means of payment in circulation. Therefore.... one needs to introduce much

[5] *League of Nations* (*1922*): *p. 33*, also *Taylor* (*1926*): *p. 189*.

> bigger quantity of the money in circulation in the country... otherwise our Mark suffers for this reason in the international opinion' (*Taylor 1926: pp. 186–187*).

The most celebrated stabilisation, that went into the history books as the Grabski stabilisation, was also unfortunately a premature celebration. In December 1923, *Władysław Grabski* became both Prime Minister and Minister of Finance in a technocratic government. On 3 January 1924, he was given exceptional powers by the Sejm for a six-month period, while the stabilisation programme was implemented in the Act on the State Treasury Reform and Currency Reform, enacted at breakneck speed on 11 January. The critical legislation became law through a presidential decree already on 20 January 1924. Under the decree law of 20 January 1924, a new central bank, Bank Polski (BP), was created, with a note circulation was backed at least 30 per cent by gold (coins and bars) as well as gold-based foreign currencies (at that moment the pound had not yet returned to gold convertibility). The new currency, the złoty (or "golden" in Polish), would be set at the gold value was set at that of the Swiss franc, 1/3.444 gram of pure gold. The new initiatives stabilised expectations, and the markets began to be more confident.

But then the reform faltered, in part due to bad luck. The harvest of 1924 was poor, and Polish exports fell off at the same time as prices weakened. Then a major tariff war with Germany began in mid-1925, and exports of Polish coal to Germany fell precipitately. The foreign holdings of BP fell from 269 million złotys at the beginning of 1925 to 120 million at the end of June, and 70 million by the end of the year. The exchange rate started to fall. Then a series of bank runs and failures prompted a clash between the new central bank and the government. In these conditions, Walter Bagehot's *Lombard Street*, which had become the classic handbook for central bankers, recommended extending credit to banks that were fundamentally sound but faced a temporary liquidity shortage, but at the same time raising interest rates to combat the external drain. That course, however, would hit industry, agriculture – indeed the whole economy – hard. In the clash, Grabski argued for bank support, and BP for the support of the currency, even at the expense of the financial sector. It was probably impossible, as even Grabski later realised, to defend both the banks and the currency. BP won out, and forced the resignation of the Grabski government on 13 November 1925, with the exchange rate continuing to slide. Banks in Britain and the United States were unwilling to commit themselves to a support operation. Grabski's legacy appeared to be in tatters, and the opposition began to use the term "grabszczyzna" to indicate a completely messed up policy.

Marshal Józef Piłsudski's coup of May 1926 and the move to a political sanation (*sanacja*) represented a turning point in terms of currency assessments. It followed a painful five months of austerity imposed by Finance *Minister Jerzy Zdziechowski* in the government led by *Aleksander Skrzyński*, which cut pensions by 35 per cent,

laid off 25,000 railroad employees, and reduced sickness and disability support, while it increased taxes, utility prices for gas and electricity, and alcohol prices. The measures heightened the economic crisis. But the fiscal stabilisation did not stabilise the exchange rate: on the contrary. Austerity often fails to induce confidence, either domestically or on the part of foreign investors, who often read it as signalling political fracturing and stalemate.

The critical part of the rescue was in fact the likelihood of outside assistance. Only after the 1926 Piłsudski coup did the US position became much more favourable to Poland. The US Minister in Poland explained to Edwin Kemmerer, the Princeton professor who had initially been asked by Grabski to advise on a stabilisation scheme, that

> the indications are that the government will be in a position to solve its economic difficulties much more rapidly than heretofore and I believe in a spirit much more friendly to America. … It is hard to foresee the effect of the revolution on Poland's credit among foreign nations. A few days after the fighting I learned of not less than four financial operations involving fairly large credits to Poland which had been concluded. The Harriman interests, as you probably know, are ready to go ahead with their investments in the country.[6]

In the end, stabilisation and ending inflation required foreign support, but also an end to political turmoil.

In mid-1932, with other countries in the depth of depression and despondency, the Bank of England's *Harry Siepmann* commented chirpily on the Polish situation as depicted by its representatives in Basel:

> From all the reports we heard, much the best of the bunch. They themselves think that they have a year to go before they will be in as bad a position as their neighbours are in already. They attribute their success to the harmonious working of the Government with the Bank, to the loyal support of the private banks, and to general administrative efficiency. Bank Polski claim to have had the whole credit position well in hand and they now thank their stars that foreign capital did not come pouring into Poland a few years ago, though it may have been a good thing that Blairs induced them to borrow more than they needed at that time. Public mentality seems to be much less troublesome than in any other country. Their boom was short and came late and they now look back upon 1928 as having been the exceptional time, so that they are the more ready to regard present conditions as approaching to normal period. There is none of the readiness which one finds in Germany to consider that the present state of

[6] Edwin W. Kemmerer Papers, Box 205, Stetson to Kemmerer, 4 June 1926. Public Policy Papers, Department of Special Collections, Princeton University Library.

> affairs represents a lapse from what any decent people are entitled to expect. Perhaps what has a good deal to do with all this is the fact that, to all intents and purposes, there are no politics.[7]

The solution in other words involved a combination of conscious depoliticisation and painful limitations to national sovereignty.

4. Conclusion

There were substantial costs to ending inflation and hyperinflation, most obviously in terms of recession and unemployment of the ending of inflation. The discussion of the costs also brought calculations in peripheral countries that inflation might be used to effect an international as well as an internal redistribution of wealth. Ending the inflation was politically costly, and usually involved ceding some aspect of sovereignty or limiting the room for domestic political manoeuvre. It could only be attractive when the international financial system was capable of producing real resources to sweeten the bitter medicine of adjustment. Hence at moments of international political and financial instability, many inflations were not really ended, but produced premature celebrations before a relapse, usually accompanied by a move against external influence and control. The dynamic was powerful in the interwar years; it resurfaces however at moments of strain in what is generally a more robust financial order, when the periphery becomes less peripheral.

The dynamic identified by *Edward Taylor* of a continual search for "medicine" in the midst of the inflationary malaise has the elements of a classic tragedy. Indeed, *Aeschylus* addressed the psychological and political mechanism in the *Eumenides*, the drama in which he showed how Athenian institutions and juridical certainty could solve social disintegration and political discord: "Man to man foresees his neighbour's torments, groping to cure his own – poor wretch, there is no cure, no use, the drugs that ease him speed the next attack".[8]

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Fiscal Risks in an Ageing World and the Implications for Monetary Policy*

Manoj Pradhan – Charles Goodhart

Ageing societies are likely to face rapidly changing structural macroeconomic trends, with fiscal balances likely to worsen over time. It is widely acknowledged by forecasters and financial markets that debt-to-GDP ratios are tending to rise over time, but there are signs that the size and persistence of future deficits and debts may be underestimated. This underestimation comes from three sources: i) incorrect consideration of the medical complications of older cohorts; ii) a demography-driven rise in inflation, real interest rates and interest expenses; and iii) misalignment of fiscal and monetary policy incentives in an inflationary environment. We argue that a new era is starting, when we will have to face complicated relations between demography, and fiscal and monetary policy.

Journal of Economic Literature (JEL) codes: E20, E30, E40, E50, I11, J11, J14, N10, N30, P10

Keywords: Demography, globalisation, China, ageing, inflation, inequality, debt, monetary and fiscal policies

1. Rapidly changing structural macroeconomic trends

In the USA, the non-partisan Congressional Budget Office (henceforth CBO) estimates that the US debt-to-GDP ratio is likely to rise to 166 per cent of GDP over the next three decades (*Figure 1*). In contrast to the period after both World War I and World War II, the era of an ageing society will not allow debt/GDP to fall in the US, and instead it will rise in the coming decades. On the basis of present policies, deficits are therefore set to be a permanent feature of the fiscal landscape. These deficits are made up of a steady-to-weaker primary deficit and a rising net interest outlay (*Figure 2*). Persistent primary deficits are strongly linked to the needs of an

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

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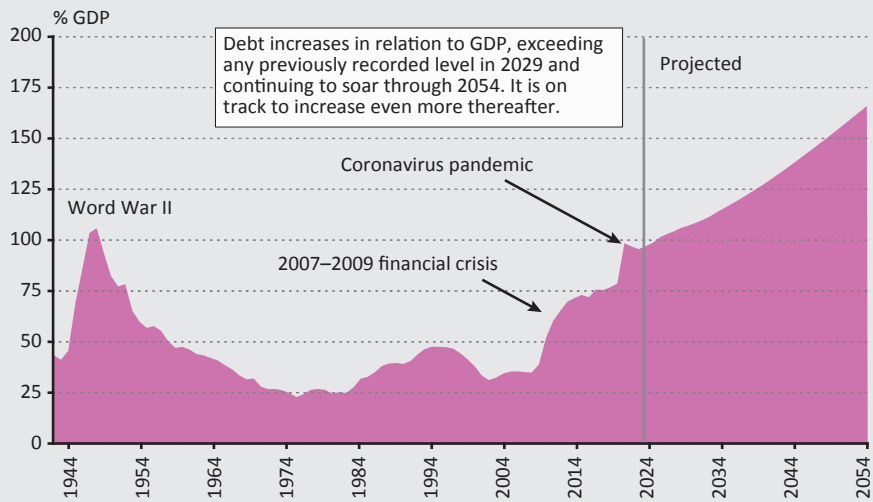
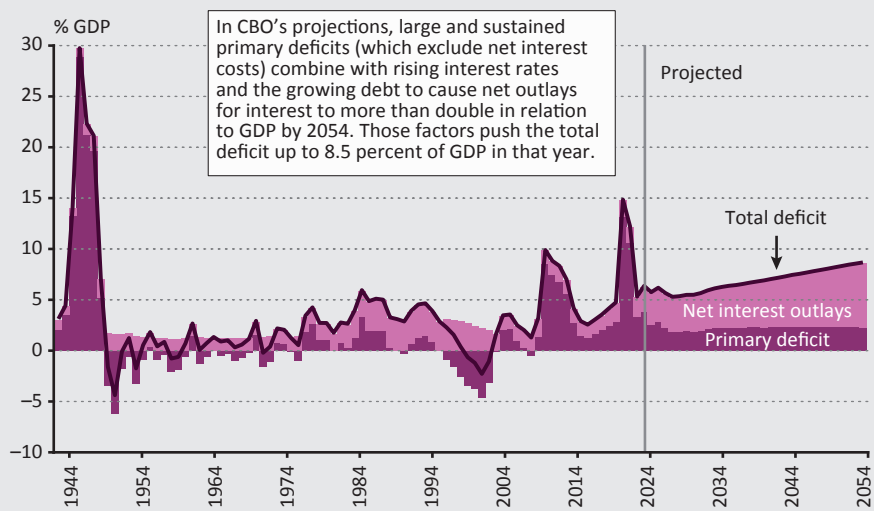
ageing society as we argue in our 2020 book "The Great Demographic Reversal" (*Goodhart – Pradhan 2020*). Alongside these deficits, rising interest expenses are predicated on financing costs of around 3.5 per cent (similar to the levels seen in the US bond market in 2024).

Figure 1
Federal debt held by the public



Source: CBO (2024)

Figure 2
Evolution of total deficits, primary deficits and net interest outlays



Source: CBO (2024)

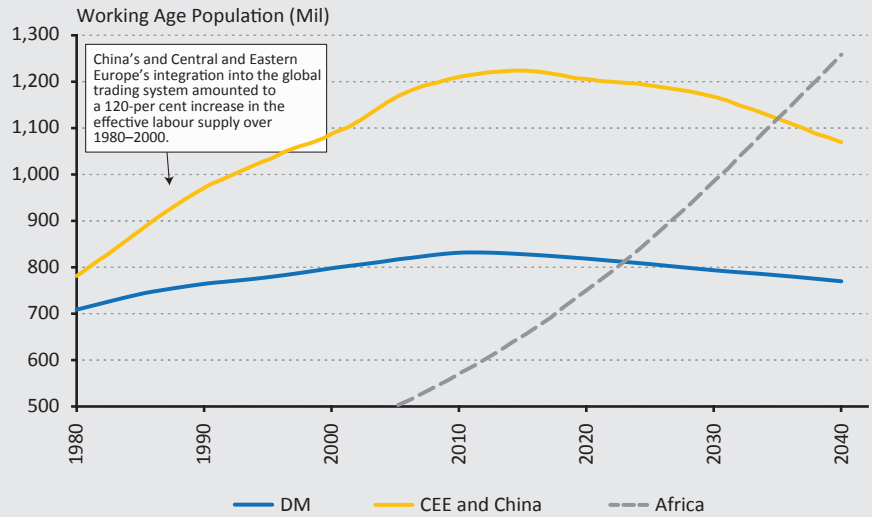
Both components may be underestimated. Even if deficits and debt develop exactly as the CBO forecasts, the implications of such a sharp increase in the debt-to-GDP ratio has major implications for monetary policy, interest rates and debt sustainability in the US economy and around the world.

For the last few decades, financing rising debt has never really been a problem. Will that really change in the future? We think so. Demography and the integration of China played a strong role in driving interest rates lower in the decades leading up to the pandemic. In turn, lower interest rates raised the willingness and ability to borrow and kept debt financing costs low. Demography and China are now implying a less disinflationary path, and that means the dynamics of debt, its sustainability and the cost of financing debt are all going to change.

China's integration into the global manufacturing system also resulted in the integration of its massive, well-trained labour force into the global supply of labour. Along with Central and Eastern Europe (CEE), the rapid increase in the effective labour supply for the global economy amounted to a huge positive supply shock – a 120-per cent increase in the supply of labour over the period 1980–2000 (*Figure 3*). The only other comparable shock of this magnitude is probably the tragic events during the Black Death in which a huge number of fatalities reduced global labour supply by one third. Along with the rise of the Baby Boomers, this increase in labour supply naturally put downward pressure on wage growth in the advanced economies. In his Jackson Hole paper, *Guvenen* (*2021*) argues that the increase in inequality within the US was driven by the underperformance of real wages of the lower 50 per cent of the labour force (sorted by wages), rather than the outperformance of relatively high wages. China's rise as a manufacturing giant helped to explain the underperformance of mid/lower-skilled workers.

Effectively, the global equilibrium wage was set by China, and other economies in the world gravitated towards that wage level over the decades following China's integration. *Autor et al.* (*2013*) measure the response of local US labour markets to increasing exposure to imports from China. They find "Rising exposure increases unemployment, lowers labor force participation, and reduces wages in local labor markets. Conservatively, it explains one-quarter of the contemporaneous aggregate decline in U.S. manufacturing employment." Economies where real labour costs were higher than China's would lose market share to China and see their real wage growth falling – this was true for the advanced economies. Emerging market economies that connected with China as input providers were able to piggyback on China's rapid rise and provide higher real wages for their own labour force. This evolution is consistent with *Milanovic's* (*2016*) observation that global inequality fell even though inequality within the advanced economies rose.

Figure 3
Main trends in the effective labour supply (1980–2040)



Note: Working age population: people aged 20–64; DM: developed markets; CEE as Eastern Europe according to United Nations geoscheme: Belarus, Bulgaria, Czechia, Hungary, Poland, Republic of Moldova, Romania, Russian Federation, Slovakia and Ukraine (https://unstats.un.org/unsd/methodology/m49/).

Source: UN Population Statistics

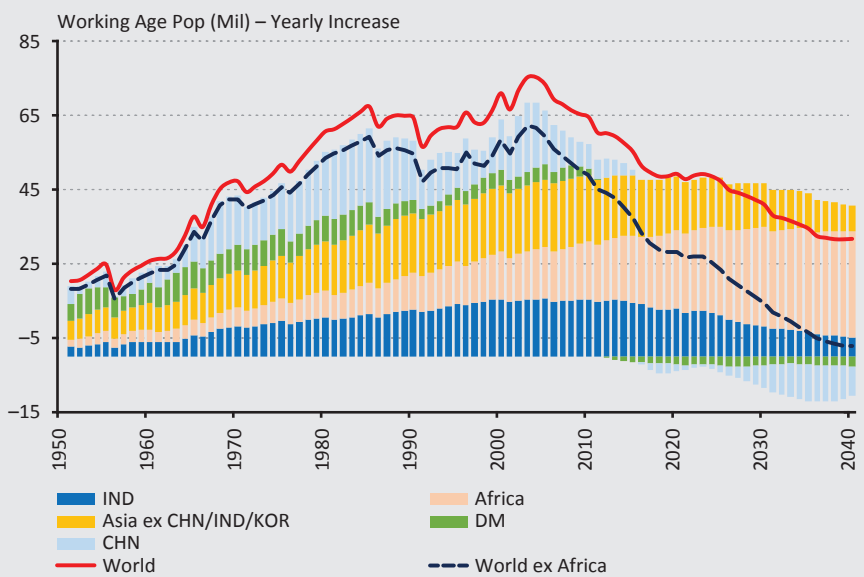
China's introduction into the world's trading system also resulted in major changes in investment and real interest rate dynamics. Faced with the "Impossible Trinity" – i.e. that an economy cannot simultaneously have a fixed exchange rate, free capital movement and independent monetary policy – China's policymakers chose to restrict capital flows in order to retain control over the exchange rate and domestic monetary policy. This choice had the added advantage of incentivising physical investment within China for those who wished to tap the massive potential available on its shores. As physical capital flowed to the Pearl River Delta and other destinations in China, incremental investment within the advanced economies slowed. Relative to local savings, the advanced economies consequently faced a deficit in investment. Since global interest rates have always been determined within the advanced economies, the shortfall of investment relative to savings lowered the real interest rate for the global economy.

Together, lower wage growth, a fall in the price of goods now manufactured in China and a decline in the real interest rate led to falling interest rates, which in turn created a bull market for bonds that lasted for decades. Borrowing and lending were relatively low-risk activities since the cost of servicing debt continued to fall year after year. A sustained fall in the cost of leverage then fed into a rise in the price of assets, particularly the one asset which always needs a lot of leverage… housing. The consequences of that exuberance are very well known.

That's history. As the Hollywood film title goes, let's get 'back to the future'.

Most agree that China and demography had a role, probably an important role, to play in the decline in the nominal and real cost of borrowing in the decades leading up to the Global Financial Crisis (GFC) in 2008–2009 and the Covid-19 pandemic. Despite accepting that causation, there is resistance to accepting a *reversal* in the direction of inflation, real interest rates and wages, even though it is very well understood that demography and China are already reversing the path they have followed over the last few decades and thus a great demographic reversal is underway (*Figure 4*).

Figure 4
Evolution of working age population



Note: Working age population: people aged 20–64; DM: developed markets
Source: UN Population Statistics

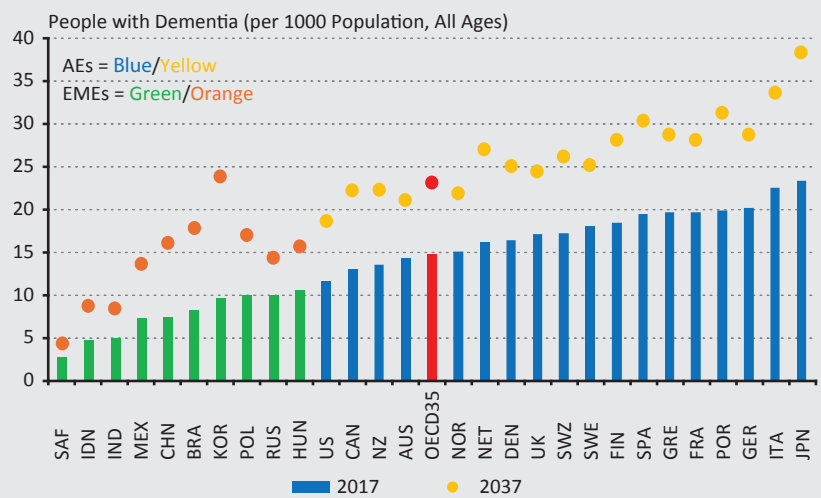
2. What does this mean for future monetary policy?

Are deficits and debt being underestimated? Three arguments suggest that the fiscal position of the US economy may worsen faster than the CBO forecasts. At the outset, it must be stated that the CBO's remit is to project deficits and debt based on existing policy. That remit does not allow for a probabilistic assessment of future policies. We are not constrained in this manner and hence can assess the future on a much wider range of possible outcomes (see *Balogh et al. 2024* for a recent perspective on the challenges facing monetary policy).

2.1. Ageing

First, the medico-fiscal needs of an ageing society are likely being underestimated. The fastest growing cohort of the population in almost every economy is the oldest-old. As individuals go past their 60s and into their 70s, 80s and 90s, the risk of suffering from a neuro-degenerative disease (henceforth NDG) rises sharply everywhere around the ageing world (*Figure 5*). This is a medical development that the global economy has never experienced as an issue of macroeconomic proportions.

Figure 5
Incidence and expected evolution of neuro-degenerative diseases around the world



Note: AEs: Advanced economies, EMEs: Emerging economies
Source: OECD Health Statistics 2017

NDGs are different from the more familiar afflictions of our time, such as cancer and heart disease, in three important ways. First, the ailments that we are more familiar with tend to preserve the quality of life for large periods except for relatively short periods of the disease, but particularly the very last stage, when patients tend to suffer. Severe cases of the current ailments of old age tend to lower life expectancy once the disease sets in. NDGs, on the other hand, lower the quality of life slowly and markedly, but they allow the patient to live for a very long time. Second, as a result, most patients suffering from diseases such as cancer and heart disease are able to perform the activities of daily life fairly effectively except in critical times. Patients suffering from NDGs are increasingly unlikely to perform daily activities. As the mental condition deteriorates, every patient require help to complete even simple tasks. Third, patients suffering from today's ailments have an ability to re-join the labour force upon successful competition of treatments that allow (sometimes) for a full recovery. There is no coming back from NDGs. There is no possibility of a patient suffering from any version of such diseases to go back into the labour force. This is particularly important because it means that people afflicted with NDGs cannot finance their treatment and caring expenses with new earnings. Everything must be financed by savings from the past, intergenerational transfers within the family, or fiscal support.

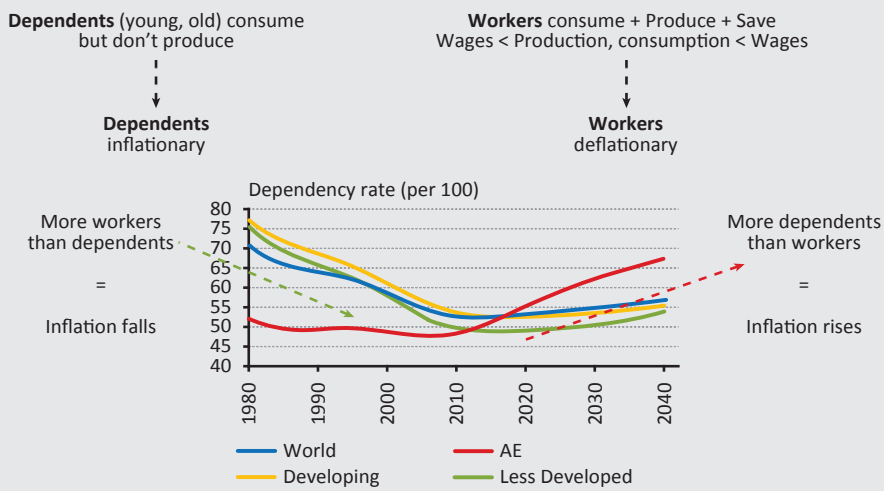
Forecasters have not fully incorporated the additional threat of NDGs into the medico-fiscal estimates. The CBO's estimates of age-related expenditures almost certainly underestimate the fiscal expenses that would need to be incurred when NDGs spread through an ageing population. If we are right, primary deficits in the future will worsen as societies age.

The second reason that deficits and debt might be underestimated is that an ageing workforce, in which the proportion of elderly dependents rises relative to the working age population, is likely to result in both higher inflation and a higher real interest rate. If one or both are correct, interest rates are likely to remain higher than they have been in over the last 2 to 3 decades on average. Towards the late stages of business cycles, interest rates may rise further above these averages. In the CBO's projections, it is the interest expense (rather than the steady primary deficit in its projections) that accounts for the bulk of the rise in successive fiscal deficits.

Why would inflation and real interest rates rise? Inflation is likely to rise for two reasons.

Dependents and workers have a different effect on inflation. Dependents consume without adding to supply in the economy. In other words, dependents create excess demand and tend to be inflationary. Workers, on the other hand, tend to be disinflationary if not outright deflationary. Workers are paid a wage that is less than the value of their marginal product – that means the firm captures the wedge between revenues and wages. Out of their wages, workers will save for the future. Thus, the revenue stream that a worker creates exceeds the spending by that worker because of two wedges, profits and savings. The excess of supply produced by workers relative to the demand they create is disinflationary. In the period when China, CEE and domestic labour forces in the advanced economies dominated flows in the labour market, the flow of workers joining the world's labour force far exceeded the flow of dependents. The dynamics we describe help explain why we saw a sustained period of disinflation. As flows of older dependents outstrip in the inflow of workers, it is the inflationary effect of dependents that will be the dominant factor (*Figure 6*).

Figure 6
Flow of workers relative to the flow of dependents and some inflationary consequences



Source: UN Population Statistics, authors' annotations

Debt dynamics will tend to be inflationary as well. If financing the fiscal position is a daunting task, inflation targeting can be difficult. Central banks lower inflation by tempering demand. However, weak growth in an era of rising fiscal risks could raise questions about the sustainability of the debt profile. To put it differently, central banks can pursue disinflation, but only to the extent that their disinflationary policies do not create fiscal/financial instability by hurting growth. If modest growth

is important for convincing financial markets about the sustainability of debt, the ability and willingness of central banks to control inflation will be lower.

Real interest rates are likely to rise if the build-up in debt outstrips growth and productivity in the economy. During wars and even during the pandemic, debt and GDP tended to move in the same direction. During these difficult times, government expenditures rose and growth improved. As the need for fiscal support abated, deficits fell and debt/GDP ratios stabilised or even fell. *Figure 1* suggests that debt/GDP could rise and then fall after a major event like WWII. That will not be the case when it comes to ageing – note that the debt/GDP continues to rise after the pandemic… that's because of ageing.

2.2. Productivity

Demography is one of a small number of factors that can push debt and GDP in different directions – another one is productivity. From our discussion above, it is clear that ageing societies will continue to be naturally associated with rising debt. However, a shrinking workforce implies lower growth unless productivity rises. In an ageing society where debt is rising at a steady rate while growth is slowing, productivity has to be strong enough to not just compensate for a smaller workforce, but go beyond that to assure us of the sustainability of rising debt.

Unsurprisingly, the rise of AI has created a serious discussion whether we are on the cusp of exactly this kind of a surge in productivity. We are not technology experts, but we would make three points. First, technology revolutions tend to create new sectors and new jobs – that means running out of jobs is not consistent with a technology revolution. Second, adoption of productivity-enhancing technologies tends to create rising household incomes – that means credit growth and demand will also be boosted by the adoption of AI. Finally, a destruction of repetitive jobs is a necessary evil. There are so many jobs in the pipeline of an ageing society that jobs in other sectors must be destroyed in order to reallocate labour to sectors that cater to the elderly.

2.3. Misaligned fiscal and monetary policy objectives

A third possible reason that the fiscal position could worsen more than projected is that the objectives of monetary and fiscal policy may no longer be as well aligned as they have been in the past, leading to larger deficits and a more cyclically-active fiscal policy. In the decades leading up to the pandemic, the introduction of China's labour force and the rise of the Baby Boomers led to falling inflation, wages and real interest rates. The result was a strong willingness and ability of borrowers and lenders to transact. Credit growth was strong and house prices rose. Inflation targeting by central banks aided this process. Incumbent administrations could hardly have asked for a better macroeconomic backdrop.

In the inflation surge in the post-pandemic recovery, we saw some increasing friction between central banks and governments. The US continues to run very large fiscal deficits, despite several warnings from prominent economists that expansive fiscal policy during a strong economic recovery could make disinflation very difficult. Such political realities need not be a permanent feature of the future, but it would be naïve to think we have seen the last of such frictions between central banks and governments. *Schnabel* (*2024*) raises concerns about the future independence of monetary policy in the event that future fiscal policy in the euro area deviates persistently from the new European fiscal rules. *Leeper* (*2023*) urges "a fundamental rethink of how America conducts its fiscal policy". Specifically, he urges "fiscal behaviour that is compatible with an inflation-targeting monetary policy".

3. Conclusion

In summary, fiscal positions in ageing societies might deteriorate more than expected because of (i) an underestimation of the medical complications of an ageing society which inevitably means higher healthcare and pension spending; (ii) a rise in inflation and real interest rates because of demography, and hence a rise in interest expenses on existing debt; and (iii) a misalignment of fiscal and monetary policy incentives at the cyclical frequency in an inflationary environment, which prompts governments to be more active in countercyclical policies, particularly when elections approach.

Two other implications of demography and fiscal policy need to be outlined: the *cost of decarbonisation*; and the *global effects of US fiscal policy*. Any estimate of the cost of decarbonisation is daunting. How will governments allocate fiscal funds to the needs of reducing global warming if an increasing share of future expenditures is allocated to the needs of an ageing society? Moreover, the global effects of fiscal policy and sustainability in major economies will impinge upon the rest of the world. Even if an economy pursues very responsible fiscal policy, the cost of financing its national debt is likely to rise if the cost of financing US sovereign debt rises.

The implications of these fiscal risks are deep and widespread. Will central banks be able to maintain their inflation targeting mandates if both debt/GDP and interest rates are higher in the future compared to the benign conditions over the last three decades? Can financial markets absorb the vast sums of fiscal issuance that are inevitable? Can global debt financing remain resilient if even one of two of the gigantic issuers of government bonds, the US and the euro area, faces increasing questions about sustainability? Or will there simply be a new disinflationary force in the form of AI that will solve all our problems?

We hope the discussion above provides a sense of how deep and complicated the relationships among demography, fiscal policy and monetary policy will become. One thing we are sure of, the sequel to "Back to the Future" won't be anything like the first movie.

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Fighting Inflation without Massive Transfers to Banks*

Paul De Grauwe – Yuemei Ji

The major central banks now operate in a regime of abundant bank reserves. As a result, they can only raise the money market rate by increasing the rate of remuneration of bank reserves. This, in turn, leads to large transfers of central banks' profits to commercial banks that will become unsustainable and renders the transmission of monetary policies less effective. We propose a two-tier system of reserve requirements that would only remunerate the reserves in excess of the minimum required. This would drastically reduce the giveaways to banks, allow the central banks to maintain their current operating procedures and make monetary policies more effective in fighting inflation.

Journal of Economic Literature (JEL) codes: E42, E52, E58

Keywords: central banks, inflation, bank reserves, remuneration

1. Introduction

The major central banks pay interest on commercial banks' holdings of bank reserves held at the central bank (see *Table 1*). In order to fight inflation, these central banks have started to raise interest rates since late 2021. Taking the example of the Eurosystem: bank reserves held by credit institutions at the national central banks and the ECB amounted to EUR 3.5 trillion in March 2024, while the remuneration rate on these bank reserves held by commercial banks was 4 per cent. This means that the Eurosystem was paying out EUR 141 billion in interest to credit institutions as of March 2024, on a yearly basis.

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* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

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Other central banks, in particular the Federal Reserve and the Bank of England, follow the same procedure of raising the interest rate by increasing the rate of remuneration on bank reserves. In *Table 1*, we compare the interest transfers for these three central banks. We find that these transfers to commercial banks have become substantial. The last column of the table shows these interest payments as a percentage of GDP. One observes that, in relative terms, the transfers made by the Bank of England are the highest, followed by the ECB and the US Fed.

Table 1
Bank reserves and interest payments to banks (end-March 2024)

	Bank reserves (billions)	Interest rate (%)	Interest payments	
			(billions)	Per cent of GDP
ECB	EUR 3,524	4.00	EUR 141	1.10
Fed	USD 3,472	5.4	USD 187	0.75
BoE	GBP 792	5.25	GBP 42	1.75

Source: Bank of England: Central Bank reserve balances liabilities, Board of Governors of the Federal Reserve System (Federal Reserve Balance Sheet) and European Central Bank (Consolidated financial statement of the Eurosystem. ECB Data Portal.)

To give an idea of the size of these transfers in the Eurozone, consider the following: With a yearly transfer of EUR 141 billion by the Eurosystem to the Eurozone banks, we are approaching the total annual spending of the EU, which amounted to EUR 168 billion in 2022. Although these transfers will decline as a result of falling interest rates and declining levels of bank reserves due to 'quantitative tightening,' they will remain substantial for years to come. This is a remarkable situation, which is even more remarkable when one considers that these transfers by a European institution to the banks are decided without any political discussion and are granted without attaching any conditions. This contrasts with EU spending, which is the result of an elaborate political decision-making process and is usually accompanied by tight conditions.

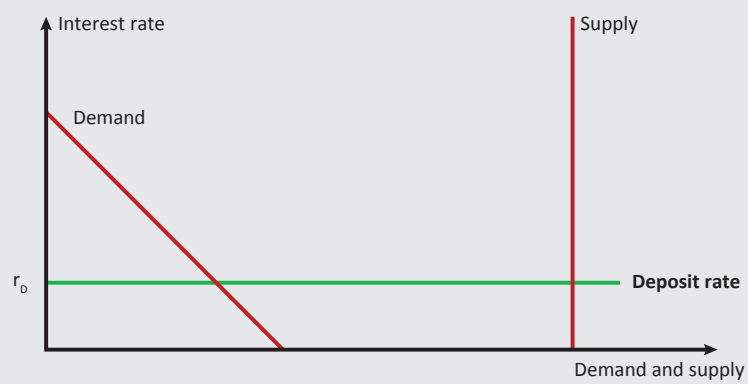
In this paper, we address a number of issues that arise from these large transfers. In *Section 2*, we review the theoretical idea of the need to remunerate bank reserves. In *Section 3*, we discuss the major problems with the remuneration of bank reserves. Although the interest transfers by central banks occur in most advanced countries (including Hungary, the Czech Republic and other countries in the CEE region) and create similar problems such as large losses for central banks in all of these countries as well, we focus on the Eurozone in this paper and use it as a good example. This allows us to study some of the special problems that arise from these transfers in a monetary union. In *Section 4*, we look at the alternative operating procedures of central banks in their fight against inflation that do not imply massive transfers of central banks' profits to banks. We propose a two-tier system of minimum reserve

requirements as an alternative operating procedure. In *Section 5*, we argue that there is a need to rethink the role of minimum reserves to ensure financial stability. We conclude in *Section 6*.

2. Is the remuneration of bank reserves necessary for monetary policy?

Is the remuneration of bank reserves necessary to conduct monetary policy? The standard answer of many economists and central bankers is positive (see *De Grauwe and Ji 2024b*). Today, there is an oversupply of bank reserves thanks to the large-scale QE operations of the past. There is, in other words, no scarcity of liquidity, but rather an abundance (see, for example, *Bailey 2024*). This creates a problem for the central banks when they want to raise the interest rate. We illustrate this in *Figure 1*. This represents the demand for reserves (by banks) and the supply (by the central bank). The demand is negatively related to the money market interest rate (interbank rate). The supply is determined by the central bank. The latter increases (reduces) the supply by buying (selling) government bonds. *Figure 1* presents the regime of reserve abundance: the central bank has bought large amounts of government bonds in the past and thus created an excess supply of reserves. As a result, without the remuneration of bank reserves, the interest rate is stuck at 0 per cent and the central bank cannot raise the interest rate.

Figure 1
Demand and supply of reserves in a reserve abundance regime



Note: This is a stylised representation of the market for bank reserves. It does not show the marginal lending rate which acts as a ceiling and is raised together with the deposit rate.

Source: De Grauwe – Ji (2023a)

To raise the interest rate in this reserve abundance regime, the central bank can remunerate bank reserves, which are essentially deposits at the central bank held by commercial banks. In doing so, the demand curve becomes horizontal at the level of the deposit rate, i.e. the deposit rate, r_D, acts as a floor for the interbank interest rate. The reason is that banks will not lend in the interbank market at an interest rate below the (risk-free) deposit rate. Given the abundance of bank reserves, this is the only way to raise the money market interest rate.

An increase in the interest rate on bank reserves (deposit rate) is then transmitted into an increase in the money market interest rate and to the whole structure of interest rates (*Ihrig – Wolla 2020*; *Baker – Rafter 2022*). Such an increase in the interest rate is necessary to fight inflation. Therefore, in the present regime of reserve abundance, the only way to raise the interest rate is to remunerate banks' reserves and increase this remuneration rate.

Many economists and central bankers today take it for granted that bank reserves are remunerated so as to conduct anti-inflation policy. Yet this remuneration is a recent phenomenon. Prior to the start of the Eurozone in 1999, most European central banks did not remunerate banks' reserve balances. During the 1970s and 1980s, for example, the Bundesbank used very high unremunerated minimum reserve requirements to siphon off large inflows of money into the country (*Schobert – Yu 2014*). The ECB started the practice of remunerating bank reserves in 1999. The Federal Reserve introduced the remuneration of banks' reserve balances only in 2008. Thus, before 2000 the general practice was *not* to remunerate banks' reserve balances. This made good sense: commercial banks themselves do not remunerate demand deposits held by their customers. These demand deposits have the same function as bank reserves at the central bank: they provide liquidity for the non-bank sector. These are not remunerated. It is not easy to justify why bankers should be paid when they hold liquidity, while everybody else should accept not being remunerated.

3. Problems with the remuneration of bank reserves in the current operating regime[1]

The large remuneration of bank reserves creates several problems that we discuss in this section. Some of these problems may have political economy implications in the Eurozone.

[1] This section is based on *De Grauwe and Ji* (*2024b*)

3.1. Large transfers and fiscal implications

First, when the central bank makes interest payments to commercial banks it transfers part of its profits to the banking sector. Central banks make profit (seigniorage) because they have obtained a monopoly from the state to create money. The practice of paying interest to commercial banks thus amounts to transferring this monopoly profit to private institutions. This monopoly profit should be returned to the government that has granted the monopoly rights. It should not be appropriated by the private sector, which has done nothing to earn this profit. The present situation of paying out interest on banks' reserve balances amounts to a subsidy to banks paid out by the central banks at the expense of taxpayers. In *Table 2*, we show the size of the potential annual interest payments of central banks of the Eurosystem. We observe large differences in these transfers by these central banks, varying from 0.43 per cent to 9.15 per cent of GDP. These different levels may reflect different sizes of banking systems and asset structures across different Eurozone countries.

Table 2
Remuneration of bank reserves in the Eurosystem (August 2023)

Country	Remuneration (million EUR)	Percentage of GDP
Luxembourg	7,095	9.15
Cyprus	920	3.31
Finland	5,285	1.97
Belgium	10,326	1.88
Netherlands	13,918	1.45
Malta	241	1.40
France	35,925	1.36
Germany	49,107	1.27
Austria	4,108	0.92
Croatia	593	0.87
Estonia	302	0.84
Slovenia	426	0.75
Spain	9,170	0.68
Ireland	3,277	0.65
Portugal	1,434	0.59
Greece	1,201	0.58
Latvia	215	0.55
Lithuania	360	0.53
Slovakia	484	0.44
Italy	8,347	0.43

Source: European Central Bank

The payment of interest on banks' reserve accounts has an unfortunate fiscal consequence. It transforms long-term government debt into short-term debt. Most of the government bonds held by the central banks were issued at very low interest rates, often even zero or negative. This implies that governments are immune for some time to interest rate rises. By paying an interest rate of 4 per cent in the Eurozone on bank reserves and thus reducing government revenues by the same amount, the central banks transform this long-term debt into highly liquid debt, forcing an immediate increase in interest payments on the consolidated debt of the government and the central bank. This may contribute to higher budget deficits and increasing government debt, leading to fiscal austerity in some countries. Paradoxically, central banks contribute to a worsening budgetary outlook for the government.

3.2. Large losses of central banks

The large central bank transfers to banks have important implications for the profit and losses of central banks. These transfers are so high that not only do they wipe out central banks' profits, but they also push many of them into loss-making territory (see *Wellink 2003*). This is well-illustrated by the study *Belhocine et al.* (*2023*), which analyses the profit and loss accounts of five major Eurozone central banks. The authors show that the Bundesbank incurs the largest losses. It is estimated that it will take until 2027 for the Bundesbank to make profits again. The Banque de France is ranked second in the list of central banks with losses. Profit-making is estimated to start again in 2025. Surprisingly, the Banca d'Italia is the only one of the larger central banks not to suffer losses (although its profits declined in 2022–2023), while the Bank of Spain incurred some small losses in 2023–2024.

The cause of this divergence is the following. The Bundesbank, and to a lesser degree the Banque de France, hold a portfolio of low-yielding long-term government bonds. As a result, interest revenues are very low, and given the long duration of these bonds, it will take time before they start earning interest. This is not the case for the Banca d'Italia and to a lesser degree the Bank of Spain, which hold relatively high-yielding government bonds. It follows that the Bundesbank and the Banque de France have transformed low-yielding long-term government bonds into short-term liabilities (bank reserves) on which they pay high interest rates. This transformation is much less costly in the case of the Banca d'Italia and the Bank of Spain. It is also interesting to note that not only the national central banks within the Eurozone face the issue of large losses, but countries outside the Eurozone as well, such as the National Bank of Hungary and the Czech National Bank, encounter similar challenges.

Belhocine et al. (*2023*) also show that the cumulative losses can lead to a point where the equity of the central banks turns negative. This is likely to occur in the case of the Bundesbank and possibly the Banque de France. Should one worry about the negative equity of central banks? Not really. Central banks, in contrast

to commercial banks, do not need to have positive equity to conduct credible monetary policies. In addition, a more relevant concept of the net worth of central banks is the net present value of future seigniorage gains and losses (see *Buiter 2008*). The cumulative profit and loss profiles shown in *Belhocine et al.* (*2023*) indicate that the losses are likely to be temporary. As a result, the net present value of future gains and losses is most likely to be positive.

While negative equity does not technically pose problems for a central bank, the political economy of this issue is very different (see *Wellink and Marsh 2023*). The negative equity of the central banks expresses the fact that these are transferring large amounts of money to private agents and incurring large losses in doing so. These losses must be borne by governments and taxpayers. Negative equity (when it may take many years to get equity back to positive) reveals this underlying problem. When this appears in the open, citizens – especially in countries where the central bank incurs larger losses – will ask the question of why it was necessary to enrich the bankers to fight inflation. They will also insist on knowing why the central banks did not look for other operating procedures that were equally effective to combat inflation and that avoided making transfers to banks at the expense of taxpayers.

The ECB has announced that it will gradually reduce its holdings of government bonds by not reinvesting in new bonds when old bonds come to maturity. This will lead to a gradual decline in the amount of government bonds on its balance sheet. It will take many years, however, to reach the point where the excess supply of reserves has been eliminated. Thus, it appears that the Eurozone will remain in a reserve abundance regime for many years to come. This implies that the operating procedure of the ECB (and the other central banks of advanced countries) will continue to be based on manipulating the rate of remuneration of banks' reserves as their central policy tool, which in turn also implies that these central banks intend to continue to make large transfers of their profits to commercial banks for many years to come.

3.3. Central banks have solved the biggest risk of banks

Related to commercial banks, the problematic nature of remunerating bank reserves appears from the following. Banks are 'borrowing short and lending long'. In other words, banks have long assets (with fixed interest rates) and short liabilities. As a result, an interest rate increase may lead to losses and reduces banks' profits because the interest cost of their liabilities may increase quickly in cases of strong competition for liquidity, while interest revenues are slow to pick up. Banks are supposed to hedge this interest rate risk. But this is costly, and as a result, they are often reluctant to buy such insurance. By remunerating bank reserves, the central banks are providing free interest hedging to banks. The latter obtain immediate compensation from the central banks when interest rates rise.

The profit and loss profile of the central banks mimics the profit and loss profile of commercial banks during periods of interest increases. Paradoxically, this time banks are escaping the burdensome loss profile as they made large profits during the period of interest rate increases in 2022–2023. This appears to be possible because central banks have taken over this burden from the commercial banks. It is difficult to see the economic rationale of a system where public authorities provide free insurance of the banks' interest rate risks at the expense of taxpayers. It is also worth mentioning that during the 1970s and 1980s when central banks raised interest rates to fight inflation, they did not make losses (*Humann et al. 2023*). They increased their profits. One of the main reasons was that they did not remunerate bank reserves.

This free provision of interest hedging to banks is likely to intensify moral hazard risks. First, the remuneration of reserves reduces banks' incentives to hedge their interest rate risk. The ECB as the single supervisor in the Eurozone requires that banks manage their interest rate risk appropriately. However, when at the same time the ECB remunerates commercial banks' reserves, it undermines its own micro- and macroprudential supervision objectives. In addition, because the remuneration of reserves will lead to a lower degree of interest rate risk hedging by banks, the central bank will find it increasingly difficult to stop remunerating reserves, as it might fear that the interest rate risk of some banks could materialise, triggering banking crises. Second, as will be shown in *Section 4*, the remuneration of bank reserves strengthens the equity position of reserve-rich banks, thereby giving them incentives to increase the loan supply and weakening the transmission of monetary policy.

3.4. Transmission of monetary policies in the current regime

One important issue is how the existence of remunerated bank reserves affects the transmission of monetary policies. Does remuneration make the transmission of monetary policies effective? In the context of central banks' anti-inflationary policies this question can be reformulated as follows: Does the remuneration of bank reserves enhance or reduce the effectiveness of interest rate hikes to fight inflation?

There is a large economic literature on the equity channel of bank lending which is relevant here. This channel can be described as follows. When a bank's capital (equity) declines, it has an incentive to reduce lending. There are essentially two reasons for this. One is a balance sheet effect. Lower equity means that the bank may not satisfy the capital requirements imposed by regulators. The bank will then have to reduce the supply of loans. The second reason is that with lower equity, the cost of funding bank loans will tend to increase, thereby leading to fewer incentives for banks to lend. Thus, declines in the value of banks' equity lead to less bank lending. Conversely, an increase in the value of equity stimulates banks to lend

more (see *Shin 2015*; *Gambacorta and Shin 2016*; *Van den Heuvel 2002*; *Diamond – Rajan 2000*). This theory has been subjected to many empirical tests confirming its importance (see *Boucinha et al. 2017*; *Girotti – Horny 2020*).

This equity channel of bank lending is important in terms of understanding how the remuneration of reserves may affect bank lending. By increasing the profit margins of banks, the use of remunerated minimum reserve requirements tends to increase the net worth (equity) of banks. With a higher equity ratio, banks will be more willing to supply loans to households and firms. Thus, when the central banks raise the interest rate to fight inflation and as a result increase the remuneration of reserves, they give incentives to banks to extend more loans (*ceteris paribus*). Put differently, the expected negative effect of a rate hike on loans is (partly) offset by the positive equity effect on bank loans when bank reserves are remunerated. The transmission mechanism is made less effective, i.e. increases in the policy rate have a smaller effect on the loan supply and ultimately on inflation.[2]

In *De Grauwe and Ji* (*2024b*), this equity effect was tested empirically using econometric techniques and it was confirmed that this effect is significant. These results are in line with the recent findings of *Fricke et al.* (*2023*), who employ a methodology with very detailed bank-level data for the Eurozone. They conclude from their empirical analysis of these micro-data that "banks with larger excess reserves display a relative increase in their credit supply to non-financial companies following the rate hike", thereby confirming that the remuneration of bank reserves tends to weaken the transmission mechanism of monetary policies aimed at reducing inflation.

4. A two-tier system of minimum reserve requirements

The major central banks are now embracing their new operating procedure (arising from the abundant reserve regime), which consists of raising the rate of remuneration on bank reserves as an instrument to increase market interest rates in their fight against inflation. Despite the problems discussed in *Section 3*, there is still a surprising and widespread conviction among central bankers and economists that this is the only reasonable operating procedure.

[2] The equity channel can also reduce the effectiveness of the transmission mechanism when interest rates are cut during a recession, such as in 2007–2008.

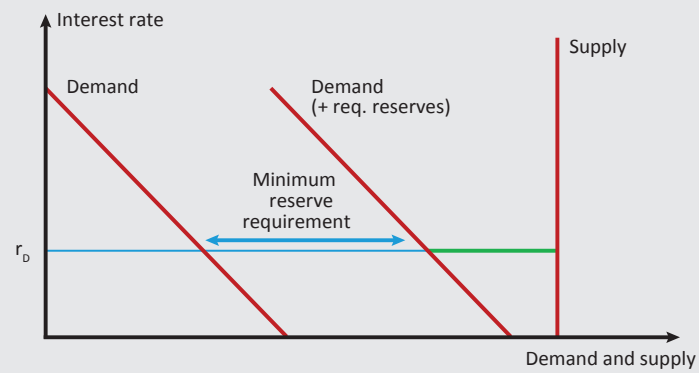
Can one design a system that would avoid the need to make substantial transfers to banks, while maintaining the current operating procedure used by central banks, and in doing so (hopefully) gaining their backing? We believe it is possible to design such a system. It is a two-tier system.

4.1. The proposal of two-tier system[3]

The two-tier system involves imposing non-interest-bearing minimum reserve requirements on *part* of the bank reserves. Bank reserves exceeding the minimum requirement (excess reserves) would then be remunerated as they are today (for similar proposals for a two-tier system, see *Whelan 2021*; *Buetzer 2022*; *van Lerven – Caddick 2022*; *Tucker 2022*); see also *Angeloni* (*2023*) for a proposal not to remunerate bank reserves).

Imposing minimum reserve requirements leads to a horizontal displacement of the demand curve for bank reserves to the right (see *Figure 2*). The minimum reserve requirement would apply only to part of the total bank reserves. As a result of this partial displacement of the demand curve, we remain in the abundant reserve regime. The central bank then remunerates the excess reserves at the rate r_D (the horizontal green line). As before, this rate of remuneration acts as a floor for the market rate, and the central bank can raise the market rate by increasing the interest rate on (excess) bank reserves.

Figure 2
Demand and supply of reserves: two-tier system



Source: De Grauwe – Ji (2023b)

[3] This subsection is based on *De Grauwe and Ji* (*2024b*).

A combination of sustained sales of government bonds and minimum reserve requirements would probably be the best policy option. Thus, the central bank would raise minimum reserve requirements as in *Figure 2*. It would then gradually start reducing its bond holdings allowing the supply curve to shift to the left. This also would make it possible for the minimum reserve requirements to be relaxed gradually. In such a strategy, both the supply and the demand curves in *Figure 2* would then shift to the left, maintaining a regime of reserve abundance and allowing the central bank to use its monetary policy tools while reducing subsidies to banks.

The advantage of this two-tier system is that the operating procedure so cherished by central bankers can be left unchanged. The central bank continues to use the interest rate on bank reserves as its monetary policy instrument. The banks continue to have the same incentive to hold excess reserves, as these continue to be remunerated as today. However, the transfer of central banks' profits to commercial banks can be reduced significantly. We show this in *Table 3*, where we assume that the central banks would block 50 per cent of the existing bank reserves in the form of non-remunerated minimum reserves. The remuneration would then be on the excess reserves using the same interest rates as shown in *Table 1*. We observe that in our proposed system there would be a significant reduction of interest transfers to banks. In our two-tier system, the banks would continue to profit. They would continue to receive relatively large transfers on what is essentially a risk-free asset. However, this would be much less than today in 2024 and surely less 'exorbitant'.

Table 3
Interest transfers in March 2024

	Present system (billions)	Two-tier system (billions)
ECB	EUR 141	EUR 70
Fed	USD 187	USD 93
BoE	GBP 42	GBP 21

Sources: Own calculations based on data from Bank of England, Board of Governors Federal Reserve and European Central Bank

There is a window of opportunity today as the ECB decided in July 2023 to stop remunerating required reserves (1 per cent). This implies that the ECB could increase required reserves and reduce its losses, without having to change its operating procedures. We performed some calculations that illustrate the range of choices available to the ECB. In *Table 4*, we show the total reserves as of March 2024 (column 1). We then apply different minimum reserve requirements (column 2). Column 3 then shows the size of the minimum required reserves on which no remuneration is paid. This leads to column 4 showing the reduction of transfers to

banks resulting from these different minimum reserve requirements. Finally, the last column presents the level of excess reserves that are remunerated. At the end of 2023, with a minimum (unremunerated) reserve requirement of 1 per cent, the transfers of the Eurozone's central banks to the banks were reduced by EUR 6 billion. Clearly, the ECB could gradually increase minimum reserve requirements and it would achieve a number of things. Profit transfers to banks could be reduced and hence less money base could be created, the ECB could maintain its operating procedure consisting of changing the deposit rate and, as we showed in the previous section, the fight against inflation could be made more effective with a lower interest rate.

Table 4
Total reserves (March 2024), minimum reserves and transfers

Total reserves (billion EUR)	Minimum reserve (%)	Minimum reserves (billion EUR)	Reduction of transfer (billion EUR)	Excess reserves (billion EUR)
3,675	1	151	6	3,524
3,675	5	755	30	2,920
3,675	10	1,510	60	2,165
3,675	15	2,265	91	1,410

Note: total reserves = deposit facility + current accounts (min. reserves)

4.2. Answers to critics[4]

Our proposal has been subject to criticism by several observers, which we believe reflects popular views in the financial sector and may concern policymakers. Two points of criticism have been raised: (1) this system will lead to large displacements of bank activities; (2) due to the heterogeneity of banking sectors, our proposal will be felt very differently in different countries. In this subsection, we respond to these criticisms.

4.2.1. Minimum reserve requirements and footloose banks

Bofinger (*2023*) and *McCauley – Pinter* (*2024*) argue that the imposition of unremunerated MRRs would lead to large-scale displacements of banking activities. In particular, Eurozone banks that would face larger unremunerated MRRs would move the deposits held by their customers to countries with no, or lower, MRRs and perform their lending activities from these countries. This would have dramatic effects on the banking sectors in the Eurozone.

[4] This part is based on *De Grauwe and Ji* (*2024a*).

First, some empirical perspectives. Our question is whether large-scale displacement is a credible threat. Banks usually offer worse conditions for EUR holdings outside the Eurozone compared to within the Eurozone. As a result, deposits are less likely to move outside the Eurozone. There is a long tradition of the use of MRRs in Europe. Prior to the creation of the Eurozone, several countries such as Germany, France and Italy used MRRs, sometimes exceeding 10 per cent of deposits. No such major displacements of banking activities took place. Today, Switzerland uses a 2.5 per cent MRR (in contrast to the 1 per cent used in the Eurozone) and one is still waiting for large displacement effects.

Second, every regulation leads to attempts to evade it. Is this a reason not to impose the regulation? Take the example of minimum capital ratios. Most economists agree that minimum capital ratios are essential for maintaining a stable banking system. But bankers dislike minimum capital ratios, and therefore they also try to circumvent this regulation. This does not mean that we should abstain from imposing minimum capital ratios. What we should do instead is to design a regulatory system that minimises the evasion. Here is how to do this.

If these displacement effects following the imposition of a two-tier system of reserve requirements were to occur, the ECB could easily counter these by using an asset-based system of reserve requirements (*Schobert – Yu 2014*). This would consist in defining two tiers in the bank reserves held by banks. Thus, if bank A has total bank reserves of 100 and bank B of 200, the ECB could tell these banks that, say, 20 per cent of these bank reserves are unremunerated and 80 per cent would be remunerated. For bank A this would mean that 20 of their 100 of bank reserves would be unremunerated, and for bank B this would be 40. No amount of displacement of deposits to London, or elsewhere, would help these banks to reduce their unremunerated MRRs. Note that in this tiered system banks would not be required to hold a particular amount of bank reserves.

4.2.2. Heterogeneity of the banking sector

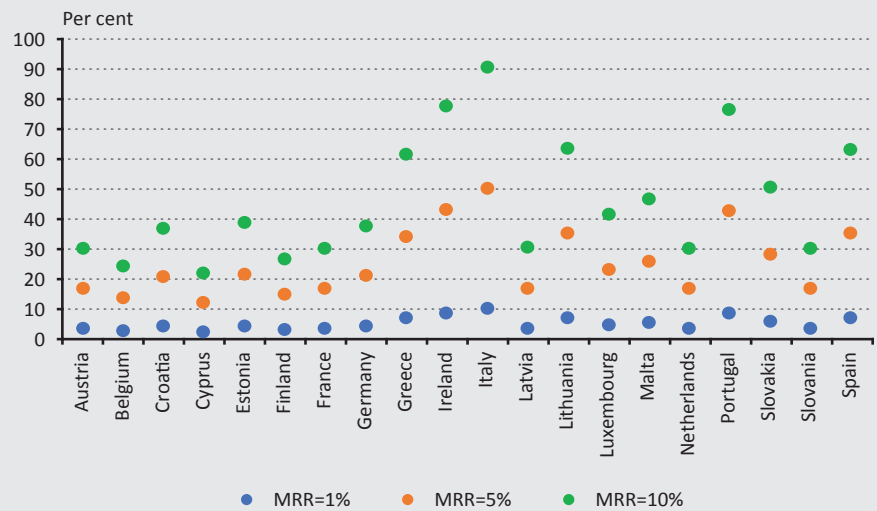
It has been noted by some observers (*Deuber – Zobl 2023*; *Kwapil 2023*; *S&P Global 2023*) that the use of a two-tier system of reserve requirements in an environment of heterogeneity of the banking sector could create liquidity problems for some banks that have relatively low bank reserves. These would be forced to borrow funds in the interbank market to satisfy the minimum reserves. In this connection, these observers have pointed at Italian banks that could face liquidity difficulties.

We do not think there would be a systemic problem under reasonable MMRs. We show the evidence in *Figure 3*. This presents the minimum required reserves (that today are 1 per cent of outstanding deposits) as a per cent of the total reserves of the banks. We do indeed observe heterogeneity in the distribution of bank reserves

across countries in the Eurozone. If the MRR is raised from 1 per cent to 9 per cent all Eurozone countries should have enough reserves to satisfy the MRR while maintaining some excess reserves.

Take the case of Italy. In 2023, these minimum reserves represented 10 per cent of total bank reserves of Italian banks. If the MRRs of outstanding deposits were raised to, say 5 per cent, this would imply that these minimum reserves would represent 50.2 per cent of the total reserves of Italian banks. The Italian banks would still have 49.8 per cent of their bank reserves as excess reserves. Hence, we can conclude that as long as the MRRs remain below 9 per cent of outstanding deposits Italian banks would have enough reserves to satisfy these minimum requirements. As long as there are excess reserves in the system as a whole, borrowing liquidity by a few banks to satisfy MRRs does not create a systemic issue.

Figure 3
Minimum required reserves as a per cent of total reserves (August 2023)



Note: MRR is defined as the per cent of deposits issued by banks that must be held as required reserves at the respective central banks.

Source: ECB, Disaggregated financial statement of the Eurosystem. We use the reserve level of each national banking system in 2023 August as the total reserve base.

But if it turned out that significant numbers of banks (in Italy or elsewhere) were to experience serious liquidity problems to satisfy MRRs, the ECB could define these MRRs on an asset base as defined in the previous section. In such a tiered asset-based system, banks would be told to keep a given per cent of their total

bank reserves in the form of unremunerated minimum reserves. All banks would be able to satisfy such a requirement without encountering liquidity problems. A tiered asset-based system would solve both the foot-loose and the heterogeneity problems.

5. Rethinking the role of minimum reserves[5]

As argued earlier, minimum reserve requirements were a standard tool of monetary policy in the past in many industrialised countries. This monetary policy tool is still being used in many emerging countries. Its use as an active tool of monetary policy has been discontinued, however, in most industrialised countries.

5.1. A tradeoff between liquidity and profitability

One would have expected that after the banking crisis of 2008 monetary authorities would have taken recourse to minimum reserve requirements as an instrument to stabilise the banking system. They did not. Instead under Basle III they introduced a new instrument of liquidity control. Banks of a certain size were subjected to a 'Liquidity Coverage Ratio' (LCR) (see *BIS 2013*). The Basel III agreement defines the assets that qualify as liquid assets to be included in the LCR and calls them 'High Quality Liquid Assets' (HQLA). The problem is that there are just too many HQLAs eligible for liquidity purposes. Not only do bank reserves at the central bank qualify,[6] but also government bonds and even certain types of corporate bonds.

It is difficult to understand how regulators designed such a system of liquidity management. Common sense dictated that they would reactivate the only sound instrument of liquidity control, i.e. reserve requirements at the central bank. They did not do so. This seems to be an example of capturing the regulators by banks that want to have their cake and eat it, i.e. they want to have liquidity and make profits. In fact, there is a tradeoff between liquidity and profitability. Assets that are very liquid are not profitable; assets that generate profits are not very liquid.

By remunerating bank reserves the central banks have made it possible for banks to have their cake and eat it: banks can hold highly liquid assets and make a lot of profit. Central banks have eliminated the tradeoff between liquidity and profitability for the banks. In the Eurozone (October 2023), banks could earn more on their bank reserves (4 per cent) than on 10-year German government bonds (2.75 per

[5] This section is based on *De Grauwe and Ji* (*2024b*)

[6] There is some discussion about whether required reserves qualify for inclusion in the LCR. The BIS qualifies central bank reserves (including required reserves) as belonging to the level 1 assets in the stock of HQLAs "to the extent that the central bank policies allow them to be drawn down in times of stress", *BIS* (*2013*). The experience of the post-financial crisis shows that central banks typically allow these reserves to be drawn down. Required reserves should be included in the LCR calculations.

cent). This is an extraordinary act of generosity towards bankers, at the expense of taxpayers.

5.2. Tradeoff between efficiency and stability

The decline in the use of minimum reserve requirements by central bankers was very much the result of a paradigm shift from the 1980s on; a shift that stressed the use of market forces and that frowned on policy-induced distortions. Minimum reserve requirements were seen as introducing important inefficiencies in the financial markets that had negative effects on the optimal allocation of capital. It was often seen as a form of financial repression that led to wasteful investment with a negative effect on economic growth (see *McKinnon* (*1970*) for an early and influential analysis of this view). The corollary of this view was that in truly free markets (provided the monetary authorities maintained price stability) the risk of financial crises would be minimal.

The size of the cost of the inefficiencies induced by minimum reserve requirements is an empirical matter.[7] The jury is still out on this.[8] But clearly there is a tradeoff between efficiency and stability of financial markets. The existence of such a tradeoff has now been firmly established both theoretically and empirically. On the one hand, there is a large literature documenting how financial liberalisation spurs efficiency and growth (see *Levine 1997*; *Beck – Levine 2004*; *Bekaert et al. 2005* for both theory and empirical validation). On the other hand, there is an equally large literature showing that financial liberalisations tend to lead to excessive risk-taking activities in financial markets increasing the risk of crises (*Stiglitz 2000*). As a result, most banking crises in the postwar period have occurred after financial liberalisations (see *Demirgüç-Kunt – Detragiache 1998*; *Kroszner et al. 2007* and *Arregui et al. 2013*). The fact that financial liberalisation leads to more efficiency and more instability leads to the conclusion that financial liberalisation leads to a tradeoff between efficiency and stability.

By abandoning the use of minimum reserve requirements, central banks also abandoned the use of an instrument of monetary policy whose primary aim is stabilisation of the banking sector and, more generally, the business cycle. Thus, one can also conclude that in the choice between efficiency and stability, central banks chose efficiency, to the detriment of stability.

[7] We also have to evaluate whether the cost of these distortions of minimum reserve requirements is offset by gains. These gains are that the authorities can eliminate another distortion which is the subsidy that is granted to the banks today.

[8] See, for example, *Cuaresma et al.* (*2019*) who find medium levels of reserve requirements may be optimal for medium- to long-run growth.

In an important paper, *Kashyap and Stein* (*2012*) show that the use of minimum reserve requirements together with the interest rate makes it possible for the central bank to pursue the two objectives of price stability and financial stability. The interest rate can be geared towards achieving the goal of price stability, while the minimum reserve requirement can be used to achieve financial stability. When banks engage in maturity transformation (borrowing short and lending long) they take risks on their own balance sheets. There is also an externality involved in that bankruptcies of individual banks can lead to bank runs and systemic risks. Individual banks typically do not take these externalities into account. By using reserve requirements, the central bank can force the banks to internalise these externalities.

This also leads to the view that there may not really be a tradeoff between efficiency and stability. If we enlarge the concept of efficiency to include risk externalities, dealing with these externalities and thereby reducing instability can also be interpreted as policies that increase the efficiency of the financial system.

6. Conclusion

Government bond purchase programmes in the framework of QE have led to a fundamental change in the operating procedure of the major central banks, which now operate in a regime of abundance of bank reserves. This requires raising the money market interest rate by increasing the rate of remuneration of bank reserves. This, in turn, leads to a large transfer of central banks' profits (and more) to commercial banks. We argue that this is unsustainable, not only because of the sheer size of these transfers, but also because central banks' profits belong to the governments that have granted the monopoly power to create money base, and the accompanying profits, to central banks. We also argue that there is no serious economic argument to justify why banks should receive an interest rate that now varies between 3.5 per cent (Eurozone) and 5.4 per cent (US) on liquid deposits that carry no risk.

We showed that the present system of remunerated bank reserves strengthens banks' equity position, thereby giving them incentives to increase the supply of bank loans. This has the effect of reducing the effectiveness of the transmission of monetary policies which today is focused on reducing inflation.

We argue that the remuneration of bank reserves is not inevitable and that there is an alternative to central banks' current operating procedure. This alternative reduces profit transfers to private agents and makes monetary policies more effective in fighting inflation. We propose using a system of two-tier minimum

reserve requirements. This consists of freezing part of the existing bank reserves in non-interest-bearing deposits, while remunerating reserves in excess of these minimum requirements. This achieves two things. It allows for a drastic reduction in the transfer of central banks' profits to private agents, and it makes it possible for the central banks to maintain their current operating procedure.

We find that there are arguments of fairness to reject the present operating procedure that transfers the profits of central banks (and more) to commercial banks. There is also an argument based on the effectiveness of monetary policies. We argued that the present operating procedures reduce the effectiveness of monetary policy in combatting inflation and that the use of minimum (unremunerated) reserves enhances this effectiveness.

The current problems faced by major central banks are also being experienced by other central banks across Europe. We believe that a two-tier minimum reserve requirement system provides an alternative to address the many challenges discussed in this paper. For policymakers interested in our proposal, it is crucial to carefully evaluate the current regime of abundance of bank reserves, which includes not only political economy issues but also the transmission mechanisms of monetary policy. More empirical evidence is needed to understand how interest rate increases may have varying effects in different markets in an environment of abundant reserves. Additionally, we believe there are valuable lessons to be learned from the 1970s and 1980s. More empirical studies should be drawn from that period, focusing on minimum reserve requirements policy and its impact on central banks, liquidity levels, bank profits and losses and the stability of the financial sector.

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Fighting Inflation within the Monetary Union and Outside: The Case of the Visegrad 4*

Reiner Martin – Piroska Nagy Mohácsi

The post-pandemic inflation surge tested monetary policy frameworks around the world. It was a particular test for the four Visegrad countries (V4) in Central-Eastern Europe, which provided a "natural experiment" to examine monetary policy outcomes under two different monetary regimes. With broadly similar economic characteristics, Slovakia was already in the Economic and Monetary Union (EMU) before the post-pandemic inflation hit, whereas the other three countries (Czechia, Hungary and Poland) were not. What was the inflation performance of the V4 countries under the two different regimes? What does this imply for the cost/benefit analysis of euro adoption for countries which are still outside the euro area? We find that EMU membership was beneficial both during "normal times" as the benefits of monetary sovereignty for small, open, integrated economies faded away, and particularly helpful during crisis times.

Journal of Economic Literature (JEL) codes: E02, E31, E42, E52, E58, F02, F31

Keywords: Inflation, monetary policy, EMU, ECB, euro area, Central-Eastern Europe

1. Introduction

Following the global financial crisis (GFC) of 2008–2009, inflation in the euro area was very low and in some cases even negative. Slovakia joined the EMU during the GFC, first navigating its way through the demanding context of the global crisis and then the euro area's own crisis. Along with the rest of the EMU, Slovakia later entered the pandemic with one of the lowest levels of inflation on the continent and certainly in CEE.

The post-pandemic inflation period tested monetary frameworks across the globe, with satisfactory results overall. After a spectacular surge in inflation in 2022–2023, most advanced and emerging market economies have since brought inflation back

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

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down close to their central banks' target. However country experiences differed. Early monetary policy tightening in response to rapidly rising inflation allowed for gradual interest rate increases. This brought down inflation earlier, allowed for a timely reversal of policy tightening, avoided risks to banks and financial stability more broadly, and made policy communication to the public clearer. This was the approach in most emerging market economies (*Nagy Mohácsi et al. 2024*). By contrast, delays in policy tightening may have kept inflation higher for longer and necessitated steep interest rate increases in a short period of time. This was the policy approach in advanced economies such as the US, UK, Australia and the euro area. In some parts of the world, this led to financial sector stress, as it did in the US in March–April 2023.

The handling of the post-pandemic inflation surge was a new experience for mature EMU members, which had not seen high inflation in a generation. By contrast, the CEE euro area members – Slovenia, Slovakia, the Baltic states, and the soon-to-be-member Croatia – did have more recent high inflation experiences from the turbulent initial years of transition from centrally planned to market economies in the 1990s.

The purpose of this paper is to take a closer look at this recent period of high inflation in the CEE region, which experienced a sort of "natural experiment" with structurally similar countries living under two different monetary regimes: Slovakia as an EMU member and Czechia, Hungary, and Poland as countries with independent monetary policy. We consider how this episode informs us with regards to the complex issue of the pros and cons of euro adoption in the small/medium-sized, open economies of the CEE region that are still outside the euro area.

2. Review of literature

We start with the literature that analyses the impact of euro adoption itself on long-term inflation and inflation expectations. There are several studies looking ex-post at the initial price effects of euro adoption. These effects can come for example from the rounding up of prices, but tend to be rather limited, amounting to a maximum of half a percentage point price increase (see *Pufnik 2017* for an overview). Consumers may, however, perceive prices as much higher after the changeover, resulting in a stronger rise in perceived inflation and inflation expectations.

From a medium- to long-term perspective, however, these effects are not particularly important. Empirical studies looking at the impact of euro adoption on long-term inflation developments are, however, limited. A recent model-based paper by *Dreyer and Schmid* (*2020*) does not find any clear evidence for an upward or downward effect of euro membership on inflation. The relative scarcity of such studies is likely due to the extended period of very low inflation in Europe in the wake of the GFC.

Turning to the long-term impact of the 2009 euro adoption on economic developments in Slovakia, several analyses look at the macroeconomic impact of euro area membership but none focus on inflation – perhaps because post-GFC inflation was so low. Using a systemic control group approach, *Žúdel and Melioris* (*2016*) estimate that euro adoption resulted in a 10-per cent higher real GDP level by 2011, although much of that gain had already materialised before euro adoption, reflecting at least in part Slovakia's long-standing goal to adopt the euro as soon as early as possible. *Gunnella et al.* (*2021*) deploy a gravity model to look at the impact of euro adoption on trade. They find that in total trade increased between 4.3 per cent and 6.3 per cent in countries which adopted the euro and that this trade-creation effect is strongest in countries which adopted the euro after its launch in 1999, including Slovakia. *Bruha and Tonner* (*2018*) use a DSGE-model to look at the possible effects of euro adoption in Czechia. Drawing on the experience of other countries to calibrate their model, they argue that euro adoption would have positive effects on macroeconomic variables at the cost of an increase in nominal volatility. Meanwhile, other countries' records point to mixed economic growth results, for example for Portugal or Italy (*Kiss and Marincsák 2020*). All studies stress that euro adoption is *not* a substitute for sustained structural reforms that are crucial to maintain or improve competitiveness and thus long-term growth.

3. Post-Covid inflation in the EMU and V4 countries

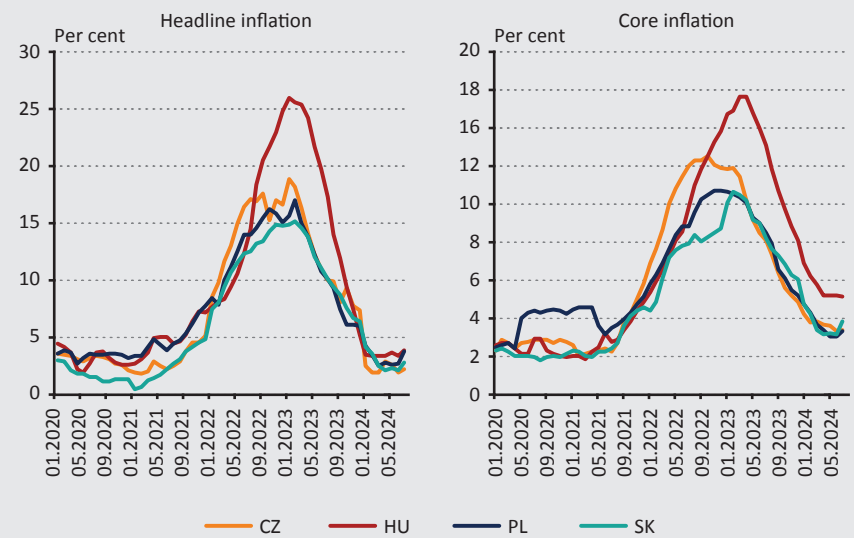
It is important to note at the outset that *within* the euro area, the CEE countries – Estonia, Latvia, Lithuania, Slovakia, Slovenia and Croatia – had considerably higher post-pandemic inflation rates than the euro area average. *Falagiarda* (*2024*) explains this with two major factors. First and most important, there are significant differences in economic structure between the CEE countries and the rest of the euro area. These structural differences relate to higher exposure to global shocks such as disruptions in global value chains and the economic consequences of Russia's invasion of Ukraine. Also, the share of energy and food in CEE consumption baskets is higher than the euro area average, making measured and experienced inflation higher other things being equal. Additionally, CEE economies are more deeply integrated into global supply chains, which translates into higher sensitivity to supply bottlenecks – as it did during the post-pandemic inflation period. Second, domestic demand pressures also played some, though more limited, role. In this regard, Falagiarda points to higher unit profit increases in CEE euro area countries than elsewhere, linked, *inter alia*, to less competition. More importantly, labour market conditions are tighter in CEE than elsewhere in the euro area. Low unemployment rates and massive outward emigration from CEE countries to the rest of the EU have resulted in large wage increases in excess of productivity growth – particularly as the young and more skilled left — creating upward price pressures.

How can policy makers react to such differences within a monetary union? As ECB monetary policy cannot react to country-specific differences, fiscal and structural policies must bear the brunt of the necessary adjustments.

3.1. Trends in V4 countries

Headline inflation, as measured by the Harmonised Index of Consumer Prices (HICP), started to rise almost at the same time in the four Visegrad countries in the fall of 2021, albeit from higher initial levels in the three non-EUR countries compared to Slovakia. Hungary's inflation was already at the top of central bank's inflation target of 3 per cent (with +/- 1 per cent tolerance band) at the beginning of the period (*Cohn-Bech et al. 2023*). Core inflation also started to rise in the fall of 2021, except for in Poland where core inflation was already elevated in the spring of 2020 (*Figure 1*).

Figure 1
Inflation in V4 countries



Source: Eurostat

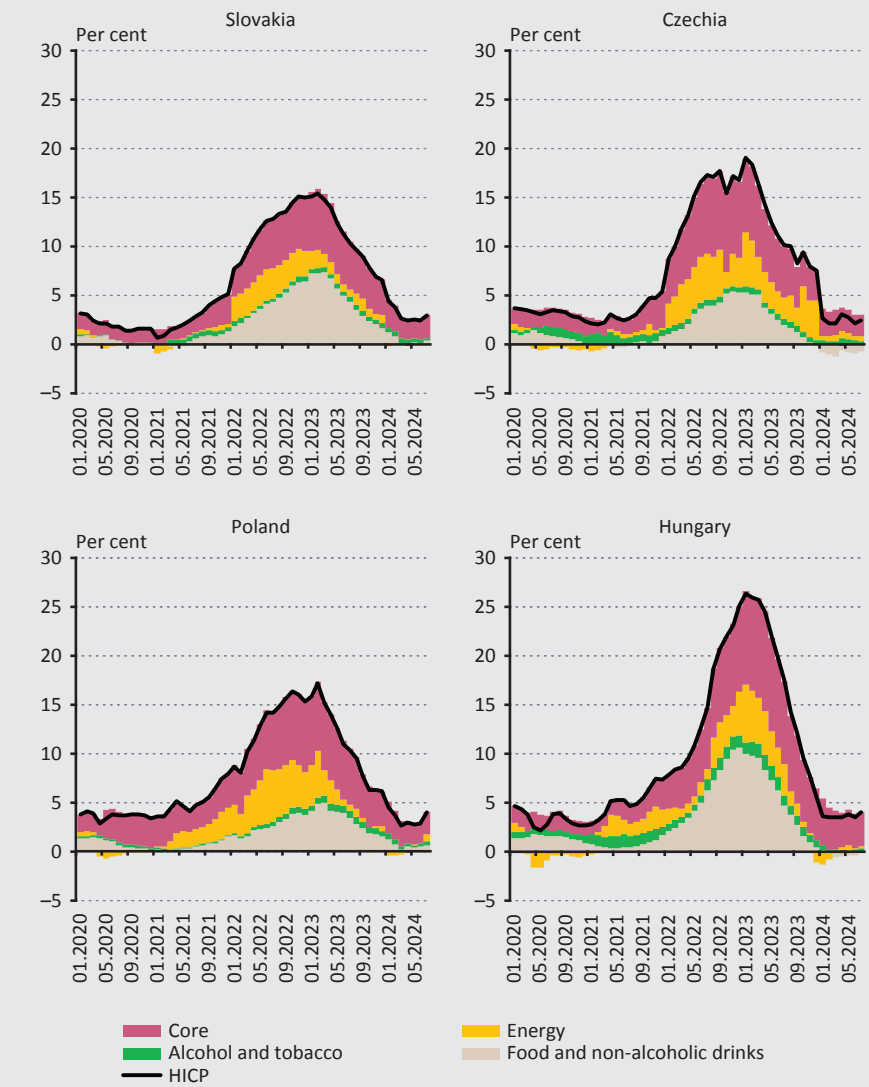
Hungary experienced the highest headline inflation among the V4 countries with over 25 per cent in late 2022. Inflation reached around 15–17 per cent in the other Visegrad countries as well, including Slovakia, where price increases were only a bit lower than in Czechia or Poland. All of these countries' inflation rates were significantly higher than the euro area's peak rate of slightly over 10 per cent in the fall of 2022.

3.2. Inflation components

What were the key inflation components in each country? The energy price shock in early 2022 appears to be a key driver of inflation in each country, particularly in Slovakia and Hungary (*Figure 2*). Food inflation played a particular role in Hungary and Slovakia, reflecting not only the impact of higher energy prices in the agriculture

and food processing sectors, but also drought effects and unfavourable weather conditions. Core inflation including all non-energy non-food items was especially high in Hungary, in line with its highest headline inflation, but it was also elevated in Czechia and Poland, and, to a more limited extent, in Slovakia as well.

Figure 2
Inflation components in the V4 countries

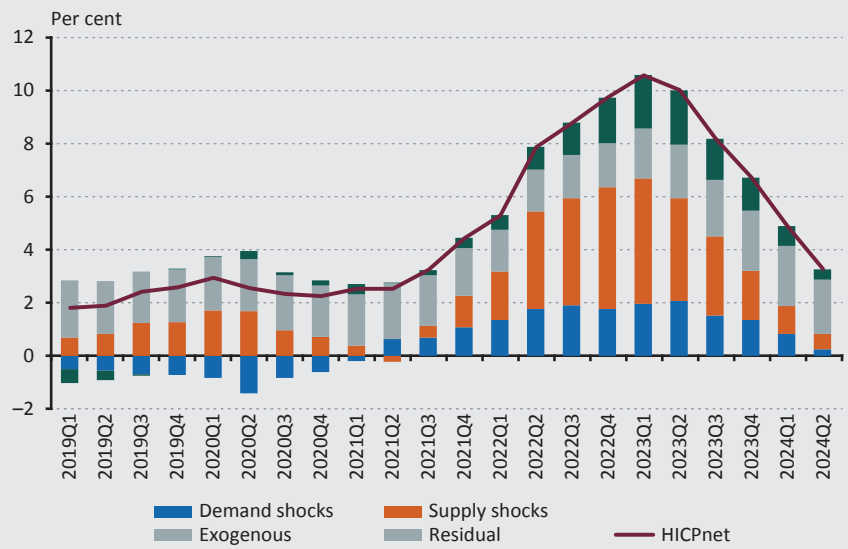


Source: NBS and authors' calculation

3.3. Decomposing supply and demand shocks – A "perfect storm"

Focusing on Slovakia, we calculate demand and supply side shock contributions to headline CPI inflation (*Figure 3*). In the period 2020–2023 we witnessed a "perfect storm". The Covid pandemic initially suppressed demand and limited supply in many ways, such as lockdowns, quarantines and social distancing measures. These led to disruptions in global supply chains to which CEE's globally integrated markets are particularly sensitive. Scarcities appeared, which in market economies can be a precursor to price increases. Fiscal measures implemented from the spring of 2020 to support households and enterprises added to demand pressures and increased imbalances in supply and demand. As vaccination became widely available, social distancing was curbed and supply constraints eased. But soon after Russia invaded Ukraine, another negative (energy) supply shock hit the economy, adding to the remaining positive demand shock from lingering pandemic measures and new expenditures to cushion the large energy price increases.

Figure 3
Slovakia: contributions to HIPC inflation (year-on-year)



Source: NBS and authors' calculations

4. Policy response

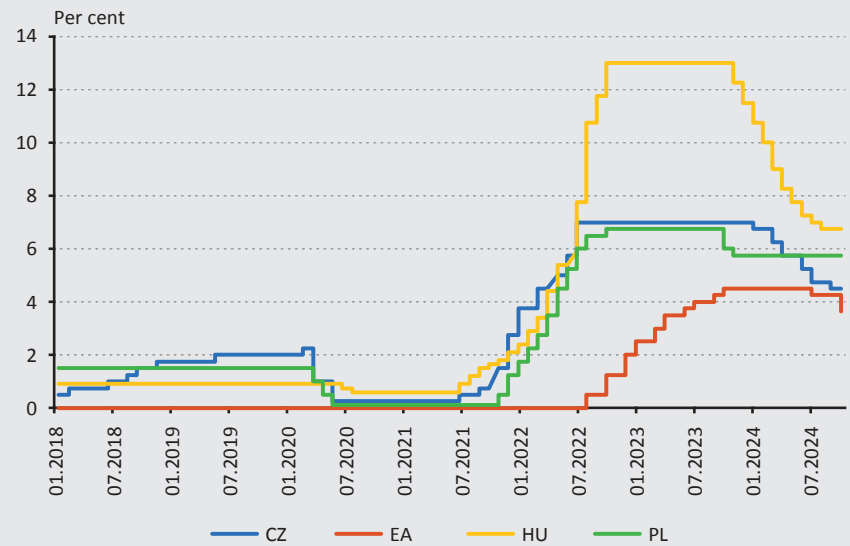
4.1. Monetary policy

Monetary policy responded to inflationary pressures earlier in the three non-euro area CEE countries than in the EMU member Slovakia (with a difference of up to a year) (*Figure 4*). As mentioned, this was in line with the observed global trend of emerging market central banks reacting faster to the rise in inflation than their advanced country counterparts, underpinned by improved monetary policy frameworks including in the CEE region (*Nagy Mohácsi et al. 2024; Balogh et al. 2024*).

Interest rates were raised to much higher levels in the three non-euro area countries than in the EMU/Slovakia. Given its record level of inflation, Hungary's interest rates increased the most. However, real interest rates remained negative for some time in all V4 countries, as well as in the euro area, the US and the UK.

Czechia and Poland experienced similar inflation rates to Slovakia, but Slovakia had lower nominal interest rates, resulting in more deeply negative real interest rates for some time. This could, in principle, lead to a decline in the real value of debt and thus more buoyant domestic conditions.

Figure 4
Policy rates in the Visegrad 3 and EMU/Slovakia



Source: National bank websites

Did Slovakia suffer in terms of fighting inflation because of the later and more muted monetary policy tightening by the ECB? Did ECB monetary policy lead to additional demand pressures in Slovakia relative to the other V4 countries? Inflation performance does not seem to suggest so. Inflation started to come down roughly at the same time in Slovakia as in the other V4 countries (except Hungary), confirming the finding that a larger part of the inflation was supply-shock driven. It may also imply that inflation expectations in EMU/Slovakia were better anchored than in the other countries.[1] A belated and smaller EMU monetary policy reaction was enough to bring inflation down roughly at the same time as in the other V4 countries. The common monetary policy does not seem to have penalised Slovakia by creating additional prices pressures or extending the high inflation period.

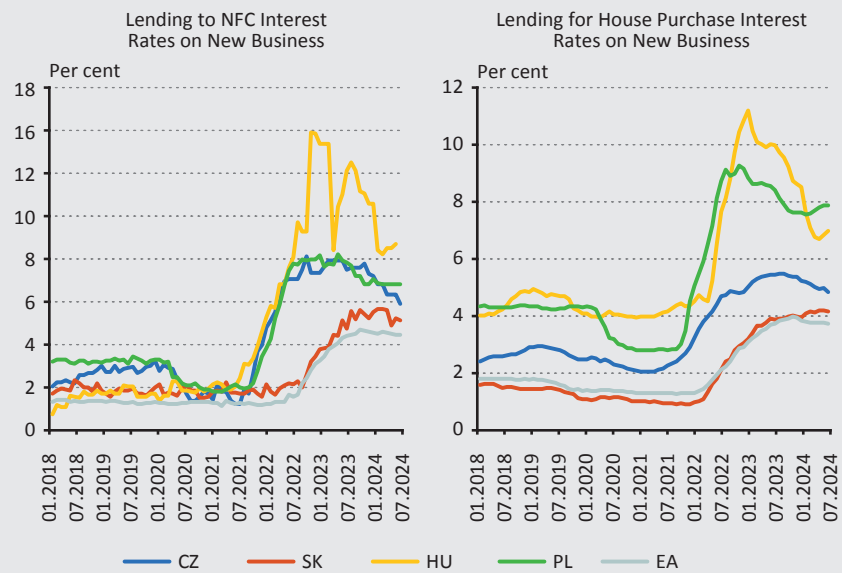
How did *monetary transmission mechanisms* work in the V4 countries? How fast and to what extent were the increases in interest rates passed through to prices of goods and services and assets, and did they impact financial and demand conditions?

The IMF's April 2024 Regional Outlook for Europe found that the financial condition index – which includes a host of financial variables such as corporate and sovereign spreads, interest rates, credit growth, equity and house price returns – in CEE and South Eastern Europe (SEE) showed tighter financial conditions *before* 2021 than in the rest of Europe, but conditions then loosened faster and deeper until mid-2023, *despite* the early start of monetary policy tightening in this region. This puzzling behaviour may point to weaker transmission mechanisms in the region and/or existing high domestic liquidity (*IMF 2024*).

Several factors may be behind this. Similarly to elsewhere in the world, banks passed through the increases in policy rates almost immediately to lending rates (*Figure 5*), but only with a lag in the case of deposit rates. This restrained bank lending, particularly for mortgages, while boosting bank profits. Households reacted to the belated deposit rate increases by switching into term deposits and shifting to treasury bills as fiscal financing needs increased, except for in Czechia (see below). Given that savings rates were already relatively high due to pandemic-related policies and rising fiscal financing needs, the limited pass-through into deposit rates did not hinder demand. Note also that in Hungary, for example, savings remained high for a longer period of time, similarly to other countries with higher uncertainty in the wake of a severe cost-of-living crisis and other uncertainties, such as in the UK (*Greene 2024*). Fiscal policy measures to limit price increases to safeguard consumers may have also weakened the effectiveness of the monetary transmission mechanism.

[1] More econometric work is needed to verify this point.

Figure 5
Lending rates for corporates and household mortgages in V4 countries



Source: NBS and authors' calculation

4.2. Exchange rate impact and ECB FX swaps and repos[2]

Currency developments also influenced inflationary paths. The currencies of the three Visegrad countries outside the euro area exhibited wide fluctuations against the euro (and also the US dollar), although less so for Czechia. The Hungarian forint and, to a lesser extent, the Polish zloty depreciated against the euro at the start of the pandemic in March 2020 and again after Russia's invasion of Ukraine, which fed into price increases (*Figure 6*).

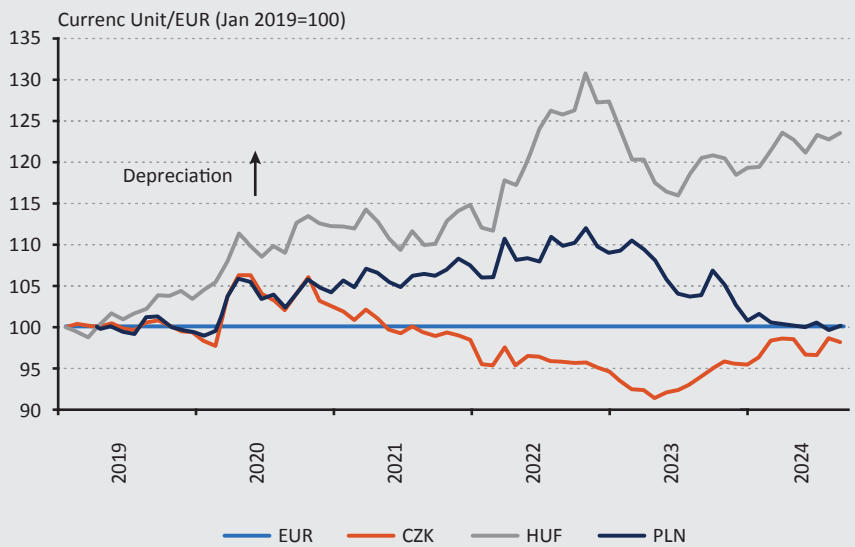
It is critical to highlight, however, that currency depreciations may have been much higher in Poland and Hungary (and several other CEE and SEE countries) without the ECB's foreign exchange swap and repo operations at the height of the market stress, such as in March–April 2020. During this stress period the ECB provided currency swaps – accepting the countries' local currency assets – for Croatia (still outside the EMU but almost in at that point) and Bulgaria (which has had its exchange rate de facto pegged to the German mark since 1997 and then the euro), as well as for Poland and Romania. Hungary received a foreign exchange repo operation, handing over euro-dominated long-dated assets in exchange for short-term liquid euro

[2] For a summary of the ECB's motivation behind its currency swap and repo operations, see *Panetta and Schnabel* (*2020*).

assets. Several non-EU countries such as Albania and North Macedonia received support similar to that of Hungary. All of this helped, though swaps are clearly much better than repos for the beneficiary countries. The criteria applied for offering swaps or repo operations seem to be quite heterogenous across countries.[3]

As an EMU member, Slovakia did not have to worry about exchange rate fluctuations against the euro, currency swaps and so on. The adoption of the euro and the backing of the ECB's massive balance sheet makes crisis management incomparably easier for small, open economies such as the V4 countries.

Figure 6
Currency movements vis-à-vis the euro



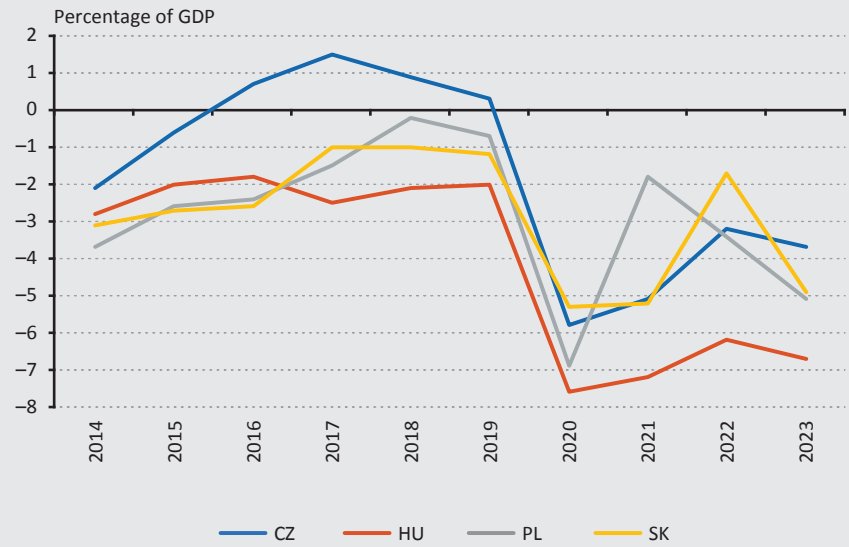
Source: NBS

4.3. Role of fiscal policy

Fiscal policy influenced the post-pandemic inflation surge in two important ways: (i) via expansionary fiscal policies, first related to pandemic support to households and businesses, and then via energy subsidies in the wake of the surge in energy prices following Russia's invasion of Ukraine (*Figure 7*); and (ii) by "providing shelter" to households and firms from the impact of monetary policy action, for example in the form of interest rate caps for certain activities or borrowers.

[3] For an assessment of the high usefulness of ECB currency swaps, see Croatian National Bank Governor *Vujčić* (*2020*).

Figure 7
Fiscal balance in V4

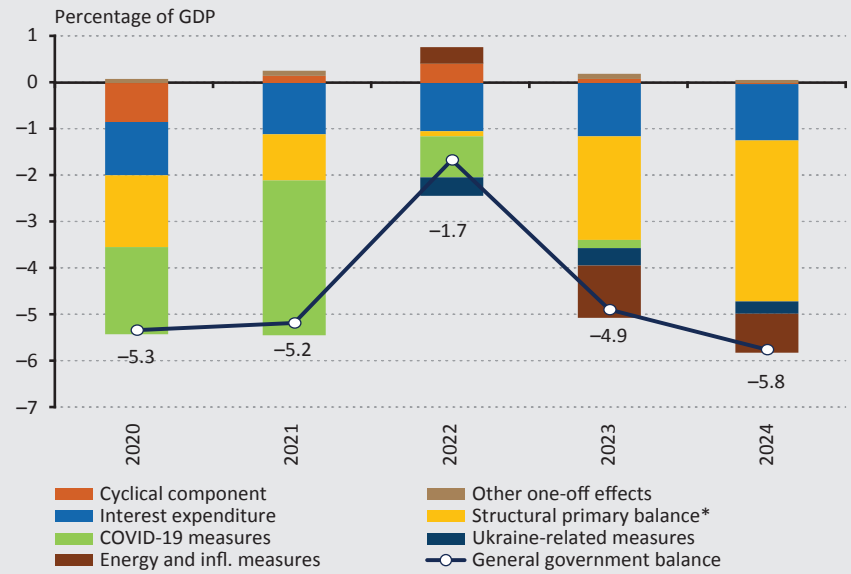


Source: Eurostat

The V4 countries entered the pandemic period with broadly balanced fiscal positions/small deficits. The pandemic crisis management measures increased fiscal deficit across the region in 2020–2021, and, except for Czechia, deficits persisted through 2024 due to subsequent measures to protect households and certain industries from the impact of surging energy prices and inflation.

Let us examine Slovakia's fiscal record in more detail. It has experienced elevated fiscal deficits since 2020 (except for 2022). As shown in *Figure 8*, the Covid measures of 2020–2021 were taken at a time when inflation was (still) relatively low. The deficit rose significantly in 2023–2024 on the back of mounting inflation that increased social benefit spending, direct energy support measures, new social measures and rising interest costs.

Figure 8
Slovakia: Fiscal balance decomposition



*Note: *Without Covid, Ukraine-related and energy measures*
Source: NBS, authors' calculation

In Poland, the "Anti-Inflation Shield" measures introduced in early 2022 – a reduction in VAT and excises on a range of food and service items – are estimated to have contained inflation temporarily for one year by some 4 percentage points (*IMF 2023*). In Hungary, limiting utility and energy price increases and related open and de facto subsidies were also significant. For example, the government specifically introduced caps on interest rate increases ("*kamatsapka*"), which weakened the pass-through of policy interest rate increases to prices; it also provided below-market interest rate loans under various government schemes (*Coen-Bech et al. 2023*). The only exception was Czechia, where significant fiscal consolidation took place in 2022–2024, supporting inflation reduction but also contributing to weaker domestic demand and growth. However, public debt levels remain, manageable in the V4, particularly in Czechia and Poland (44 per cent and slightly above 50 per cent of GDP, respectively).

4.4. Policy mix

A complete macro policy assessment requires a simultaneous analysis of monetary, fiscal as well as macroprudential (financial stability) policies,[4] with a focus on policy interactions and dynamics. We can distinguish three main periods since the GFC:

- In the aftermath of the GFC, fiscal and monetary policies – with the reinvention of quantitative easing (QE) — were counter-cyclical, while macroprudential policies had to tighten in response to previous excessive credit growth that had given rise to the GFC in the first place (among other factors).

- During the pandemic, by contrast, all three elements of the policy mix were highly counter-cyclical and massive in the face of hitherto unknown health and macroeconomic risks. Such coordinated loosening of policies worked, even though it was possibly applied longer than necessary, adding to global inflation pressures. Subsequent shocks from Russia's war on Ukraine and emerging geopolitical risks again necessitated some fiscal loosening.

- As post-pandemic inflation hit and central banks had to tighten monetary policy, looser fiscal policies made the inflation-fighting task of central banks much harder. This meant that monetary policy tightening had to be longer/interest rates higher than would have been the base without expansionary fiscal policies. Moreover, some of the fiscal measure such as caps on interest rates acted specifically against monetary policy, reducing the latter's effectiveness, necessitating higher interest rates for longer and making policy communication harder.

4.5. How about growth?

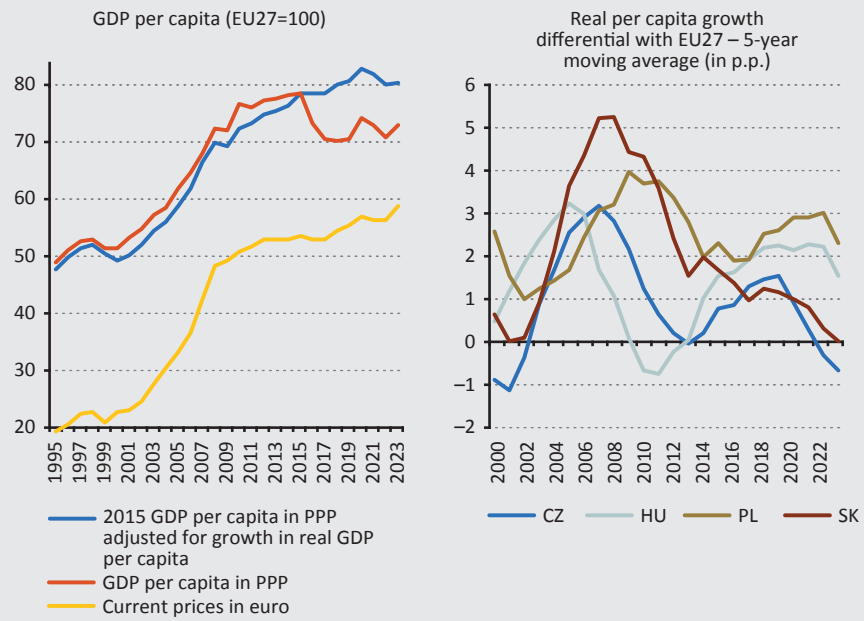
The V4 countries as a group have made remarkable progress towards convergence since their EU membership in 2004.[5] Recent studies prepared around the 20th anniversary of EU membership identify significant "European Union accession bonus" in the growth performance for the initial eight members that joined in 2004. The *EBRD* (*2024*) finds that compared to Germany, this group of countries observed a convergence of 24 percent in per capita income, of which 14 per cent is an "EU accession bonus", that gave rise to faster GDP and real income growth. *Grassi* (*2024*) similarly finds a significant "EU bonus" for this group of countries.

[4] Macroprudential policies have been upgraded and more integrated into the modern policy mix following the global financial crisis of 2008/2009. *Eller et al*. (*2020*) analysed macroprudential policies in the CEE-SEE region between 1997–2018. They find that a few had already used macroprudential policies extensively prior to GFC; and all used it extensively afterwards with building capital and liquidity buffers as well as better procedures which together tightened credit allocation. In their update that includes the pandemic period (*Eller et al. 2021*), they confirm strong reliance on loosening macroprudential tools to fight the fallout from the pandemic. These policies were gradually phased out as the pandemic receded.

[5] Romania and Bulgaria joined a little later in 2007 and Croatia in 2013.

However, within the V4 we observe some country differences with regards to growth performance and convergence. Convergence in Slovakia seems to have stalled, possibly along with Czechia, though it also slowed in other V4 countries (*Figure 9*).

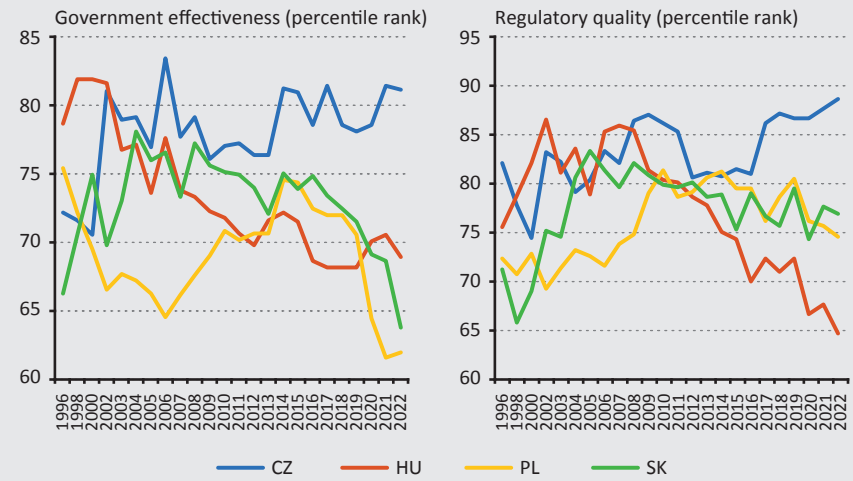
Figure 9
GDP per capita in Slovakia (left) and V4 countries (right)



Source: Grassi (2024)

Analysing the reasons behind this trend is beyond the scope of this study. Suffice it to say that productivity growth has declined in the past decade or so in the V4 countries (albeit this is a more general phenomenon). At the same time, public investment has for example "flatlined" in Slovakia, because EU funds tended to substitute rather than add to national public investment. In Poland and Hungary, public investment also declined, and there were at times issues with the ability to access EU funds, due to governance compliance issues. The business environment in terms of government effectiveness and, to some extent, regulatory quality may have also played roles in all V4 countries, except Czechia (*Figure 10*).

Figure 10
"Doing business" environment in the V4, 1996–2022



Source: World Bank, World Development Indicators

With sovereign monetary policy out, EMU membership puts a much bigger *onus* on national fiscal policies and structural-regulatory reforms. This is even more so the case for smaller economies, which often benefit from lower interest rates and more abundant liquidity than outside EMU. What EMU members do with this depends largely on the member countries themselves. Some have taken a proactive role to accelerate structural reforms and invest in human capital, such as Finland and Ireland. Others have taken a more complacent approach to reforms, which may be the case in Portugal, where convergence has stalled and reversed since EU membership (*de Souza 2024*), among others. The single most important lesson is to avoid complacency and take good advantage of available funding for productivity-increasing investment in human and physical capital as well as innovation in a more business-friendly environment.

5. Summary and concluding thoughts

We analysed the recent post-pandemic inflation period in the four Visegrad countries. Given their similar economic structures and context, the inflation surge under two different regimes – within the euro area's common monetary policy framework for Slovakia and outside EMU for the other three countries – can be seen as a "natural experiment" to test the impact of common monetary policy in small, open economies, compared to independent monetary and exchange rate policy.

Our findings are as follows:

- Slovakia, which adopted the euro in 2009, did not experience a boost in inflation upon euro adoption (similarly to other countries) and entered the pandemic and the post-pandemic inflation surge with the lowest inflation rate in the V4.
- Independent monetary policy does not appear to have added to monetary policy effectiveness in the V4 countries outside the EMU to address inflationary pressures. This is in line with research suggesting that small, open economies do not have much de facto monetary sovereignty when faced with the impact of decisions of systemic global central banks such as the US Federal Reserve and the ECB (*Rey 2015*).
- Central banks in the non-euro Visegrad countries started reacting to rapidly rising inflation earlier than the ECB by up to a year. They also raised their policy rates higher than the ECB in response to their much higher inflation rates, particularly in the wake of the Russian invasion of Ukraine. The currencies of Poland and Hungary depreciated at the height of the pandemic and after the Russian invasion. But this does not seem to have helped growth materially, while probably having a negative impact on inflation. By contrast, it appears that inflation expectations within the EMU were better anchored, given the ECB's institutional credibility and much larger balance sheet.
- Crisis management is significantly better and easier for small, open economies within EMU than alone, as already seen during the GFC and even more so during the pandemic.

What does the management of the post-pandemic inflation surge in the V4 countries imply for euro membership? Beyond the fact that countries need to get prepared for euro adoption in terms of convergence criteria, in our view, the conclusions are rather clear. For small, open, highly integrated economies, de facto monetary sovereignty is quite limited. By contrast, membership in a very large monetary union, encompassing the main trading partners and benefitting from the credibility and – if needed – crisis management capacity of the ECB, provides clear benefits, even in case of very large, multiple supply-side shocks to inflation.

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The Impact of Monetary Policy Institutional Decisions on Convergence in Central and Eastern European Countries*

György Szapáry – Balázs Vonnák

Our study looks at the role of monetary policy related institutional decisions in the nominal and real convergence of the 11 former socialist Central and Eastern European EU Member States over the three decades following their regime change. We use our empirical model to estimate the impact of four key drivers of the monetary policy framework (exchange rate regime, central bank independence, inflation targeting, euro adoption) on inflation and real economic growth. Our main finding is that the convergence rate over the past decades has had little to do with the choice of exchange rate regime or the potential adoption of the euro or inflation targeting and much more with the establishment of central bank independence. The latter has reduced inflation by roughly 5 percentage points, while boosting real GDP growth by about 2 percentage points. This suggests that central bank independence significantly enhances the credibility and predictability of monetary policy and largely determines the success of each monetary regime.

Journal of Economic Literature (JEL) codes: C33, E42, E65, O43

Keywords: monetary policy, convergence, institutions, inflation, economic growth

1. Introduction

Our study looks at the impact that the decisions made by monetary policy institutions had on nominal and real economic convergence of the 11 former socialist EU Member States in Central and Eastern Europe (Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia) after their regime change. For more than four decades, these countries operated on the

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

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basis of the Soviet economic system in which the state dominated the economy, making decisions on investment, production, prices and trade. The market operated only in a negligibly small segment of the economy where it was allowed. Socialist countries essentially traded among themselves and foreign trade was very limited.

All of this suddenly changed in the early 1990s when these countries regained their sovereignty. They immediately faced massive economic challenges as the break-up of the Soviet Union and the disintegration of the COMECON market led to shrinking GDP, while price liberalisation fuelled inflation. These trends were observed in all of the countries covered, albeit to varying degrees.

All of these countries' announced policy goal was to achieve convergence with developed countries as soon as possible. This was also the main hope and expectation of the population after regaining sovereignty, as a result of market reforms and the establishment of capitalism. Governments had to make some important decisions in selecting the economic policy institutional set-up that effectively promote convergence.

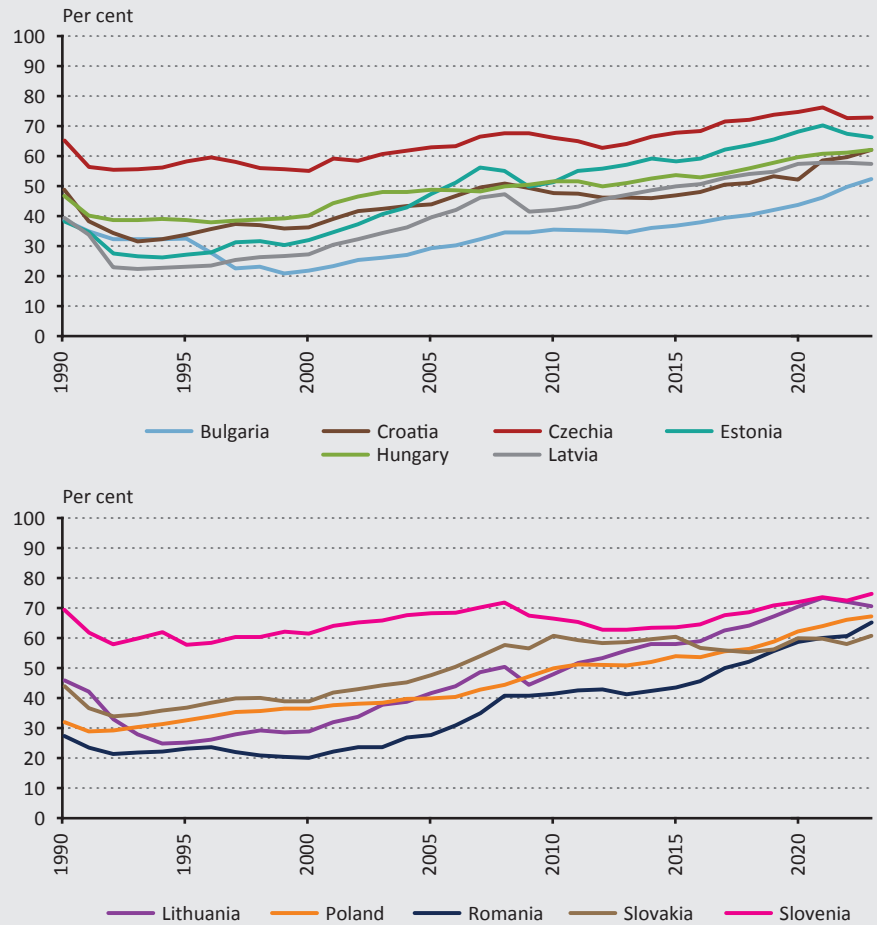
It should be pointed out that policymakers at the time had limited knowledge of how these institutions worked, and even less practical experience, although some former socialist countries, for example Hungary and Yugoslavia, had already initiated limited market reforms in the 1980s. Institutional decisions in the early 1990s, such as the choice of exchange rate regime, were often taken on external advice. Typically, external advisors included the IMF, the World Bank and the EU. Preparation for EU membership itself played a decisive role in the institutional decisions under review.

There is no doubt that all of the former socialist countries have been on a path towards real and nominal convergence since their regime change, which is natural as they started from a much lower level of development compared to developed Western European countries. We present real economic convergence compared to Austria through the evolution of GDP per capita (*Figure 1*).

In all of the countries covered, GDP declined in the years following regime change, mainly due to the break-up of the Soviet Union, the loss of export markets and increases in the prices of oil and gas imported from the Soviet Union. After a few years, as the former socialist countries transitioned to a market economy, all of them embarked on a convergence path, albeit with some differences. Slovenia, which had the highest GDP per capita (69 per cent of that of Austria in 1990), shows slower convergence, but had still made the most progress as of 2022 (75 per cent). By contrast, Romania's convergence has been very significant, with its GDP per capita increasing from 27 per cent to 65 per cent compared to Austria between 1990

and 2023. Over the years, the differences between the levels narrowed sharply, falling from 42 percentage points to 22 percentage points, with differences now ranging from 60 to 75 per cent, with the exception of Bulgaria and Latvia.

Figure 1
GDP per capita in comparison to Austria

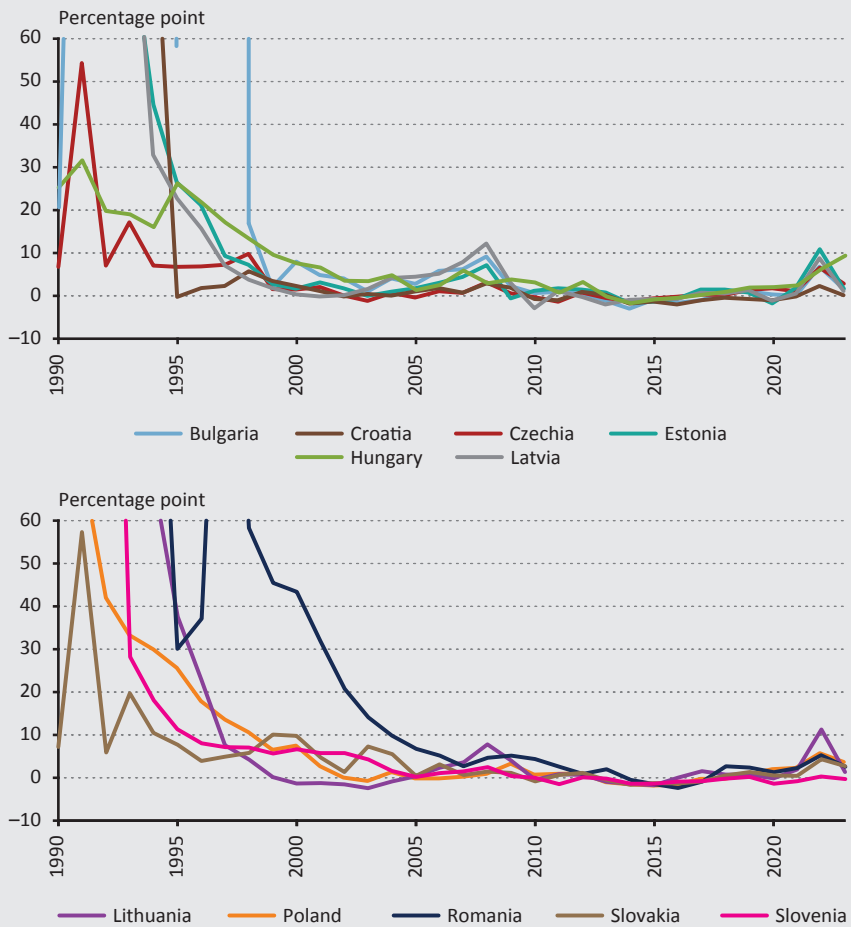


Note: Based on per capita GDP data in USD
Source: World Bank, World Development Indicators, authors' calculations

The differences between inflation in each of the countries compared to inflation in Austria is shown in *Figure 2*. It can be seen that inflation in the 1990s varied widely in the countries covered, both in terms of level and dynamics. Some countries started from very high levels, typically followed by rapid decline. Others, by contrast, went from the initial levels to even higher inflation levels before a decline occurred.

With the exception of Romania, nominal convergence was more or less achieved by the early 2000s, and the gaps between the countries covered narrowed. This trend was temporarily interrupted after the 2008 global economic crisis and the Russia–Ukraine war that started in 2022, but by 2023, 10 out of the 11 countries had relative inflation rates (compared to Austria) between –0.37 and 3.71 per cent.

Figure 2
Evolution of inflation differences in comparison to Austria



Source: World Bank, World Development Indicators, authors' calculations

Our study does not analyse the rate of convergence of each country, but rather the extent to which the choice of monetary policy framework has contributed to growth and disinflation. This study is novel insofar as it offers guidance on the choice and the timing of introduction of institutional framework to former socialist countries

planning to join the EU. Our results can, of course, be useful for all developing countries.

Our empirical analysis examines the impact on convergence of the following four key drivers of the monetary policy framework: exchange rate regime, central bank independence, inflation targeting and euro adoption. These drivers were chosen as they are associated with institutional decisions that all of these countries had to make and that are measurable.

Our results show that, in these countries, central bank independence was the driver that contributed the most to real and nominal convergence, that is, to GDP growth and inflation decline. However, it is important to stress that the methodology applied does not guarantee that the strong link shown is necessarily causal in nature, meaning that it captures the pure causal effect of central bank independence on inflation and GDP growth. The interpretation of our results is further put into context by the fact that they may also reflect the impact of other institutional changes that took place in parallel with the strengthening of central bank independence, essentially as part of the EU accession process.

Several authors have mentioned that, over the years, the independence of central banks has been steadily growing (*Dincer – Eichengreen 2014; Romelli 2024*). Considering 16 countries over the period between 1955 and 1988, *Alesina and Summers* (*1993*) looked at how inflation and GDP growth and their volatility changed as central bank independence evolved. They found that central bank independence played a significant role in price stability. *Cukierman et al.* (*1993*) studied 70 countries over the period between 1960 and 1989 to show that central bank independence reduces inflation, but its effect on growth varies depending on how developed a country is. For less developed countries, central bank independence also contributed to growth, but for developed countries, this effect disappeared. The authors explained this by the fact that developed countries mostly had a higher level of central bank independence than less developed countries. Looking at 96 developing countries over the period between 1980 and 2014, *Garriga and Rodriguez* (*2023*) showed that central bank independence reduced inflation volatility. *Casinhas* (*2019*) provided a good summary of the results on the impact of central bank independence on inflation and growth.

Several authors highlight the role of central bank independence. To the extent that high inflation has a negative impact on the development of the economy in the long term by reducing investments and their efficiency (*De Gregorio 1996*), the commitment to low and stable inflation by a central bank that is independent and communicates in a transparent manner may be more credible. This improves predictability and confidence among economic agents, thereby reducing the

risk premium, which in turn stabilises money markets and stimulates long-term investment (*Alesina – Summers 1993*). Generally, but not in every case, central bank independence insulates the institution from short-term political pressures, thus also contributing to improved predictability and confidence. This in turn contributes to keeping inflation down and to economic growth. Accordingly, it comes as no surprise that central bank independence is a key driver in our results. In addition, central bank transparency is an important factor, as examined by several previous studies. *Dincer and Eichengreen* (*2014*) found that central bank transparency has also increased in Central and Eastern European countries, alongside central bank independence. For the countries covered, transparency indices are available for only a part of the period covered and are therefore excluded from our model. As *Dincer and Eichengreen* (*2014*) showed that central bank transparency and independence are interrelated, we believe that omitting transparency from the model does not reduce its explanatory power.

Another important implication of our estimation is that inflation targeting has played a key role in reducing inflation in the countries that have adopted it, which is consistent with the results of other studies. *Mishkin and Schmidt-Hebbel* (*2007*) examined the monetary policy and macroeconomic performance of 21 developing and developed countries before and after inflation targeting over the period between 1989 and 2004, comparing them to a group of countries with no inflation targeting. They concluded that the adoption of inflation targeting reduces inflation as well as the volatility of both inflation and growth. This effect is stronger in developing countries. *Arsić et al.* (*2022*) looked at the impact of the adoption of inflation targeting on macroeconomic performance in 26 emerging economies in Europe and Central Asia over the period between 1997 and 2019. The results of the study showed that the adoption of inflation targeting reduced both the level and volatility of inflation and the volatility of GDP but had no effect on GDP growth. Looking at 35 developing countries over the period between 1995 and 2017, *Romdhane et al.* (*2023*) showed that the adoption of inflation targeting helped maintain economic growth and financial stability.

However, no similar effect was found for euro adoption, presumably due to nominal convergence being achieved before accession to the euro area.

For both drivers (inflation targeting and euro adoption), we found a negative, although insignificant, effect on real growth. The results obtained for inflation targeting seem to contradict the generally accepted view that a sustained decline in inflation has a positive impact on potential growth. In our view, however, the impact of the adoption of inflation targeting should not be viewed in isolation, as in the countries covered it has always been accompanied by an increase in central bank independence, and taking the latter into account, we can talk about both significant disinflationary and positive growth effects.

The literature offers varying views on the impact of exchange rate regimes on inflation and growth in developing countries. Some studies find a positive correlation between a fixed exchange rate, and low inflation and accelerated growth. Others, however, consider more flexible exchange rates to be more effective in terms of these two factors. It is always highlighted in the literature that many other factors may influence the role of exchange rate regimes, including, for example, the commitment of governments to maintain a particular regime, or whether a shock to a country's economy is caused by exogenous or endogenous factors. *Ghosh et al.* (*2013*), studying 159 countries, *Ghosh et al.* (*2015*), studying 50 emerging countries, and *Zeev* (*2019*), studying 40 emerging countries, found that a flexible exchange rate regime has a more positive effect on growth than a fixed one. The reason for this was the economy's better resilience due to the flexible regime, which was mostly shown in case of shocks. Authors who have looked specifically at Central and Eastern European (CEE) countries found exactly the opposite correlation, meaning that a rigid, fixed exchange rate regime had an advantage over a flexible one. *Arratibel et al.* (*2011*) and *Morina et al.* (*2020*) studied 14 CEE countries. They argued that exchange rate volatility increased GDP volatility, which curbed growth.

Our study covers a limited group of countries and a period when countries were aiming to join the European Union, with many of them also acceding to the euro area. Our model calculations show that intermediate regimes, such as band pegging and managed floating, may have contributed to disinflation, but we did not see any significant difference for each exchange rate regime in terms of real economic impact. This is in line with *Rose and Rose* (*2024*) that the literature has been unable to find large differences between different exchange rate regimes.

Overall, the monetary policy frameworks of the countries covered have been effective in promoting nominal convergence and have also been able to contribute to economic growth. There were no significant differences in the extent of these effects between countries which based their monetary policy strategy fundamentally on exchange rate policy and early euro adoption, and countries which consistently based their monetary policy on inflation targeting. Our calculations clearly show that central bank independence has a positive impact on reducing inflation and boosting GDP growth.

In the second section of this study, we briefly describe the evolution of monetary policy regimes in the countries covered from regime change to the present. We then set out our empirical model (*Section 3*) and use it as a basis to present our calculations of the extent to which decisions by monetary policy institutions contributed to nominal and real convergence (*Section 4*). *Section 5* summarises the main findings and draws the lessons learned.

2. Evolution of monetary frameworks in the countries covered[1]

In the following, we briefly describe the evolution of the monetary frameworks of the 11 countries in the focus of our study in the decades following regime change.

Bulgaria

During the first years of transition, the Bulgarian central bank's monetary policy focused on the money growth rate. No explicit targets were set for the exchange rate of the Bulgarian lev; interest rate policy, however, was often influenced by significant exchange rate fluctuations (*Mihov 2002*).

With the real economy contracting almost continuously, a banking crisis unfolded in 1995 and inflation dynamics reached hyperinflationary levels in 1997. The stabilisation package implemented in response to the crisis included the establishment of a currency board that pegged the Bulgarian lev to the Deutschmark. Later on, the euro replaced the Deutschmark as the anchor currency. Bulgaria joined ERM II in 2020, retaining the currency board.

Croatia

In 1991, the year when Croatia declared independence, it adopted its own currency, the Croatian dinar. This was replaced in 1994 by the kuna, which remained Croatia's official currency until the country's accession to the euro area in 2023. The Croatian central bank always based its monetary policy on the stability of the exchange rate, mainly due to the openness of the economy and its high degree of euroisation. The regime was often called a quasi-currency board (*Vujčić 2003*) as the central bank's foreign exchange reserves always exceeded the monetary base and the latter was expanded mainly through foreign exchange purchases and increases in the reserves. However, it differed from an actual currency board in that there was no explicit exchange rate target announced and the kuna exchange rate was not fully stable against any of the currencies. Croatia has been a member of the euro area since 2023.

Czechia

Czechia introduced the Czech koruna in 1993 after the dissolution of Czechoslovakia. The exchange rate of the Czech koruna was pegged to a basket of currencies with a narrow intervention band. In addition to exchange rate targeting, the central bank also pursued money supply targets (*Frömmel – Schobert 2006*). In February 1996, the intervention band was widened to ±7.5 per cent. In 1997, following the koruna exchange rate crisis, the Czech central bank moved from pegging the exchange rate to free float.

[1] In this Section, we have drawn on information available on the website of each central bank, in addition to the studies cited.

Czechia was the first in the region to adopt an inflation targeting regime in 1998. Initially, so-called net inflation (net of regulated prices and indirect taxes) was targeted, with target bands that changed from year to year, but were consistently reduced. From 2002, the central bank defined its inflation target band by using the headline inflation rate, and from 2006 a fixed target of 3 per cent was set, which was then reduced to 2 per cent from 2010. This target still applies to this day.

In 2013, the central bank reached the zero lower bound for interest rates and introduced an asymmetric exchange rate target to weaken the koruna, in order to further stimulate the economy. The exchange rate target was maintained until 2017 when the central bank reverted to a pure inflation targeting regime.

Estonia

Gaining its independence in 1991, Estonia adopted its own currency, the kroon, in 1992 and pegged its exchange rate to the Deutschmark in a currency board. In 1999, the euro became the anchor currency. Estonia joined ERM II in 2004 and acceded to the euro area in 2011.

Hungary

In the first half of the 1990s, the Magyar Nemzeti Bank applied an exchange rate peg. Exchange rate targets with a narrow intervention band were often devalued on an ad-hoc basis. The devaluations were aimed at maintaining external balance. In 1995, a crawling peg regime was introduced where the pre-announced monthly devaluation rate of the Hungarian forint's ±2.25 per cent intervention band was gradually reduced from the initial 1.9 per cent to 0.2 per cent in 2001.

Under the crawling peg regime, inflation fell from 30 per cent to 10 per cent, but the disinflation process stalled there. In 2001, the central bank therefore decided first to widen the intervention band to ±15 per cent and then adopted inflation targeting. Initially set for the end of each year, the targets were reduced from 7 per cent in 2001 to 3.5 per cent in 2006. Since 2007, a continuous 3-per cent target has been in place.

Latvia

Latvia declared independence from the Soviet Union in 1990. Adopted provisionally, the Latvian ruble, which had been in circulation simultaneously with the Russian rouble since 1992, was replaced in 1993 by the country's own currency intended to be definitive, the lats, which was pegged to the IMF's unit of account, the SDR, with an intervention band of ±1 per cent. The narrow band, combined with the central

bank's ample foreign exchange reserves, made the regime virtually equivalent to a currency board (*Staehr 2016*). The country switched to pegging to the euro immediately before joining ERM II in 2005. Latvia adopted the euro in 2014.

Lithuania

Gaining independence in 1990, Lithuania initially adopted a temporary currency, the talonas, which was in circulation simultaneously with the rouble, as in Latvia. It was replaced in 1993 by the Lithuanian litas which floated freely for a while. However, in response to persistently high inflation, a currency board regime was set up in 1994, pegging the litas to the US dollar. In 2002, the US dollar was replaced by the euro as the anchor currency. Lithuania joined ERM II in 2004 and adopted the euro in 2015.

Poland

For most of the 1990s, the Polish central bank used money supply and exchange rate targets to curb inflation. Also, with a view to maintaining external competitiveness, it applied a crawling peg to the Polish zloty from 1991. The intervention band around the central parity was widened in several steps from the initial ±0.5 per cent (in 1991) to ±15 per cent before the exchange rate band was abandoned in 2000 (*Jurek – Marszałek 2008*).

Although the central bank had had public targets for inflation since 1995 (*Jurek – Marszałek 2008*), the inflation targeting regime as we understand it today, where the inflation target takes precedence, was introduced in 1999. The crawling exchange rate band target was nevertheless maintained until 2000. Inflation targets were gradually lowered until 2004, from an initial target of 9.5 per cent to the current 2.5 per cent.

Romania

In the first half of the 1990s, the main challenge for the Romanian central bank was inflation, which mostly ranged in the triple digits. Its monetary policy was based on targeting the money supply and the leu exchange rate. Given that ensuring price stability was not yet its primary objective by law, the central bank aimed to strike a balance between disinflation efforts and other objectives such as external balance (*Dragulin – Radulescu 1999*). Inflation was only brought down persistently to double-digit levels in the second half of the decade.

In 2005, the Romanian central bank redenominated the currency (1 new Romanian leu was worth 10,000 old Romanian leu) and introduced an inflation targeting regime. Initially set at 7.5 per cent, the inflation target was gradually lowered to the 2.5-per cent level that has applied since 2013. The Romanian central bank has regularly intervened in the foreign exchange market to prevent excessive volatility in the leu exchange rate.

Slovakia

In the period following the introduction of the Slovak koruna as an independent currency in 1993, Slovakia, similarly to Czechia, maintained a narrow-band exchange rate target, while trying to control the money supply. In 1996, the koruna intervention band was widened from ±0.5 per cent to ±5 per cent in order to reduce speculative capital movements. 1998 marked the move to a floating regime, but the Slovak central bank intervened in the foreign exchange market in both directions on numerous occasions.

The central bank's medium-term monetary programme of December 2004 set up a monetary policy framework for the period up to euro adoption which was based on joining the ERM II and pursuing inflation targeting. The koruna joined the European exchange rate regime in November 2005, where its central parity was revalued once in 2007 at the request of Slovakia. The central bank set the inflation target at 2.5 per cent in December 2006 and 2 per cent in December 2007. Slovakia adopted the euro in January 2009 at a rate stronger than the ERM II central parity.

Slovenia

In 1991, Slovenia became an independent state, established its central bank and adopted its own currency, the tolar, which floated freely throughout 1992. From 1993, the central bank sought to reduce inflation through monetary targeting. It also intervened in the foreign exchange market on a regular basis to lower exchange rate volatility. In 1995, capital controls were implemented, allowing monetary and (implicit) exchange rate targets to be decoupled to some extent. During this period, the exchange rate became an intermediate target of equal importance to money supply (*Caprirolo – Lavrač 2003*).

By the early 2000s, adopting the euro as soon as possible already became a priority of the monetary strategy. By 2001, capital controls were fully lifted and a shift was made to a monetary policy purely based on the exchange rate with the primary objective of achieving price stability (*Caprirolo – Lavrač 2003*). Slovenia joined ERM II less than two months after acceding to the EU and was the first former socialist country in Central and Eastern Europe to adopt the euro in 2007.

3. Empirical model for the impact of institutional decisions

In our empirical analysis, we sought to quantify the impact of monetary policy strategy on nominal and real convergence. For this purpose, a linear regression model was estimated based on panel data. The dependent variables in our regression model were the annual average inflation rate and the annual real GDP growth rate. The estimation period runs from 1990 to 2019, but the years for which data are available for all variables in the estimate vary across countries. A fixed

effect model was used to estimate the coefficients. Observations where annual inflation exceeded 100 per cent were excluded from the estimate.

In addition to the 11 countries covered by the study, our panel database included data for Albania, Bosnia and Herzegovina, Moldova, North Macedonia and Ukraine. The reason for this is that, although our study focuses on the countries in the region that have already acceded to the EU, the aforementioned five additional countries, as former members of the former socialist bloc, are also aiming for ever closer European integration, with real and nominal convergence being an important element. We believe that including them in the estimation allows for a greater number of useful observations without significantly increasing heterogeneity, thereby enabling a more accurate estimation of the effects sought.

The monetary strategies implemented are captured by a number of measurable variables, hereinafter referred to as institutional variables. These are the flexibility of the exchange rate regime, the adoption of inflation targeting, euro adoption and central bank independence.

We experimented with two indicators for the exchange rate regime: one is the de facto classification (hereinafter "IRR") by *Ilzetzki et al.* (*2019*) and the other, based on the latter, is the so-called effective exchange rate regime variable (hereinafter "HK") by *Harms and Knaze* (*2021b*). We chose these databases because, first, they cover most of the countries and time periods examined and, second, they are *de facto* classifications, meaning that they do not consider the regime declared by the central bank/government, but rather the actual behaviour of the exchange rate.

As the first step, *Ilzetzki et al.* (*2019*) identify the reference currency or basket of currencies against which the exchange rate of the country covered has shown relative stability. As the second step, exchange rates are classified into the following categories based on their volatility against the reference currency or basket: 1) currency board, peg with a band of up to ±2 per cent; 2) crawling peg with a band of up to ±2 per cent; 3) crawling peg with a wider band, managed float; 4) free float.[2]

The monthly data from *Ilzetzki et al.* (*2019*) were converted to annual data by assigning the value that occurs in most months to each year. A particular feature of the index is that the exchange rate regimes of Poland, which has officially floated its exchange rate freely for a long time, and Czechia before 2014 are classified as managed float (Category 3) and, in our sample, only the Albanian lek's exchange rate for 1994 and 1995 is classified as free float (Category 4).

[2] In our sample period, there are also two additional categories, namely the so-called free falling exchange rate and the case where the official exchange rate does not reflect market conditions, while the actual market ("black") exchange rate is unknown. These observations were excluded from the estimation.

Harms and Knaze (*2021b*) argued that using only one reference currency, the stability of an exchange rate can only be determined to a limited extent, as countries typically engage in foreign trade with many other countries. For this reason, an effective exchange rate regime index was constructed based on, among others, the methodology of *Ilzetzki et al.* (*2019*), by weighting together the bilateral regimes established by *Harms and Knaze* (*2021a*), where the weights were determined by the share of bilateral trade volume in a country's total foreign trade. Given that this indicator is potentially more accurate in capturing *de facto* exchange rate stability, we have also used it to prepare our estimates. The index by *Harms and Knaze* (*2021b*) can be considered as a continuous variable with a potential set of values ranging from 1 to 4.

It should be noted that, in addition to actual (*de facto*) exchange rate flexibility, the declared, i.e. *de jure*, regime in itself can also have a macroeconomic impact. *Ghosh et al.* (*2014*) show that an explicit commitment to a stable exchange rate can help anchor inflation expectations. Similarly to *de facto* exchange rate regimes, *Harms – Knaze* (*2021b*) also calculate an effective *de jure* index using the classification in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions. However, this database is only available for the 2000s and, since the 1990s are of great importance to our analysis, we only employed the *de facto* indices.

In addition to exchange rate policy, we also wanted to see whether the adoption of inflation targeting had a demonstrable effect on nominal and real convergence. This is captured by a dummy variable that takes a value of 1 in the year when a country officially applies inflation targeting and 0 otherwise. Similarly, a dummy variable was used to capture the regime change when a country officially accedes to the euro area.[3]

The central bank independence index by *Romelli* (*2022*) was used to approximate the level of development of the institutional set-up. This index assesses the institutional background and statutory mandate of central banks based on 42 criteria, grouped into 6 dimensions: (1) central bank governor and decision-making body; (2) monetary policy and conflict resolution; (3) monetary policy objectives; (4) restrictions on lending to the government; (5) financial independence; and (6) accountability. We chose this indicator because, in addition to being based on previously widely-used indices, it is available for most of the countries in our sample dating back to the early 1990s.

[3] For the dates of adoption of the euro and inflation targeting, see the discussion of each country's monetary regime. The only exception is Slovakia, as we ignored its inflation targeting in ERM II because we did not consider its inflation targets to be the primary nominal anchor during this period; ERM II and the upcoming euro adoption may have been the real nominal anchor via the exchange rate.

In addition to the institutional variables that are the focus of our study, we sought to improve the accuracy of estimates and minimise endogeneity bias by employing a wide range of control variables commonly used in the literature. These included money growth rate, foreign trade openness, financial openness, current account balance as a share of GDP, budget balance as a share of GDP, government debt as a share of GDP, quality of institutions,[4] inflation and GDP growth in the euro area, and the logarithm of GDP per capita (calculated on a PPP basis) lagged by one year. In addition, the inflation model also included the contemporaneous GDP growth in a country, while the GDP model included the contemporaneous inflation rate in a country.[5]

Estimation results may be biased if there is also an inverse relationship between inflation and GDP, and institutional variables, or if a third variable has an impact on both. We seek to minimise the latter risk by including in the control variables as many variables as possible that could affect inflation and GDP, as well as institutional variables. The potential variables were chosen based on the literature (e.g. financial openness may affect the exchange rate regime – *Yeyati et al. 2010*; foreign trade openness and current account balance may affect the adoption of inflation targeting – *Arsić et al. 2022*). In addition, we estimated regression models for the effective exchange rate regime variable, the central bank independence index, the euro and the inflation targeting dummy, with lagged values for inflation and GDP growth included among explanatory variables. The latter variables had no significant effect on institutional variables.[6] The wide range of control variables and the results of the auxiliary regressions provide greater confidence that our estimation results contain no endogeneity bias.

First, we examine the impact of institutional variables on inflation. The first column of *Table 1* shows the results of the model using the exchange rate classification (*IRR*) by *Ilzetzki et al.* (*2019*). It is estimated that the adoption of inflation targeting has led to a considerable and statistically significant reduction in inflation rates. The coefficient of 4.01 is more than twice as high as measured by *Harms and Knaze* (*2021b: Table A8, Specification* (*3*)) on a much larger sample of countries. Adoption of the euro reduces inflation by almost one half a percentage point, but this result is not statistically significant. Increasing central bank independence reduces inflation as well, but this estimate is also not significant. Similarly, the coefficient of the dummy variables for the exchange rate regime (*IRR*) was also not significant.

[4] Captured by the World Bank's Worldwide Governance Indicator (*Kaufmann – Kraay 2024*). The arithmetic mean of the six sub-indices was used.
[5] The data are described in detail *in Appendix A* and their main statistics are included in *Appendix B* (*Table 3*). As the central bank independence index was found to be a key variable, its evolution in the 11 countries covered is also presented there (*Figure* 5).
[6] Estimation results are presented in *Appendix C.*

The second column in *Table 1* presents the results for the model that includes the effective exchange rate regime variable (*HK*) by *Harms and Knaze* (*2021b*). Given that there may be a non-linear effect between the increase in exchange rate flexibility and inflation, we also used the square of the variable in the regression. The estimate still shows a significant disinflationary impact of inflation targeting, both in economic and statistical terms. The estimated coefficient for euro adoption is not statistically significant.

In this model, the effect of central bank independence is much stronger and significant at a confidence level of 1 per cent. To interpret the resulting coefficient of around –14.2, the extent of the variable within the samples should be considered. The lowest value of the index in our sample used for estimation is 0.42, with the highest being 0.91. Increasing the independence of a central bank from 0.42 to 0.91 reduces inflation by roughly 7 percentage points, more than double the estimated impact of inflation targeting. Looking at the impact of the change in the index for each country, an increase in central bank independence contributed to disinflation by 1 to 5 percentage points over the period covered.

From the estimated coefficients of *HK* and HK^2, it can be calculated to what extent annual inflation changes when the flexibility of the exchange rate regime is increased from the hypothetical[7] hard peg (*HK=1*) to 4 (free float). From this, we found that the increase in flexibility has a disinflationary effect, but in a non-linear way: it is strongest in intermediate cases (over 5 percentage points for values between 2 and 3), but decreases when approaching the free-floating regime (only 0.6 when *HK=4*). This is because the quadratic specification allows for a U-shaped effect between the index and inflation. It should be noted here that in the 11 countries and periods covered by our study, the HK index value typically ranged between 1.5 and 3.5, i.e. exactly in the range that is most favourable from a disinflation perspective. Although these values do not clearly correspond to the IRR index, a value of around 2 is more likely to apply to a narrow-band peg and a value of around 3 to managed float.

As apparent from *Table 1*, the effective exchange rate regime variable by *Harms and Knaze* (*2021b*) yields more pronounced results for the effect of institutional variables than the classification by *Ilzetzki et al.* (*2019*), and the exchange rate regime itself is proven to be a more significant factor. However, the latter is widely used in the literature, so we consider it important to present the regression results obtained with both indices.

[7] It is hypothetical because a country can only have a value of 1 if it pegs its exchange rate against all of its trading partners. This is only feasible if the trading partners also peg their exchange rates against each other, which is of negligible practical relevance, but may be a good point of reference.

Table 1
Impact of institutional variables on annual average inflation

	(1)	(2)
Inflation targeting	–4.01*	–2.97**
	(1.97)	(1.16)
Euro	–0.461	0.330
	(0.91)	(0.495)
Central bank independence	–2.80	–14.2***
	(7.03)	(3.84)
Exchange rate regime: IRR#2	0.176	
	(1.56)	
IRR#3	–0.138	
	(1.71)	
HK		–11.8*
		(6.71)
HK^2		2.4
		(1.49)
Money growth	0.098*	0.062**
	(0.052)	(0.027)
Openness	–1.55	0.20
	(2.75)	(3.41)
Financial openness	–0.45	0.555
	(0.875)	(0.489)
Current account balance	–0.087*	–0.133**
	(0.047)	(0.055)
GDP growth	–0.383**	–0.357**
	(0.155)	(0.148)
Budget balance	0.177	0.198*
	(0.12)	(0.1020)
Government debt	0.023	0.025
	(0.026)	(0.028)
WGI index	4.57	5.579
	(3.51)	(3.346)
Euro area inflation	1.25***	1.36***
	(0.289)	(0.212)
Euro area GDP growth	0.368	0.228
	(0.282)	(0.246)
Lagged GDP per capita	–4.98	–7.89
	(3.59)	(3.59)
Number of observations	303	294

*Note: Robust standard errors clustered by country are in brackets. *, ** and *** denote coefficients significant at 10, 5 and 1 per cent, respectively. IRR#2 and IRR#3 are dummy variables which take the value of 1 when the observation is classified in exchange rate regimes 2 and 3, respectively, according to the classification by Ilzetzki et al. (2019). The coefficient of these variables shows how much higher inflation is compared to regime 1 (hard peg).*

Table 2
Impact of institutional variables on annual real GDP growth

	(1)	(2)
Inflation targeting	–0.245	–0.102
	(0.977)	(0.86)
Euro	–0.566	–0.306
	(0.424)	(0.467)
Central bank independence	8.01***	4.79**
	(1.62)	(1.85)
Exchange rate regime: IRR#2	0.426	
	(0.591)	
IRR#3	–0.247	
	(0.98)	
HK		–0.60
		(3.39)
HK²		0.231
		(0.730)
Money growth	0.044	0.033
	(0.03)	(0.027)
Openness	4.8**	5.05**
	(1.87)	(2.13)
Financial openness	–0.112	0.096
	(0.335)	(0.352)
Current account balance	–0.042	–0.05
	(0.076)	(0.070)
Inflation	–0.147***	–0.192***
	(0.044)	(0.049)
Budget balance	0.285***	0.313***
	(0.09)	(0.098)
Government debt	–0.066***	–0.055***
	(0.010)	(0.02)
WGI index	3.1**	3.71**
	(1.128)	(1.672)
Euro area inflation	0.537	0.559*
	(0.316)	(0.31)
Euro area GDP growth	0.924***	0.93***
	(0.119)	(0.130)
Lagged GDP per capita	–6.71***	–7.89***
	(2.30)	(2.31)
Number of observations	303	294

*Note: Robust standard errors clustered by country are in brackets. *, ** and *** denote coefficients significant at 10, 5 and 1 per cent, respectively. IRR#2 and IRR#3 are dummy variables which take the value of 1 when the observation is classified in exchange rate regimes 2 and 3, respectively, according to the classification by Ilzetzki et al. (2019). The coefficient of these variables shows how much higher GDP growth is compared to regime 1 (hard peg).*

The regime variables in the regression models for annual GDP are the same as in the inflation models. The control variables are also identical, with the exception that inflation is used instead of simultaneous GDP growth.

The results presented in *Table 2* show that both inflation targeting and euro adoption slow economic growth, but only to a small extent, and that neither coefficient is statistically significant. Conversely, increasing central bank independence contributes positively to GDP growth. Increasing the index by 0.5 (roughly the difference between the highest and lowest values in our sample) in the two estimated models alone results in 4 and 2.4 percentage point excess growth, respectively; these values are so high that they warrant explanation.

On the one hand, it should be considered that, since independence has been on an upward trend in virtually all of the countries covered, this coefficient may also absorb other effects that influenced growth along a common trend. Perhaps the most important of these is the overall improvement in the quality of institutions, mainly related to EU accession; we try to control for this with the WGI index, but even so we cannot be entirely certain that this actually filters out all relevant factors that are independent of the monetary policy framework.

On the other hand, the increase in central bank independence should be considered in conjunction with the development of the monetary regime. The adoption of inflation targeting, or, even more so, the adoption of the euro, presupposes the improvement of the institutional framework and the establishment of central bank independence. For this reason, the impact of these factors can only be properly understood together. For example, the Magyar Nemzeti Bank adopted inflation targeting in 2001, and the MNB Act was amended in support the same year, increasing the Romelli independence index by 0.24. The combined effect of these two steps on annual GDP growth, calculated with the coefficients presented, is 1 and 1.7, giving a much more realistic picture of the impact of the development of the monetary framework.

Finally, the estimated strong effect may also be due to a model specification problem, such as cross-sectional dependence, which seems plausible as the economies of the countries covered show similarities in many respects, and some factors for which we did not control may lead to strong co-movement in shocks assumed to be idiosyncratic. In *Appendix D*, we present cross-sectional dependence tests for the main regression models, which suggest that this type of specification problem is unlikely to result in a significant bias for the estimated coefficients.

The estimated effect of the exchange rate regime is not significant in either model. Of course, this does not mean that changes in the exchange rate do not have an impact on GDP. Our estimation essentially captures the long-term impact of the

regime, so the fact that we found no meaningful effect means that, compared to a full exchange rate peg, more flexible regimes did not demonstrably cause real convergence to accelerate or decelerate over the period between 1990 and 2019. This is in line with the findings of *Rose and Rose* (*2024*).

4. Contribution of monetary policy institutions to convergence

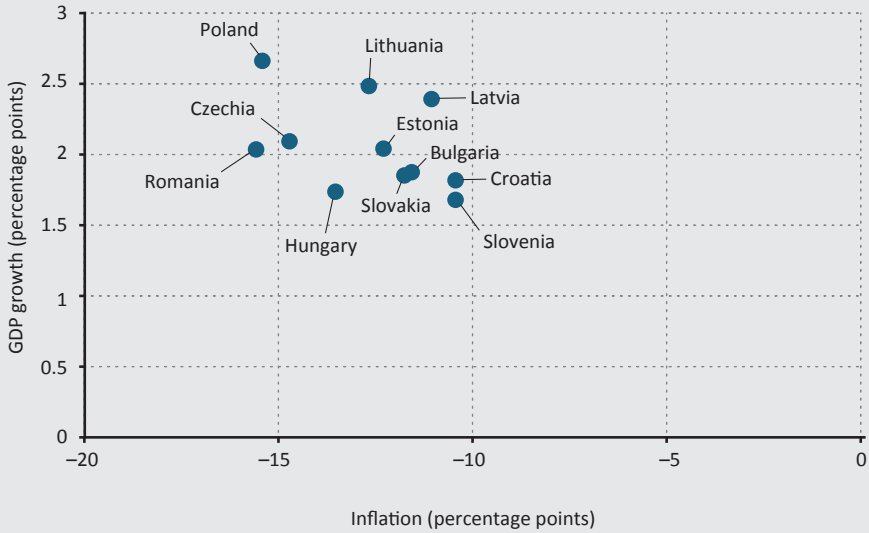
In the following, we use the coefficients estimated above to quantify the extent to which the monetary policy strategies in the 11 countries in the focus of our study contributed to nominal and real convergence. These are defined as the negative contribution to annual inflation rates and positive contribution to annual real GDP growth rates. Monetary strategy includes the choice of exchange rate flexibility, increasing central bank independence, introducing inflation targeting or the adoption of the euro.

Contributions are calculated for the period between 1997 and 2019, as this means that the necessary data are available for all but one country. For Romania, we can only perform calculations for the period between 2003 and 2019.

For the calculations, we use only models with effective exchange rate flexibility (*HK)*, as we were able to identify the impact of institutional choices to a lesser extent when using the classification (*IRR*) by *Ilzetzki et al.* (*2019*). For the sake of simplicity, we calculate direct contributions, meaning that we calculate for each year the extent to which the deviation of the exchange rate flexibility index, the central bank independence index and the inflation targeting and euro adoption dummies from the benchmark directly changed the target variable, i.e. the inflation rate and the GDP growth rate. Indirect effects are ignored. The reason for this is that, while in some cases these are relatively easy to calculate (for example, the effect of monetary strategy on GDP may be reflected in the inflation equation, or may also have a lagged effect through GDP per capita), in other cases a more complex model would be needed (for example, monetary strategy may also affect economic openness, but we do not have any estimates for this).

Our benchmarks were as follows: *HK=1* for exchange rate flexibility, 0.42 for central bank independence (the lowest value in our entire sample) and 0 for the two dummies. Therefore, our calculation will show how much a country has gained in terms of real and nominal convergence by showing some degree of flexibility in its exchange rate policy, strengthening central bank independence and adopting inflation targeting or the euro. This means that the hypothetical benchmark country used a completely rigid exchange rate regime all along, kept central bank independence at a low level and did not adopt either the euro or an inflation targeting regime.

Figure 3
Average annual contribution of the chosen monetary strategies to real growth and inflation between 1997 and 2019



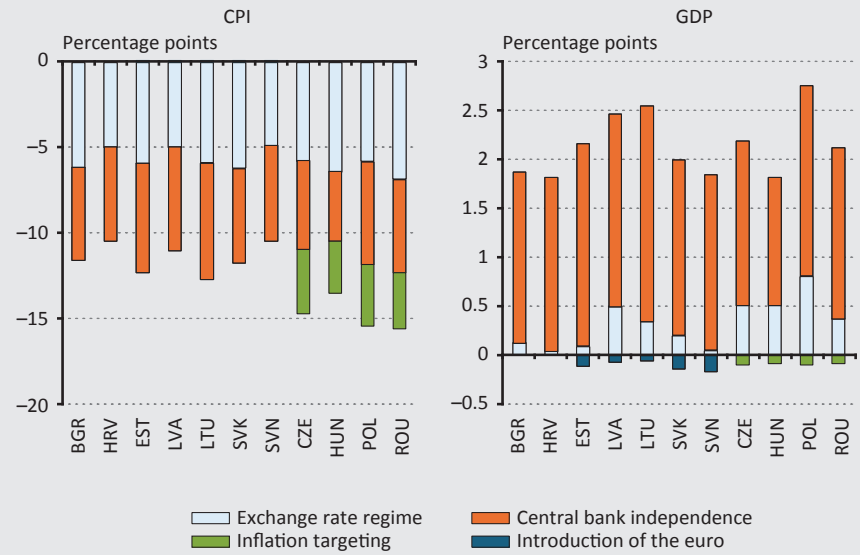
Note: For Romania, calculated for 2003–2019

Figure 3 shows the annual average impact of monetary regimes and the improvement of the institutional set-up on inflation and GDP growth. Essentially, countries can be classified into two groups. The first group consists of countries that relied heavily on inflation targeting regimes to achieve price stability, i.e. nominal convergence (Czechia, Hungary, Poland and Romania). These countries also typically more or less applied and continue to apply a more cautious, wait-and-see strategy for joining the euro area. In their case, a significant disinflationary effect of around 15 percentage points and a growth effect of 1.7 to 2.7 per cent can be quantified.

By contrast, the other 7 countries (Bulgaria, Croatia, Estonia, Latvia, Lithuania, Slovakia and Slovenia) clearly based their strategy on adopting the euro as quickly as possible, focusing typically on exchange rate pegging or strong management in the monetary framework until adoption. In their case, the estimated disinflationary effect is lower, but still significant (10 to 13 percentage points). Growth effects range between 1.7 and 2.5 per cent, in a range similar to that of the other group.

A comparison of growth and disinflationary effects shows that the strategies taking a wait-and-see approach to euro adoption and adopting inflation targeting allowed for slightly faster nominal convergence, with no meaningful difference in real convergence. On this basis, it cannot be concluded that any one strategy is clearly preferable.

Figure 4
Decomposition of contributions to disinflation and growth



Note: The impact of individual institutional factors on annual inflation and annual real GDP growth between 1997 and 2019 (2003 and 2019 for Romania).

Figure 4 shows the decomposition of contributions to growth and disinflation broken down by drivers. Some degree of flexibility of the exchange rate regime, inflation targeting and the increase in central bank independence were all key drivers behind the significant fall in inflation. However, euro adoption in itself did not prove to have a disinflationary effect.

Regarding the drivers of the GDP effect, the positive role of central bank independence is highlighted, although this is not entirely unexpected in the light of regression results. Our decomposition suggests that, while inflation targeting and euro adoption tended to inhibit real convergence, the flexibility of the exchange rate regime had a positive effect offsetting the previous two, but these effects are not statistically significant and are dwarfed by the contribution of central bank independence.

As mentioned earlier, it might not make sense to look at each element of the monetary framework reform separately. For both the effective functioning of inflation targeting and the adoption of the euro, it was essential to create the right institutional and legal environment to underpin the credibility of monetary policy. These steps were taken to an almost similar extent by countries opting for both rapid euro adoption and an inflation targeting strategy. Thus, it can be argued that the monetary strategies chosen were able to ensure rapid nominal convergence

while also having a positive impact on real convergence. Increasing central bank independence played a significant role in this, as it was able to strengthen the credibility and predictability of the chosen monetary regime, ultimately reducing the costs of disinflation for the real economy. This is in line with the results of *Spéder and Vonnák* (*2023*), who examined the aftermath of major inflation shocks and found that the disinflation phase was less painful in countries with higher central bank independence indices.

Of course, our study does not seek to evaluate all of the relevant consequences of decisions related to monetary policy institutions. Our analysis is limited to quantifying the impact on growth and inflation of the most tangible decisions. These decisions can have numerous other consequences that may be relevant to the welfare of individual societies. It is also important to stress that we did not evaluate the monetary policies of the central banks concerned, although this could be just as important in terms of growth and inflation, but rather the contribution of the choice of framework to convergence.

5. Conclusions

In our study, we looked at nominal and real convergence in the 11 former socialist Central and Eastern European EU Member States in the decades after 1990. In particular, we sought to answer the question to what extent monetary policy strategy and institutional decisions contributed to economic growth and achieving price stability. The strategy chosen is described by the flexibility of the exchange rate regime, the possible use of inflation targeting, the possible adoption of the euro and the strengthening of central bank independence.

Two strategies emerge in the countries covered. The first aims at rapid euro adoption, while seeking to ensure price stability with a pegged or more tightly managed exchange rate until adoption. This group includes the Baltic countries, Slovenia, Slovakia, Croatia and Bulgaria. Conversely, the other group, which includes Czechia, Poland, Hungary and Romania, took more of a wait-and-see, dilatory approach to adopting the euro, while providing a nominal anchor through inflation targeting.

The results of our regression model estimation suggest that in the countries covered, the improvement of the institutional set-up contributed the most to nominal and real convergence. In our model, this factor is captured by central bank independence. The increase in central bank independence in the countries covered typically contributed more than 5 percentage points to disinflation and around 2 percentage points to real GDP growth on average per year between 1997 and 2019. This comes as no surprise as an independent central bank's commitment to fighting inflation is more credible, which increases confidence and predictability,

thereby promoting real growth. All of the countries covered set their sights on EU membership and the establishment of the institutional set-up expected by the EU, including central bank independence.

In the countries that adopted it, inflation targeting curbed the annual inflation rate by another 3 to 4 percentage points.

The choice of exchange rate regime may have aided disinflation efforts, but the results were not as marked as for central bank independence or inflation targeting. Our estimation results show that disinflation was achieved most effectively in intermediate exchange rate regimes such as pegging with an intervention band and managed floating. No significant differences in the impact on economic growth were identified among the exchange rate regimes applied. Here, we can once again cite *Rose and Rose* (*2024*), who argued that no obvious differences between exchange rate regimes were found in the literature.

Euro adoption in itself had no demonstrable disinflationary effect and only a marginal negative impact on real convergence in the countries and period covered. This does not mean, however, that the strategy based on adoption as soon as possible was not effective in achieving price stability and GDP growth, as – similarly to inflation targeting – one of the prerequisites for adoption was the establishment of central bank independence, for which we were able to show a significant impact in this respect. On the other hand, nominal convergence is a prerequisite for euro adoption, and thus the countries that have already adopted it achieved price stability even before its adoption.

Accordingly, over the past 30 years or so, the development of the monetary policy framework has demonstrably supported not only nominal but also real convergence in the Central and Eastern European EU Member States. Among the countries that followed two different paths, those that based their strategy on euro adoption as soon as possible saw the choice of monetary regime and the establishment of central bank independence contribute to price stability to a slightly lesser, albeit overall significant, extent as compared to those that have pushed less for euro adoption and employed inflation targeting. Overall, however, it cannot be concluded that any (ex post) strategy was preferable.

The lesson drawn from our study for countries seeking EU membership is that inflation targeting and strengthening central bank independence can promote convergence. However, as in the literature, we did not find marked differences in the impact of exchange rate regimes on convergence. The exchange rate regime should be chosen in consideration of the economic conditions of a country, in particular the importance of foreign trade, the openness of capital markets, foreign currency debt, the competitiveness of the economy and the predictability of the fiscal position.

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Appendix

A. Sources of other data used in regressions

GDP growth: World Bank, World Development Indicators (WDI) – "GDP growth (annual %)"

Inflation: WDI – "Inflation, consumer prices (annual %)"

GDP per capita: WDI – "GDP per capita, PPP (constant 2021 international $)"

Money growth: WDI – "Broad money growth (annual %)" (for several countries, incomplete time series had to be supplemented with data available on their central banks' website)

Openness = (export+import)/GDP: WDI – "Exports of goods and services (current LCU)", "Imports of goods and services (current LCU)", "GDP (current LCU)"

Financial openness: The *Chinn – Ito (2006*) index, which measures the degree of capital account openness based on restrictions on cross-border financial transactions, https://web.pdx.edu/~ito/Chinn-Ito_website.htm

Current account balance: WDI – "Current account balance (% of GDP)"

Budget balance: International Monetary Fund, World Economic Outlook Database, April 2024 (WEO) – "General government net lending/borrowing" Percent of GDP

Government debt: WEO – "General government gross debt" Percent of GDP

WGI index: arithmetic average of the World Bank's WGI sub-indices (*Kaufmann – Kraay 2024*). Initially, when indices were calculated only every two years, the average of the two adjacent years was projected to interim years.

Euro area inflation: Federal Reserve Economic Data (FRED) – "Consumer Price Index: Harmonised Prices: All Items: Total for the Euro Area (19 Countries), Growth rate same period previous year"

GDP growth in the euro area: WDI – "GDP growth (annual %), Euro area [EMU]"

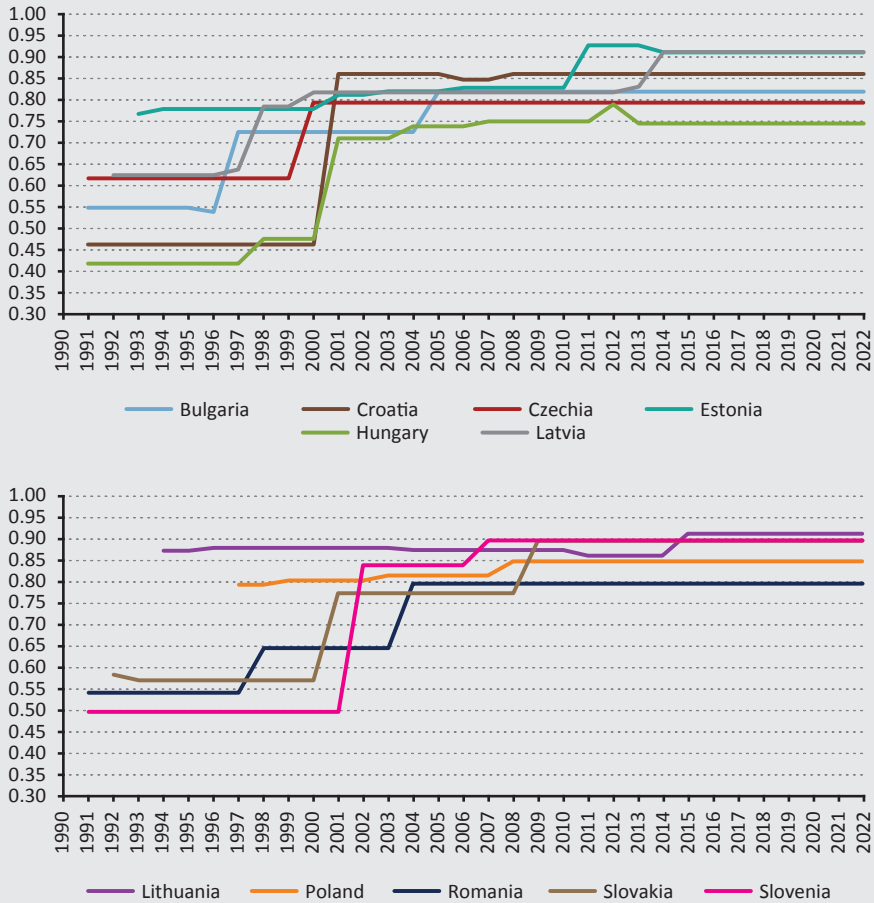
B. Descriptive statistics for the variables used in regressions

Table 3
Main statistics for the variables in regressions on the full sample

	Mean	Median	Minimum	Maximum	Standard deviation	Number of observations
Inflation targeting	0.222	0	0	1	1	627
Euro adoption	0.094	0	0	1	1	627
CBI index	0.756	0.796	0.33	0.929	0.599	508
IRR	1.576	1	1	4	3	476
HK	2.357	2.3	1.36	4	2.64	382
Money growth	24.11	11.004	–55.16	1,809.2	1,864.3	502
Openness	1.027	0.973	0.134	2.041	1.907	554
Financial openness	0.577	1.034	–1.931	2.299	4.23	433
Current account balance	–4.897	–4.55	–49.65	10.28	59.93	520
GDP growth	2.865	3.53	–29.1	88.96	118.1	544
Budget balance	–2.901	–2.68	–15.75	8.431	24.18	510
Government debt	42.18	39.34	3.765	213.8	210	481
WGI index	0.242	0.233	–1.212	1.298	2.51	489
Euro area inflation	2.175	2.2	0.2	8.4	8.2	608
GDP growth in the euro area	1.623	2.054	–6.108	5.966	12.073	627
GDP per capita	21,860	19,206	2,001	48,784	46,783	560

Note: For each variable, statistics are calculated on the basis of all the data available for the period between 1990 and 2022. The sample for regression estimates is narrower as the entire observation is excluded if there is a data gap for even one variable.

Figure 5
Evolution of the Romelli's central bank independence index in the 11 countries covered



C. Results of auxiliary regressions

Auxiliary regressions were estimated to identify potential endogeneity problems. In these regressions, the dependent variable was always a monetary institutional variable used in baseline models, while the explanatory variables included inflation and GDP growth lagged by one year and the control variables used in the baseline models. For the adoption of inflation targeting and the euro, a logit model was estimated due to the binary nature of variables, while a fixed effect model was estimated with country fixed effects for countries in the case of central bank independence and the HK index measuring exchange rate flexibility.

Table 4
Results of auxiliary regressions

	Inflation targeting	Euro	Central bank independence	Exchange rate regime (HK)
Inflation	0.014	–0.457***	–0.001	–0.006
	(0.025)	(0.143)	(0.001)	(0.007)
GDP growth	0.064*	–0.076	0.001	0.006
	(0.038)	(0.083)	(0.001)	(0.011)
GDP per capita	2.59***	–0.025	0.081	–0.214
	(0.583)	(0.553)	(0.064)	(0.267)
Money growth	–0.027*	0.001	0.000	0.001
	(0.015)	(0.033)	(0.001)	(0.003)
Openness	–3.21***	6.03***	0.039	–0.505
	(0.583)	(1.187)	(0.051)	(0.360)
Financial openness	0.291**	–0.542	0.037***	0.009
	(0.126)	(0.350)	(0.011)	(0.060)
Current account balance	–0.073**	0.125	0.000	–0.023**
	(0.030)	(0.097)	(0.001)	(0.009)
Budget balance	–0.048	0.002	0.000	–0.021*
	(0.054)	(0.108)	(0.002)	(0.011)
Government debt	0.027***	–0.031	0.001	–0.002
	(0.007)	(0.020)	(0.001)	(0.003)
WGI index	–0.463	6.51***	–0.019	–0.101
	(0.419)	(1.68)	(0.079)	(0.237)
Number of observations	346	348	346	285

Note: standard errors in brackets

The results presented in *Table 4*, with the exception of the model explaining euro adoption, suggest that changes in inflation and GDP growth do not lead to changes in monetary frameworks one year later. Given that both variables are relatively persistent, it is very likely that the possibility that the results obtained with baseline regression models reflect lagged reverse causality can be ruled out. However, because of the lag, these results do not reveal anything about any potential simultaneous endogeneity. Nevertheless, decisions by monetary institutions are typically preceded by a longer preparation period, and thus the likelihood that, for example, an inflation decline would lead to the adoption of an inflation targeting regime in the same year or that a third factor would cause a regime change and inflation decline in the same year is limited.

For euro adoption, the inflation coefficient one year earlier was significantly negative at a 5-per cent level, implying that the probability of euro adoption increases after

inflation declines. In this case, however, the time-consuming nature of institutional changes is particularly important as a prerequisite for euro adoption is compliance with the Maastricht criteria, including the criterion for low inflation. This means that adoption of the euro is naturally preceded by an inflation decline. Therefore, it cannot be clearly concluded that there is reverse causality as from our perspective, adoption of the euro does not only mean the replacement of the currency, but the whole journey there, including nominal convergence. However, in our baseline regression explaining inflation, increased caution is warranted when interpreting the dummy coefficient for euro adoption.

The coefficients obtained for control variables, which are significant in some instances (particularly in the estimate for inflation targeting), confirm that these variables should be included in the baseline regressions, helping to eliminate potential endogeneity bias.

D. Cross-sectional dependence tests

In the following, we test the cross-sectional dependence of the model's residuals (without fixed effects) for the estimates explaining inflation and GDP growth. To do so, we use *Stata's xtcd2 routine*, which performs four different tests that are most appropriate for our sample, i.e. when the dimensions T and N are nearly equal and relatively large. The CD test is the test proposed by *Pesaran* (*2015*) and *Pesaran* (*2021*). The disadvantage is that it tends to reject the null hypothesis even if it is true. For this reason, we also present the results of the following alternative tests: weighted CD test (CDw; *Juodis – Reese 2021*), "Power Enhanced" CDw test (CDw+; *Fan et al. 2015*; *Juodis – Reese 2021*), and "Bias Corrected" CD test (CD*; *Pesaran – Xie 2022*). For each test, the null hypothesis is weak cross-sectional dependence and the alternative hypothesis is strong cross-sectional dependence. Therefore, rejection of the null hypothesis may indicate a specification problem of relevance to us.

Table 5
Results of cross-sectional dependence tests

	CPI		GDP	
	(1)	(2)	(1)	(2)
CD	3.34	3.36	1.04	1.19
	(0.001)	(0.001)	(0.298)	(0.234)
CDw	1.16	–0.75	0.69	0.04
	(0.246)	(0.456)	(0.489)	(0.972)
CDw+	96.22	90.83	84.79	84.16
	(0.000)	(0.000)	(0.000)	(0.000)
*CD**	–0.5	0.77	–1.63	2.76
	(0.615)	(0.441)	(0.103)	(0.006)

Note: p-values in brackets

The tests show a mixed picture (*Table 5*). For inflation regressions, two tests (CD and CDw+) reject the null hypothesis even at a significance level of one per cent. The other two cannot reject H0 at conventional significance levels. It should also be considered that one test that rejects weak cross-sectional dependence is prone to Type I errors (CD test).

Of the regressions on GDP growth, only one test for weak dependence is rejected for the model with the IRR indexed (*Column 1*) and two for the model with the HK index (*Column 2*). As the tests are presented primarily due to the surprisingly strong growth effect of central bank independence, it is noteworthy that in the model where this effect is much stronger, three out of four tests find no specification error.

All of this leads us to conclude that the estimated strong effects are unlikely to be the result of cross-sectional dependence.

Implementing Monetary Policy in Hungary Under Flexible Inflation Targeting*

István Ábel – Pierre L. Siklos

Stabilising properties have always been an important aspect of monetary policy implementation, albeit with due recognition of the economic environment. We develop a simple theoretical model to evaluate the main elements in the choice of policy strategy aimed at inflation control. While the analytical framework is useful to assess different monetary policy frameworks, our focus is the flexible inflation targeting framework that provides a role for exchange rate fluctuations. Empirical evidence, relying on Taylor rules, suggests that monetary policy has been practiced with considerable flexibility in Hungary and has contributed to business cycle stabilisation.

Journal of Economic Literature (JEL) codes: E31, E32, E52, E58, E61

Keywords: flexible inflation targeting, monetary policy, Taylor rule, stabilisation policy

1. Introduction

This paper examines the relationship between economic policy, particularly monetary policy, and the business cycle in Hungary which is an emerging economy that also happens to be a member of the European Union. This topic continues to interest researchers and there are no signs of a let-up of interest among academics and policy-making circles, especially considering events over the past two decades. Moreover, the series of crises, both economic and geopolitical, has once again attracted the attention of analysts interested in how central banks conduct monetary policy under difficult conditions. Indeed, some observers have questioned not only whether central banks have lost their autonomy, but whether autonomy remains a desirable institutional feature in the manner it was designed several decades ago. *Friedman* (*1962*), for example, pushed back against modern notions of central bank independence by noting how monetary authorities can use crisis

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

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conditions to their advantage, implying that central banking is less technical and more political (see also *Wachtel and Blejer 2020*).

Friedman's forerunners in Chicago, especially *Henry C. Simons* (*1934*, *1936*, *1948*) and *Lloyd Mints* (*1945*, *1950*), long ago highlighted the need for a central bank to have a clearly defined mandate. More precisely, the monetary authority should be limited to achieving price stability alone.[1] The Chicago tradition also expressed the hope that this strategy would ensure that monetary policy would not be used for political purposes, that is, as a device to inflate the economy before elections. As a result, there is a well-developed intellectual connection between the concepts of price stability, central bank autonomy and the continuing preference for a monetary policy strategy that focuses on inflation performance.

Even if price stability is the optimal goal, there remains the question of what kind of monetary policy strategy is required to deliver price stability? Several decades ago, *Friedman* (*1948*) still entertained the possibility that it was somehow desirable for monetary policy to stabilise the business cycle and limit inflation. But over ten years later, he rejected this view (*Friedman 1960*), concluding that such an outcome is not feasible. Indeed, he arrived at the now often repeated conclusion that monetary policy acts with long and variable lags. The lag is relatively long (up to two years or longer). An even bigger problem is that the time span of the lag is variable and unpredictable. Empirical evidence appears to support this result (e.g. see *Havranek and Rusnak 2013*).[2] Eventually, the macroeconomic costs arising from a discretionary monetary policy were formalised in the seminal work of *Kydland and Prescott* (*1977*).

Since shortly after the end of the pandemic of 2020, renewed concerns over inflation risks emerged owing to continuing loose monetary policies, the fiscal response to the pandemic and demographic factors, to name just three factors (inter alia, see *Goodhart and Pradhan 2020*; *Bordo and Levy 2020*; *Gopinath 2021*; *Sternberg 2021*).

Goodfriend and King (*1997*) argued that the pessimism expressed by Friedman regarding inflation targeting was exaggerated. The periods highlighted by Friedman were not ones when price stability was the monetary policy strategy in place. The introduction of unconventional monetary policies (UMP) renewed attention to the

[1] Price stability should be understood here to mean inflation control. Whether there are biases in the measurement of inflation or relative price adjustments that temporarily show up in headline price level data price stability has come to mean low and stable inflation not necessarily zero inflation. A separate strand of the literature has explored the desirability of price level targeting (e.g. see *Bernanke 2017*). A discussion of this type of policy strategy is beyond the scope of this paper.

[2] Several factors explain this conclusion. It takes time to gather data, but it also takes time for decision-makers to understand the implications of these data and formulate a response, not to mention ensuring that the data forming the basis of their decisions are trustworthy (internal delay). This is reflected in the potential for monetary policy mistakes in failing to account for revisions to real time data (e.g. *Croushore 2011*, *Orphanides 2001*).

economic consequences of central banks' balance sheets and, by implication, the behaviour of monetary aggregates. Nevertheless, there continue to be discussions about the relationship between interest rates, inflation and economic slack that is addressed by the Taylor rule. Indeed, the continued popularity and usefulness of this policy rule is explained by how well it encapsulates how nominal and real economic forces influence the way central banks set the stance of monetary policy.

Emerging market economies (EMEs) are also affected by these issues because resilience to macroeconomic shocks in these economies is in question and institutions are believed to be weaker, despite significant progress over the past two decades (*Bordo and Siklos 2021*). These questions also continue to be relevant in the case of Hungary. Interestingly, while the idea that inflation and output gaps alone are sufficient to explain how central banks set the stance of monetary policy, the role of exchange rate fluctuations has been displaced as inflation targeting is seen as synonymous with a fully floating exchange rate.

Central banks in emerging markets continue to insist that best practices in monetary policy adopted from the experience of more advanced economies, including the application of inflation targeting, should remain in place. However, central banks in these countries also continue to publicly advocate for the need to balance inflation control and other traditional means of ensuring monetary discipline, such as limiting exchange rate fluctuations via verbal or other forms of intervention (e.g. *Feldkircher at.al. 2021*; *Hofman et. al. 2020*; *Nagy Mohácsi et al. 2024; Pourroy 2012*).

The principal aim of this paper is to assess, in light of exchange rate developments, how monetary policy contributed to business cycle stabilisation in Hungary. Practical considerations suggest that exchange rates play a more important stabilisation role in Hungary than given credit by the existing literature. Indeed, a form we refer to as flexible inflation targeting is practiced, which may help explain the success of the Hungarian central bank in its effort to stabilising business cycle fluctuations. This form of flexible inflation targeting manifests in a more explicit concern for exchange rate movements than in the inflation targeting regimes of central banks in larger and more advanced economies and is an under-appreciated element of the policy strategy adopted in Hungary (see also *Nordstrom et al. 2009*).

The remainder of the paper is organised as follows. *Section 2* outlines a simple model to allow a focus on the key points of debate about what is meant by best practice in the design of monetary policy. In the interests of simplicity, our model ignores dynamics only because conclusions about the role of the exchange rate are not altered by formulating a more complex model. However, our approach provides

an explicit role for the exchange rate, a variable which is left out in comparable analyses.[3]

In providing evidence, we offer a few stylised facts about the evolution of inflation and the output gap and the real exchange rate in Hungary, via an ex-post factual assessment of the aggregate macroeconomic experience. Hungary's experience illustrates the negative correlation between inflation and output gaps when central banks indicate a concern over exchange rate movements.

We then supplement the stylised facts with estimates of Taylor rules to further illustrate the notion of a flexible inflation targeting policy. This device has been adopted by many authors (e.g. *Hofmann and Bogdanova 2012*). Moreover, there is some consensus about the usefulness of Taylor type policy rules as a window through which monetary policy actions can be interpreted and understood. This approach allows us to show how the Magyar Nemzeti Bank (the central bank of Hungary, MNB) lowered policy rates more than would have been recommended by a Taylor rule prescription that leaves out exchange rate considerations. We also suggest that future research include the application of other methodologies (e.g. structural models, DSGE models).

The paper ends with a summary, and we also point out a few lessons for monetary policy design applicable to other EMEs.

2. A simple theoretical framework for monetary policy analysis[4]

One frequently used approach to the implications of monetary policy actions considers the role and functions of available policy instruments. Policy management can then be understood through rules that incorporate the impact of various instruments. The widely used Taylor rule (*Taylor 1993*; *McCallum and Nelson 2005*) is an obvious example. Of course, some have raised questions about this strategy (*Svensson 2005*).

In the following, we summarise the transmission of monetary policy via a simple theoretical model. The model has many well-known features found in most monetary policy models. However, our version aims to highlight interactions between the key macroeconomic variables used to interpret the conduct of monetary policy in countries such as Hungary. The model is used to solve for the monetary policy instrument which then responds to an assumed structure of the economy. As demonstrated below, even in this model, the Taylor rule remains an

[3] Clearly, UMP created challenges for all central banks. However, this type of policy can be accommodated within the same flexible inflation targeting policy framework. Also, the role of the exchange rate is unaffected by UMP.
[4] The material below draws heavily on *Ábel and Siklos* (*2023*).

important ingredient to interpret monetary policy decisions. Dynamics are left out both for simplicity and because the principal conclusions would be left unchanged by resorting to a more complex model.

The works of *Walsh* (*2002*), used in *Bofinger et al.* (*2006*) and *Bofinger and Mayer* (*2006*), inspire the discussion below. A similar approach is presented in *Carlin and Soskice* (*2014*) and is called the 3-equation model of macroeconomic policy used to analyse economic stabilisation (*Carlin and Soskice 2014: pp. 80–115*). Our framework can also be extended, as in *Ostry et al.* (*2012*), to take account of a role for the exchange rate in an open economy and this is the feature incorporated below. Of course, a role for the exchange rate as a policy instrument in EMEs has also been incorporated in other works (e.g. *Siklos and Ábel 2002*).

Assume that inflation is described as follows:

$$\pi = \pi^e + ax - ve + \varepsilon_1, \tag{1}$$

where, π is the rate of inflation, π^e are inflation expectations, and x is the output gap. The exchange rate, e, is such that an exchange rate appreciation (a positive value) reduces inflation. The v parameter captures pass-through effects from exchange rate changes to inflation. All other neglected factors (i.e. supply shocks) are relegated to the residual term ε_1. The output gap is defined as:

$$x = \frac{y - y^n}{y^n}, \tag{2}$$

where y^n represents potential output. Equation (1) is a model of inflation where inflation expectations change one for one with inflation. Inflation, also responds positively to any overheating of the economy as reflected in a positive output gap. Equation (1) is nothing more than a Phillips curve (PC) where the impact of exchange rates is included. In theory, equation (1) permits the derivation of sound economic policies aimed at curbing inflation expectations (fixing the anchor) while seeking to balance observed economic activity against potential. This implies an explicit objective function of the following form:

$$(\pi - \pi^T)^2 + dx^2 + he^2 \longrightarrow min \tag{3}$$

Equation (3) reflects the objective, captured by the arrow to the right, that it is desirable to minimise loss by focusing on deviations from an inflation target, π^T. The form of equation (3) is easy to criticise, but the contents reflect the main concerns frequently expressed by policymakers in their speeches and other public communications. The quadratic form, captured by the squaring of the variables, significantly penalises larger deviations from zero in the inflation target or output gaps relative to smaller ones. Since a deflationary slump is rare in most EMEs, it is useful to think of equation (3) as reflecting the challenge of minimising the

overshooting of inflation, which is a much more frequent occurrence. The parameter *d* lets the policymaker choose whether to place relatively more emphasis on the output gap than on inflation, or vice-versa. The last term in equation (3) captures the desire for exchange rate stability.[5]

When considering the implications of this model, we use equation (1) of the Phillips curve as a restriction in the Lagrangian function of the conditional minimisation written as follows:

$$L = (\pi - \pi^T)^2 + dx^2 + he^2 + \lambda(\pi - \pi^e - ax + ve - \varepsilon_1) \longrightarrow min \tag{4}$$

The optimum first order conditions for minimisation of the loss function, *L*, are obtained by using expressions for *x* and π to obtain:

$$\lambda = \frac{2d}{a}x \tag{5}$$

$$\lambda = -2(\pi - \pi^T) \tag{6}$$

The conditions in equations (5) and (6) imply the following requirement for policy implementation, namely:

$$\pi - \pi^T = -\frac{d}{a}x \tag{7}$$

Equation (7) captures the relationship that requires the monetary authority to formally meet the inflation target, as shown by *Svensson* (*2005: p. 618*). The result is also consistent with the expression in *McCallum and Nelson* (*2005: p. 603*) who focus on instrument rules instead of targeting rules.[6]

A positive output gap is normally associated with higher inflation, and thus the monetary rule described by equation (7), which predicts a negative correlation between the inflation gap and the output gap, deserves further discussion. The monetary rule described above defines the required central bank response under inflation targeting and leads to an inverse relationship between the output gap and

[5] We kept some ambiguity about the exact representation of exchange rate in the model. Interpreting the exchange rate variable *e* as a nominal exchange rate makes the interpretation of the simple model more straightforward. We could just as well use the real exchange rate here: This would not make any difference in the derivation of the model as the exchange rate is not optimised and is not considered as a policy variable. The specification can also reflect the gap between actual and equilibrium exchange rates, but we did not want to add additional ambiguity by specifying how the equilibrium exchange rate is determined. A further complication considering the exchange is its endogeneity. Changes in the monetary policy variables may generate changes in the exchange rate. We do not want to go into the complexities of how exchange rates are determined so we omitted these considerations also. From equation (7), however, we observe that this term has no major consequences for the simplified model, which focuses on the basics of inflation targeting regardless of how the exchange rate variable is specified or interpreted. The challenges associated with estimating the equilibrium exchange rate are well known.

[6] The third term in equation (3) captures the policymaker's aim for exchange rate stability. See also *Ábel and Siklos* (*2023*) for issues related to the concept of an equilibrium exchange rate which is outside the scope of this paper.

the inflation gap, stating that the central bank must reduce output (or aggregate demand) below its potential level so that inflation declines.

We now require some expressions to capture changes in the central bank's nominal policy rate to derive the central bank's reaction function.[7] Again, we start with equation (1). Next, an expression to explain the determinants of aggregate demand in the economy is necessary, which is also influenced by interest rate developments and provides the channel through which monetary policy is transmitted to the rest of the economy.[8] Therefore, we introduce an IS curve to capture the investment-saving relationship. The traditional IS curve describes how a change in real interest rates affects demand, via investment spending, which then influences the output gap. Therefore, we write:

$$x = b - c(i - \pi^e) + \varepsilon_2, \tag{8}$$

where *i* denotes the nominal interest rate. The negative correlation between real interest rate and the output gap is a typical feature of the IS curve. The term ε_2 is a residual that captures demand shocks.

A monetary rule, such as equation (7), describes the link between a central bank's policy instrument (*i*), inflation (π) and the output gap (*x*) function. Taylor's rule (*Taylor 1993*) posits a similar relationship between an inflation gap, an output gap and the central bank's policy rate. Since both inflation and the output gap are endogenous variables in the model, this leads to various ways of expressing the central bank's reaction function (e.g. see *Svensson and Woodford 2005*).

If we substitute equation (1) into the monetary rule (MR) of equation (7), this yields the following expression for the output gap:

$$x = \frac{a}{a^2 + d}(\pi^T - \pi^e) + \frac{a}{a^2 + d} ve - \frac{a}{a^2 + d}\varepsilon_1 \tag{9}$$

Substituting *x* into equation (9) and using the IS curve expression from equation (8) leads to the following solution for the nominal interest rate, here the central bank's instrument of monetary policy:

$$i = \frac{b}{c} + \pi^e + \frac{a}{c(a^2 + d)}(\pi^e - \pi^T) - \frac{va}{c(a^2 + d)} e + \frac{1}{c}\varepsilon_2 + \frac{a}{c(a^2 + d)}\varepsilon_1 \tag{10}$$

A central bank reaction function of the form (10) expresses the notion that when expected inflation exceeds the inflation target the policy rate is raised. It is also important for the effectiveness of monetary policy that the real interest rate ($i - \pi^e$)

[7] Most central banks, at least until the financial crisis of 2008–2009 used an interest rate as an instrument to tighten or loosen policy. This strategy has not changed, although many central banks also rely on other instruments to complement the policy rate. Indeed, the pandemic encouraged the spread of UMP beyond advanced economies. See, for example, *Fratto et al.* (*2021*).

[8] That is, changes in interest rates affect inflation and output developments through changes in aggregate demand.

increases in line with the increase in the nominal interest rate (i.e. the so-called Taylor principle). Note also that the exchange rate plays a role by appreciating in response to the higher domestic real interest rate. Finally, positive shocks to the output gap also lead to a monetary policy tightening. Hence, equation (10) retains the ingredients of the standard Taylor rule but adds a response from exchange rate fluctuations.

The theoretical construct above provides some background to explain the evolution of inflation, exchange rates and monetary policy in Hungary. In doing so, of course, many issues are abstracted from. Our focus is whether monetary policy in Hungary has been successful in stabilising economic outcomes consistent with the objective of price stability in the form of an inflation target. As argued in the introduction, the lags in effect in monetary policy make it difficult to precisely assign the timing of a central bank's responses to various shocks.[9] Hence, dynamics are difficult to specify. We now turn to some empirical evidence.

3. Empirical evidence

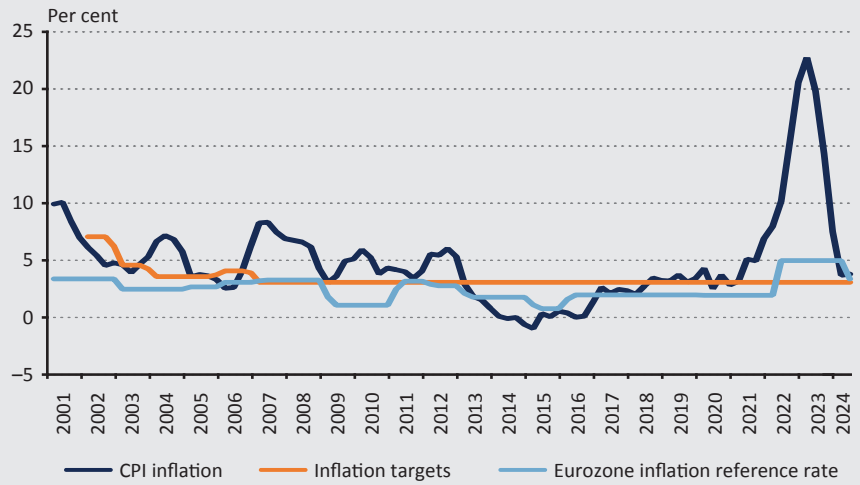
Inflation targeting was introduced in Hungary in 2001.[10] We begin with a few stylised facts to assess the relationship between inflation, exchange rates and the output gap, considering the theoretical relationships derived above before concluding with supplementary evidence relying on Taylor rules.

3.1. Stylised fact I: Inflation, inflation targets and the real exchange rate

Figure 1 depicts the evolution of observed CPI inflation (solid line), inflation targets and the inflation reference values used to determine inflation performance according to the Maastricht Treaty requirements.[11] The Maastricht reference inflation rate is the rate of inflation of the European Union member countries with the three lowest inflation rates, plus 1.5 per cent.[12] Since at least the Eurozone Sovereign Debt Crisis (ESDC), the date of euro adoption has been pushed back indefinitely in Hungary. Indeed, there are no announced plans to join the euro in a specific time.

[9] Of course, the model's implications will rest partly on how expectations are determined. While this is true, it does not change the policymaker's problem of reacting to gaps between observed and expected values. How expectations are determined is outside the scope of this paper.
[10] The appendix in *Siklos* (*2017*), and *Bordo and Siklos* (*2021*) contain the dating and details about inflation targeting regimes around the world.
[11] The EU Commission and the ECB regularly update the reference inflation value for Eurozone entry via convergence reports, generally every two years. Convergence involves several quantifiable criteria. The academic profession has tended to focus on inflation performance. Experience suggests that judgment is also involved in deciding the timing of admission into the euro area [e.g. see *Mody* (*2018*), and *Brunnermeier et. al.* (*2016*)]. See https://ec.europa.eu/info/business-economy-euro/euro-area/enlargement-euro-area/convergence-reports_en.
[12] See http://europa.eu.int/comm/enlargement/negotiations/chapters/chap11.

Figure 1
Inflation and inflation targets in Hungary, 2001Q1–2024Q2



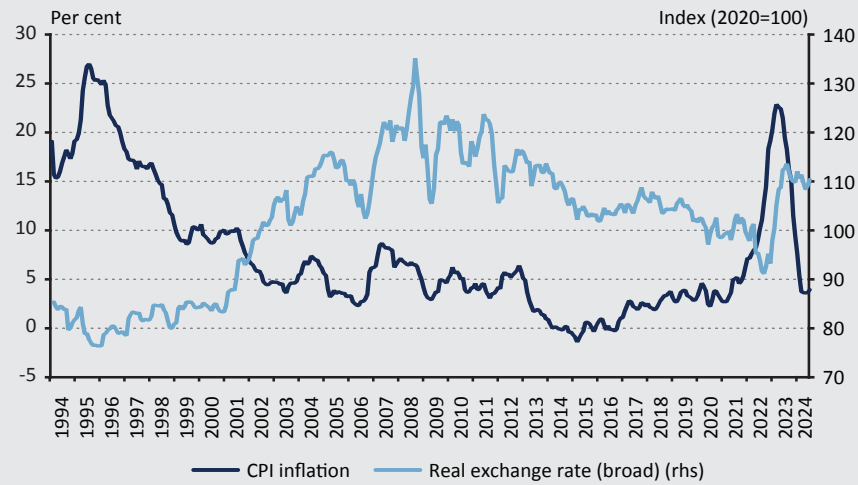
Sources: Magyar Nemzeti Bank (inflation target), Bank for International Settlements (CPI inflation), and ESTAT (https://ec.europa.eu/eurostat/cros/category/acronyms/estat_en) for convergence reference inflation rates (EUR_CONV). Convergence reports are published approximately every two years. The figure assumes that the reference inflation rate remains unchanged between reports. Data are in per cent and are quarterly.

Figure 1 reveals several interesting features in the data. The euro reference rate is more often than not lower than observed inflation. Moreover, inflation largely was on a downward trend between 2001 and 2016. The trend has been interrupted three times. The first occasion was in 2003–2004, just before Hungary entered the EU, and then again in 2007–2008 as the Global Financial Crisis (GFC) spread beyond the US economy and, finally, the noticeable surge in inflation that accompanied the COVID pandemic. Examining the inflation targets, these have mostly proved to be too optimistic relative to outturns, at least until the ESDC. It is only toward the end of the sample, but before the global pandemic, that actual inflation and the inflation targets overlap for a time. It is also worth noting that the euro area reference inflation rate varies far more often than does the MNB's inflation target.[13]

[13] *Golinelli and Rovelli* (*2005*) show progress toward convergence to the EU reference inflation rate in the period of their study (quarterly for the 1991Q1–2001Q1 period). *Siklos* (*2010*) also reports progress towards convergence for the period 1995Q1–2007Q4.

Figure 2 plots observed CPI inflation (left hand scale) against the CPI-based real exchange rate measured on the right hand scale. Data are monthly. The pre-GFC period is marked by real exchange rate appreciation which is then reversed after the financial crisis. There is, once again, a sharp appreciation in the aftermath of the pandemic. Relative to the early days of inflation targeting, the real exchange rate at the end of the sample has appreciated while inflation has generally varied around the domestically set inflation targets (see also *Figure 1*), that is, until the COVID crisis.

Figure 2
Inflation (HICP) in Hungary and the real exchange rate, 1994–2024



Note: The real exchange rate (REER) is CPI-based and is based on 42 trading partners (broad version). Data are in per cent. The unconditional contemporaneous correlations in the table below are for the series plotted above. p-values are in parenthesis. Data are monthly.

2000M1–2007M6 (pre-crisis)	*2000M1–2024M05 (full)*
–0.57 (0.00)	*–0.38 (0.00)*

Sources: Bank for International Settlements

The (unconditional) relationship between inflation and the real exchange rate is often negative, as predicted by equation (1).[14] That said, the results can be sensitive to the sample in question (results not shown), likely due to the impact of the three

[14] For a detailed description of the inflation targeting framework and maintaining the exchange rate system in Hungary and the neighbouring countries, see *Ciżkowicz-Pękała et al.* (*2019*).

great crises during the sample considered. The table in the note to *Figure 2* provides estimates of the correlation between the two series plotted in *Figure 2* for the pre-GFC as well as the entire sample. Both estimates are negative and statistically significant. Hungary's exchange rate was managed until 2008.[15] The data give the distinct impression, in the early part of the sample, that the convergence of inflation to the European benchmark was largely made possible by the strengthening of the domestic currency, the forint. Other than a brief surge around the time of the GFC, when real exchange rate behaviour is largely consistent with the model outlined in this paper, inflation remained stable, that is, until the COVID pandemic.

Although we would expect a negative relationship between inflation and the real exchange rate, it is important to keep in mind that this also assumes that pass-through effects [the coefficient *v* in equation (1)] are constant. As *Mihaljek and Klau* (*2008*) and *Jašová et al.* (*2016*) have reported, however, pass-through effects have declined in most emerging markets. It is interesting to note that the effects are asymmetric with pass-through changes different for appreciations than for depreciations.

Policy toward the exchange rate in Hungary, broadly speaking, reflects an active concern about how these threaten achieving domestic inflation objectives. It is fair to say that, prior to the ESDC, real appreciations dampened inflationary pressures. Thereafter, the effect was reversed somewhat in large part because of the offsetting effects of the loosening of monetary policy stance. We return to this aspect of stabilisation policies below.

3.2. Stylised fact II: The output-inflation gaps relationship

It is well-known that there is no consensus on how to best estimate the output gap. As a result, many filters have been proposed to estimate trend or potential output. The most popular and best-known filters include the Hodrick-Prescott (H-P), band pass (*Christiano and Fitzgerald 1999*), and Hamilton (*Hamilton 2018*) filters. Often, due to the non-stationarity of levels of (log) real GDP, first differences (i.e. annualised growth rates) are also often used as a proxy for cyclical output variations. Central banks, typically, blend various techniques to estimate the output gap or rely on some aggregate production function (see, for example, *Roeger et al.* (*2019*) for the European case). *Blondeau et al.* (*2021*) is the latest addition of estimates of the output gap in the EU. *Drehmann and Yetman* (*2020*) proved a recent evaluation of various univariate filters and *Hamilton and Leff* (*2020*) revisit some of their results.

[15] In Hungary, a crawling peg exchange rate system with a fluctuation band of +/– 2.5 per cent guided monetary policy between 1995 and 2001. The band of exchange rate fluctuations was widened to +/– 15 per cent in 2001 and was maintained after the introduction of the inflation targeting system. Maintaining a dual target (inflation target and exchange rate band) created a potential conflict, but the main concern about losing competitiveness because of exchange rate appreciation kept the system in place until 25 February 2008, when a floating regime was introduced.

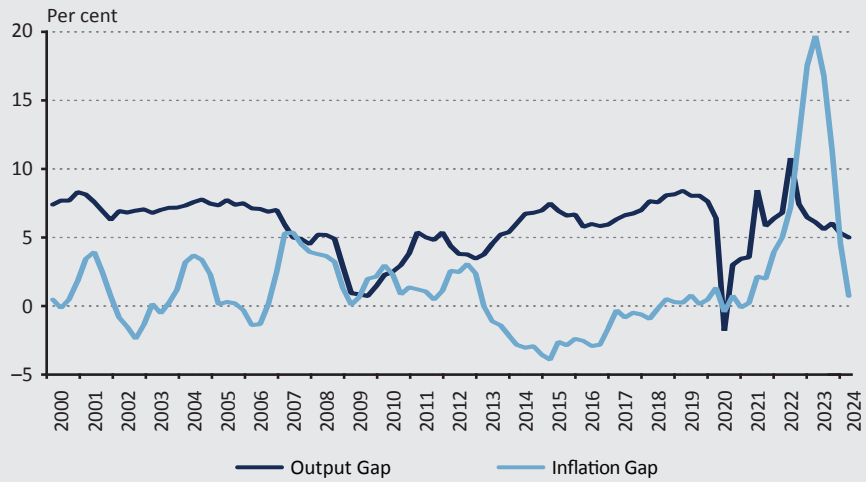
We consider what happens when we arithmetically average the Hamilton, H-P and band pass filters, together with the growth rate of real GDP.

The results of monetary policy actions may show up with long and variable lags. Therefore, while theory requires that the output and inflation gaps move in opposite directions, i.e. that the two processes are negatively correlated as seen from equation (7), the relationship is not expected to be contemporaneous. Indeed, the strength of the relationship is a function of the policymakers' aversion to the inflation and output gaps.[16] As stressed earlier, the relationship in equation (7) is expressed without time subscripts. In practice, of course, it is likely that the lags in policy referred to above also operate and this will also impact the Taylor-type rule that describes how the policy rate is set according to equation (10).

Figure 3 displays the evolution of inflation and output gaps in Hungary for the period from 2000 through early 2024. The main features of the data suggest a negative correlation between the two, albeit with a lag consistent with the observations made in the introduction about lags in monetary policy. The table in the note to *Figure 3* confirms this prediction. If, as is typically observed, prices are more flexible than output changes, combined with the desire to keep inflation near the central bank's inflation target as the means to ensure that output is also near potential, we would expect changes in contemporaneous inflation gaps to be reflected in future output gap changes. This is, in fact, what is observed in Hungary. A rise in the current inflation gap translates into a decline in the output gap several quarters into the future for the full sample (2000–2024), and the negative correlation remains even if we exclude the COVID and post-pandemic periods. Of course, the cross-correlations shown are unconditional. Hence, monetary policy alone may not have generated this outcome. Accordingly, we turn to additional evidence relying on varieties of Taylor rules.

[16] For example, in Norway, a small open economy like Hungary albeit resource rich, the Norges Bank relies on six criteria to generate an appropriate future interest rate path. The second criterion stipulates that "the inflation gap and the output gap should be in reasonable proportion to each other until they close. The inflation gap and the output gap should normally not be positive or negative at the same time further ahead." (*Kloster – Solberg-Johansen 2006: p. 119*). This approach is one that is generally followed in most inflation targeting central banks.

Figure 3
Inflation gap and output gaps in Hungary, 2000–2024



Note: Quarterly data are expressed in per cent. The inflation gap is calculated as the difference between the annualised CPI inflation less the inflation target (see Figure 1). The output gap estimation is explained in the main body of the paper and is the average of four filters applied to the logarithm of real GDP. The table below shows the peak negative unconditional cross-correlations between current inflation gap, labelled t in parenthesis, and the lagged (t-#) or lead (t+#) output gap for the full sample and the crisis sample (2010–2019).

Peak Negative Cross-Correlations

Samples	
2000Q1–2024Q1	*2010Q1–2019Q4*
–0.20 (t,t+10)*	*–0.23* (t,t+10)*

** indicates that the correlations are statistically significant at least at the 10 per cent level.*

Source: See Figure 1.

3.3. More formal evidence: Taylor rule estimates

We now extend the analysis by examining the claims in this paper through the lens of monetary policy instrument rules. It is important to note that, by the end of the sample, unlike the ECB and central banks in advanced economies, the MNB did not engage in QE-style policies to the same degree as in advanced economies (see *CGFS 2023*), nor did it reach the effective lower bounds (viz. negative interest rates), although it did come close.[17] This makes it easier to rely on conventional style policy rules to investigate the time-varying policy stances of the MNB.

[17] Policy rates did briefly come close to, but did not reach zero during the height of the pandemic (i.e. 2020Q4 and 2021Q1). However, like many other emerging markets, the MNB tightened policy earlier and faster than all advanced economies. See, for example, *Evdokimova et al.* (*2023*) and *Nagy Mohácsi et al.* (*2024*).

Mackiewicz-Łyziak (*2016*) report regime switches from active to passive monetary policy practices in Hungary and other central European countries. A passive regime is characterised by strong smoothing of the interest rate (*Mackiewicz-Łyziak 2016: p. 133*). Such persistence in interest rates to expected inflation or output gaps may be justified by uncertainty and concerns about the perceptions of the public and the market's confidence in the central bank. Interest rate persistence is a well-known and widely documented phenomenon. Monetary policies in countries such as Hungary suggest significant interest rate smoothing (e.g. see also *Mackiewicz-Łyziak 2016*, and see below).[18]

However, owing in part to disagreement about estimates from policy rules, the existing literature relies on simpler versions of the reaction function than the one derived in equation (10), especially the omission of exchange rate effects.

There is, of course, a vast body of literature dealing with estimated and calibrated versions of the Taylor rule. *Orphanides* (*2003*) and *Kahn* (*2012*) provide good overviews. Despite the simplicity of the rule, challenges exist when interpreting the stance of monetary policy using this approach. Two stand out especially. First, there continues to be considerable uncertainty surrounding the measurement of the output gap as previously noted. A similar problem applies to estimates of the real exchange rate gap. In recent years, policy rules must also deal with the decline in the neutral real interest rate, that is, the so-called r^*.[19] There is some evidence that it has also declined in some emerging markets (e.g. Brazil and Mexico, see *Perrelli and Roache 2014*; and *Carrillo et al. 2018*). The extant literature dealing with EMEs also considers whether estimated Taylor rules have been subject to structural breaks (e.g. *Galimberti and Moura 2013*; *Yilmazkuday 2008*), or are subject to non-linearities (e.g. *Klose 2019*), though usually not simultaneously with recognition of a changing r^*.

We rely on estimated rules based on Taylor's original formulation (*Taylor 1993*). However, as noted above, we also estimate versions with a time-varying neutral real rate.[20]

[18] In exceptional circumstances, such as a perceived speculative attack or the global financial crisis, monetary policies tend to switch in favour of an active regime where the interest rate reaction to expected inflation or output gap is stronger (*Mackiewicz-Łyziak 2016: p. 134*). Debate over the stochastic properties of nominal interest rates, and central bank policy rates in particular, has abated since the GFC. Evidence is generally favourable to the interest rate smoothing phenomenon. Inter alia, see *Romero-Ávila* (*2007*), and *Coibion and Gorodnichenko* (*2012*).

[19] While there is a consensus that the neutral real rate has declined over the past decade or more, there is also a great deal of uncertainty around point estimates as well as the precise source(s) of the decline.

[20] Estimates are based on a so-called state space model where $R_t = R_t^* + u_t$ and $R_t^* = R_{t-1}^* + v_t$ is latent (i.e. unobserved) which follows a random walk (i.e. only the immediate past value helps forecast its future value). The observed interest rate, R, fluctuates around R^*. Since the Kalman filter estimates are volatile, we apply an H-P filter (smoothing parameter of 100,000) and use these estimates of r^* to generate the estimates in the table in the note to *Figure 2*.

Next, since we argue that the exchange rate plays a separate role in setting the stance of monetary policy, we extend the original Taylor rules described above by adding a real exchange rate gap. Parallel to the output gap, this gap is estimated as the arithmetic mean of gaps estimated with the four filters previously described. For the real exchange rate there is no consensus about the expected size of the coefficient, but empirical evidence suggests that the coefficient is smaller than ones obtained for either the inflation or output gaps (e.g. see *Engel and West 2006*).

The inflation target π^* is proxied either by the stated inflation target or the inflation criterion of the EU Commission in their convergence reports. The output gap is constructed from real GDP data, we also consider using the mean of a variety of filters (viz. one-sided H-P, Hamilton, and real GDP growth rate) in addition to the estimates obtained from the central bank. Finally, there are cases where expected inflation is proxied by a one-year inflation forecast, while the output gap is replaced by an estimate of a one-year forecast of real GDP growth relying on the forecasts from the World Economic Outlook.[21]

Theory suggests that a positive inflation gap (viz. inflation above the target) accompanies a positive output gap (i.e. observed output is above potential), while a positive real exchange rate gap signals exchange rate appreciation that exceeds the equilibrium proxy and would serve to dampen both the inflation and output gaps in the future. This suggests then that the central bank actively contributed to business cycle stabilisation thanks to the implementation of a flexible form of inflation targeting. The so-called Taylor principle (e.g. see *Taylor 1999*) suggests that the steady state coefficient on inflation should be at least one to indicate that a positive shock to the inflation gap is met by a larger than proportional rise in the policy rate. The basic inertial version of the Taylor rule, if it is written as an estimated regression, is:

$$R_t = r^* + \pi_t^* + \beta_0(\pi_t - \pi_t^*) + \beta_1 \tilde{y}_t + \rho R_{t-1} + \varepsilon_t \qquad (11)$$

where R_t is the policy rate, r^* is the neutral real interest rate, which may be time-varying (i.e. written as r_t^*), π^* is the inflation target. For Hungary, the inflation target is shown in *Figure 1*. The remaining variables are π_t, the observed CPI inflation rate, so that $(\pi_t - \pi_t^*)$ is the inflation gap, while $\tilde{y}_t$ is the output gap. In *Taylor's* (*1993*) original calibrated specification β_0, β_1 are both set to 0.5. *Taylor* (*1999*) and *Yellen* (*2012*) raise the calibrated value of β_1 to 2, partly in recognition of the US Federal Reserve's dual mandate.

[21] These are semi-annual forecasts. We assume that the forecasts remain constant over two quarters, although converting the semi-annual forecasts to quarterly forecasts using the Chow-Lin method has no impact on the conclusions.

Returning to equation (11), at least one other extension can be considered. In view of the major crises that have impacted Hungary during the sample examined in our study, the possibility of structural breaks in the relationship would change the estimated coefficients in (11). While events can dictate the choice of break points, a preferred strategy is to let the data speak for itself. Accordingly, we write

$$R_t' = \delta_0 D_{t\leq\kappa} + \delta_1 D_{t>\kappa} + \nu_t \tag{12}$$

where $D_{t\leq\kappa}$ and $D_{t>\kappa}$ are dummy variables such that a break takes place at time κ with the estimation of the break date based on Bai and Perron's structural break test (see *Bai and Perron 1993*). While, for simplicity, equation (12) assumes a single break, we actually consider the possibility that more than two structural breaks are possible over the 2000–2024 period. Estimates of equation (12) are referred to as conditional Taylor rules as estimates are conditioned on the possibility of structural breaks.

Finally, since the claim of this paper is that the flexible form of inflation targeting practiced by the MNB requires sensitivity to exchange rate developments, we also estimate versions of equation (11), assuming either constant or time-varying neutral rates, with the addition of a real exchange rate gap. The extended model is thus written

$$R_t = r^* + \pi^* + \beta_0'(\pi_t - \pi_t^*) + \beta_1'\tilde{y}_t + \beta_2'\widetilde{reer}_t + \rho R_{t-1} + \varepsilon_t, \tag{13}$$

where $\widetilde{reer}_t$ is the real exchange rate gap. Equation (13) is referred to as an extended policy rule.

Estimation results are provided in *Table 1* in the *Appendix*. Two sets of estimates are presented, depending on whether the neutral real rate is time-varying (first four columns) or not (last four columns). While there are a few differences depending on whether the neutral real interest rate is time-varying, there is at least one striking result that consistently emerge across all varieties of estimated Taylor rules. First, in line with the central hypothesis of this paper, the MNB has shown significant sensitivity to the real exchange rate gap. Indeed, the size of the steady state response is often at least as large as that of the steady state output gap effect on the policy rate. Therefore, appreciation of the exchange has allowed the central bank to reduce the policy rate. This is in line with the simple model developed in this paper.

There are a couple of other important findings that emerge from the results shown in *Table 1*. First, the MNB has largely followed the Taylor principle, since the steady state estimates shown for the inflation gap are greater than one regardless of the estimated form of the Taylor rule. Next, the MNB has also shown that it is responsive to the output gap in the manner predicted by theory. In several cases, the size of the

steady state coefficient is comparable to some of the calibrated Taylor rules used to illustrate the conduct of monetary policy in advanced economies. Finally, we also note that three structural breaks are always found and these take place around Hungary's entry into the EU, the GFC, or the COVID 19 pandemic. Once estimates are conditioned on these breaks, our proposition on the role of the exchange rate in the conduct of monetary policy in Hungary is still supported. Moreover, the steady state responses of the three gaps are largely unchanged, although reliable estimates hold for a slightly smaller sample.[22]

3. Summary and conclusions

The implementation of monetary policy is occasionally discussed from the traditional theoretical framework of macroeconomics. The central bank's policy autonomy gives the outside observer the misconception that monetary policy, especially in the form of inflation targeting, can be independent of any kind of real economic considerations. This misunderstanding also reinforces the view among some analysts that inflation targeting translates into ignoring other macroeconomic factors when the stance of monetary policy is set. In the case of small open economies, among EMEs this attitude is often interpreted as assuming that output and inflation gaps are sufficient in dictating the stance of monetary policy.

Our study begins with a simple theoretical model of monetary policy to establish a conceptual framework. The model links real economic activity, inflation and the exchange rate. We then consider the implications of the model for Hungary. Empirically, we show that real exchange rate developments play an important role in how the stance of monetary policy is set by the MNB, in addition to the traditional inflation and output gap variables.

Exchange rate fluctuations do not entirely succeed in protecting the domestic economy from foreign shocks. Most notably, how monetary policy is set by the ECB will also impact Hungary. This is not surprising. While Hungary is someday expected to adopt the euro, the time horizon for euro adoption has lengthened considerably. It is no longer a priority for Hungary and, indeed, for its neighbours, the Czech Republic and Poland.

The results of this paper argue in favour of the view that business cycle stabilisation is enhanced by involving exchange rate considerations which are not foreign to a flexible implementation of the inflation targeting approach. The conduct of monetary policy in Hungary highlights the recognition that monetary policy

[22] We only present conditional estimates for samples between the two major structural breaks, in part because the number of observations around these breaks is small. Hence, estimates for these often very short samples are unreliable.

autonomy is not constrained by incorporating exchange rate considerations in a framework where inflation control is the central bank's objective.

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Appendix

Table 1
Varieties of Taylor rule estimates

Variable	Standard	Conditional	Extended	Conditional Extended	Standard	Conditional	Extended	Conditional Extended
Full samples	2000Q1–2024Q1	2004Q2–2021Q4	2000Q1–2024Q1	2009Q1–2024Q1	2000Q1–2024Q1	2002Q1–2021Q4	2001Q1–2024Q1	2009Q1–2024Q1
Break samples	NA	2004Q2–21Q4	NA	2009Q1–24Q1	NA	2009Q1–24Q1	NA	2009Q1–24Q1
Constant	NA	NA	NA	NA	–0.09 (0.32)	0.09 (0.32)	–0.74 (0.37)**	–0.48 (0.18)***
π_t^{gap}	1.01(0.12)***	1.06 (0.31)***	1.18 (0.17)***	1.17 (0.12)***	1.16 (0.25)***	1.19 (0.36)***	2.47 (1.28)*	1.43 (0.20)***
y_t^{gap}	0.58(0.08)***	0.39 (0.10)***	0.55 (0.09)***	0.34 (0.07)***	0.81 (0.44)*	0.23 (0.61)	2.70 (1.96)	0.78 (0.22)***
$reer_t^{gap}$	NA	NA	–0.37 (0.16)**	–0.57 (0.16)***	NA	NA	–1.65 (1.21)	0.86 (.02)***
R_{t-1}	0.80(0.04)***	0.89 (0.05)***	0.82 (0.02)***	0.80 (0.04)***	0.89 (0.03)***	0.92 (0.03)***	0.95 (0.02)	–0.95 (0.22)***
r_t^*	0.19(0.06)**	0.06 (0.05)	0.17 (0.06)***	0.07 (0.06)***	NA	NA	NA	NA
Adj. R^2	0.95	0.96	0.95	0.97	0.95	0.96	0.95	0.98
Observations	97	71	97	61	89	71	89	61
Break dates	NA	2004Q2 2022Q1	NA	2005Q2 2009Q1	NA	2004Q2 2022Q1	NA	2004Q1 2009Q1

*Note:*** means statistically significant at the 1% (** - 5%;* - 10%) level of significance. Standard errors in parenthesis. Quarterly data for the samples shown. Variable definitions are given in the text. Table 1 provides two sets of estimates depending on whether the neutral real interest rate is constant or not. The first four columns represent the estimates using the constant neutral real interest rate. In this case the extended Taylor rule is of the forward-looking variety; otherwise, the policy rule is viewed as being backward-looking. Standard is the conventional Taylor rule as written in the main body of the text. Conditional is the Taylor rule shown conditional on the estimation of up to 2 structural breaks. Extended is the standard Taylor rule augmented by the real exchange rate gap. The gap is the mean of four filters applied to the logarithm of real GDP (see also Figure 3 and the main body of the text). Newey-West standard errors in parenthesis. Trim was 10 per cent except for the conditional extended Taylor rule with time-varying neutral real interest rate (trim = 15%). The null of L+1 versus L breaks is used to test, at the 5 per cent level, for the presence of at most 2 structural breaks. For the three gap variables the steady state estimates and standard errors are shown. The steady state is found by applying the expression $z_t = \beta/(1-\rho)$ where z_t is the steady state estimate for one of the three gap variables, β is the estimated coefficient on a gap variable [see equations (11) and (13)], and ρ is the estimated interest rate smoothing parameter.*

Challenges of Reducing Interest Expenses on the Minimum Reserve in Small Open Economies – The Case of Hungary*

Csaba Csávás – Pál Péter Kolozsi – Ádám Banai

Several central banks responded to the challenges posed by enlarged central bank balance sheets reported at the beginning of the 2020s and the higher interest rates resulting from the inflation shock by raising reserve requirement ratios and lowering the interest rates paid on the reserve requirement. After providing the relevant theoretical background, a brief historical overview and international examples, this paper examines the reform of the Magyar Nemzeti Bank's reserve requirement system between 2022 and 2024 as a case study. It presents the impact the steps may have had on banking behaviour and the market yield environment, and the responses of the central bank. Based on Hungarian experience, there are significant, strong limitations on reducing the interest rate paid on the minimum reserve: given the overall interest rate environment, such a move may reduce central bank interest expenses as a technical consequence, but this may be limited by the fact that the change may have unintended consequences for the general financial market environment and foreign currency availability. These unintended consequences may vary over time and space, depending on the economic-financial situation of the country and thus very cautious introduction should be considered. The Hungarian experience may be particularly relevant for small open economies that have less developed financial markets and use their own currency.

Journal of Economic Literature (JEL) codes: E41, E47, E51

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* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

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1. Introduction

Following the 2008 financial crisis, the functioning of central banks changed fundamentally,[1] one of the consequences of which was a substantial enlargement of central bank balance sheets. The resurgence of inflation following the Covid-19 crisis of 2020 and the energy crisis linked to the Russia–Ukraine war of February 2022 – which, in the classification of *Borio et al.* (*2023*), in many of its features gave rise to an economic-financial regime with high price dynamics not seen for decades – resulted in tighter interest rate policies worldwide. In conjunction with enlarged central bank balance sheets and banking system liquidity,[2] this led to a sharp surge in central bank interest expenses. This challenging operating environment[3] prompted global central banks to rethink their toolkits and instruments.[4] In this respect, one of the monetary policy instruments that was examined with special attention and scrutiny was the minimum reserve system.

Recently, for the reasons mentioned above, central banks have rediscovered the potential of minimum reserves as a monetary policy and central bank instrument, and several advanced and emerging market central banks have reduced the interest rate paid on minimum reserves. In addition to the attention also demonstrated in practice, modification of the minimum reserve has also become a topic of public economic policy and political debate, with respected economists making proposals on the interest rate on the minimum reserve, generating professional debates.

Some central banks pay no interest or only partial interest on the central bank reserve requirement. The issue of the minimum reserve and the interest paid on such is linked to a number of central banking issues that have materialised in recent years. During the tightening cycles, the focus shifted to mounting central bank losses and the related issue of capital replenishment.[5] Rising central bank interest expenses led to an increase in bank profits[6] and, because of the interest payments, the rise in banking system liquidity is a self-reinforcing process. While central banks do not have a profit objective, as public institutions, cost-effective operation of the monetary toolkit is also an important objective, provided that the central bank continues to achieve its primary objective. On the banks' side, if the rising profits can be considered as windfall profit, one instrument to deduct such may be the imposition of lower interest rates on the minimum reserve. The interest rate on the minimum reserve is also linked to liquidity in the banking system in several ways: for example, the sharp increase in liquidity contributed to the fact that interest rate

[1] *Vonnák* (*2017*).
[2] On its concept, see: *Kolozsi – Horváth* (*2020*) and *Monnet* (*2023*).
[3] *BIS* (*2024).*
[4] *Hoffmann – Kolozsi* (*2017*).
[5] See, among others: *Nordström – Vredin* (*2022*), *Belhocine et al.* (*2023*).
[6] *Banai et al.* (*2024*) demonstrate that the profitability of Hungarian banks was outstanding in 2023, with interest income from the MNB playing a crucial role.

hikes by the central bank only partially fed through to deposit rates, which led to an increase in bank profits. Moreover, in a context of abundant liquidity and high interest rates, interest payments may themselves have a liquidity-increasing effect, which, according to the quantitative approach, may even reduce the effectiveness of monetary tightening embodied in the high interest rates.

By presenting a case study on the reduction in the interest paid on the minimum reserve in Hungary, we wish to promote the inclusion of the country's empirical experience in the economic policy and political debate about the future role of reserve requirement systems. This experience may be relevant, despite the fact that the Hungarian measures were introduced to complement other measures aimed at managing liquidity in the banking system in general. Obviously, this notwithstanding, the Hungarian case is not universal, and these experiences may be primarily relevant for small open economies with less developed financial markets, using their own currency.

2. Literature review and theoretical background

The minimum reserve system is one of the most traditional central bank instruments and is designed to facilitate the proper functioning of the financial system. This type of regulation already existed in the 19th century. In the pre-World War II period, it was mostly characterised by US financial regulation in the developed world, and after 1945 it also became a widely-used tool in Europe and Asia.[7] In the 1980s and 1990s, the level of minimum reserve requirements and the complexity of regulation declined; nevertheless, the minimum reserve remains one of the most common central bank instruments. According to an IMF survey conducted in 2018, 116 of the world's 125 central banks included provisions on the reserve requirement in their central bank toolkit (*Della Valle et al. 2022*).

Under the statutory reserve requirement system, banks are required to hold a specified proportion of liquid central bank assets against a designated pool of credit institution liabilities subject to reserve requirements. These liability items are typically deposits, borrowings, debt securities issued and repos. The reserve requirement ratio is the value that determines the proportion of eligible liabilities that commercial banks are required to hold in liquid central bank assets, typically central bank account based money and occasionally, cash. As summarised by *Csávás et al.* (*2017*)*:*

The higher the reserve requirement ratio, and consequently the ratio of liquid assets to the bank's total assets, the more secure banking operations are in terms of liquidity. That said, more liquid assets allow banks to earn lower yields compared to longer-term assets, as a result of which holding liquid assets causes a yield loss

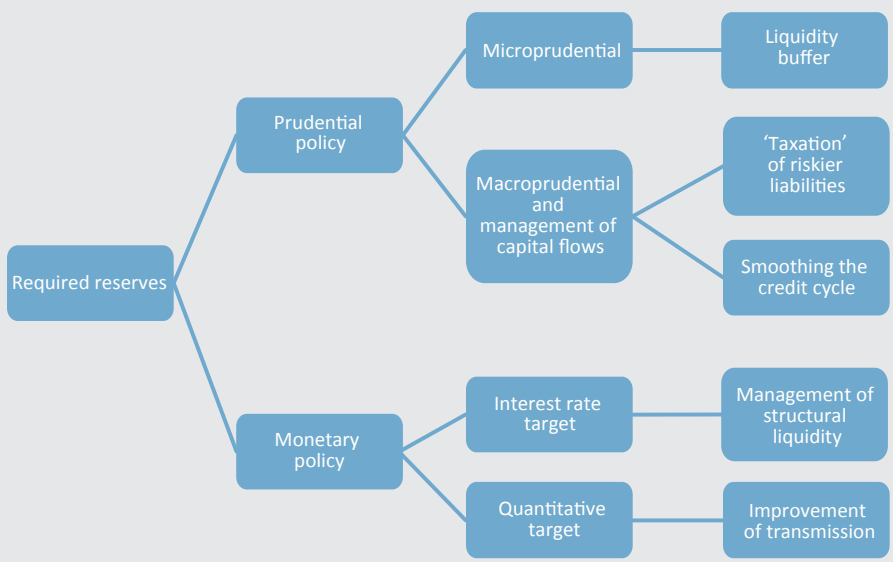
[7] Germany introduced reserve requirements in 1948, Japan in 1959 and the Bank of England in 1960.

to commercial banks. This yield loss may be mitigated by the central bank paying a market interest rate on the reserve requirement it imposes. (*p. 554*)

In other words, the amount of liabilities relevant to the reserve requirement, the rate defined, the assets eligible for compliance with the reserve requirement and the interest payment may vary in different countries and in different periods in accordance with the prevailing objectives.

The diversity of the objectives of reserve systems is presented in the study by *Della Valle et al.* (*2022*). There are two basic directions for regulation. Originally, the primary purpose of the reserve requirements was prudential, as it provided banks with liquidity to absorb potential shocks. Later, the objective of limiting risky activities and curbing excessive credit dynamics was also addressed via the minimum reserve requirement. One classic example of this is that numerous countries have attempted to prevent the rise in foreign currency lending by imposing substantial reserve requirements on foreign currency liabilities. An example of this was Romania, where in the early 2000s the reserve requirement for foreign currency liabilities was set at 30 per cent and the scope of eligible liabilities was extended to maturities longer than two years (*Hilbers et al. 2005*). In numerous cases, the reserve requirement was applied in line with monetary policy objectives, as it can also be used to influence market interest rates and strengthen transmission, for example by absorbing/reducing liquidity.

Figure 1
Objectives of the reserve requirement system



Source: IMF, cited in Della Valle et al. (2022)

Consistent with the above is *Bindseil'* s (*2004*) classification, according to which central banks have attributed or attribute the use of minimum reserves to one or a combination of the following reasons:

(a) supporting liquidity management for individual banks, in particular with regard to the risks posed by bank runs;

(b) ensuring and supporting monetary control over the financial system;

(c) facilitating the achievement of monetary policy objectives by using minimum reserves as a built-in stabiliser;

(d) improving the central bank's interest income by reducing interest expenses;

(e) fostering and encouraging competition between banks by requiring all banks to 'obtain' the liquidity needed to meet reserve requirements, which has a market-building effect;

(f) influencing the structural liquidity position of the banking system, shaping and stabilising the demand for reserves;

(g) managing short-term temporary liquidity shocks without the associated volatility of open market operations and short-term interest rates, which is ensured by the averaging mechanism that is a feature of the minimum reserve framework.

Which of the above functions the reserve system performs is reflected in the specification of the minimum reserve framework; moreover, the objectives and functions of the reserve system have been observed to change systematically over time, in the context of the evolution of the financial system of a country and of the increased knowledge of the minimum reserve requirement's impact on the monetary system. According to *Bindseil* (*2004*), the following parameters define the character and specification of the reserve requirements: (1) reserve base and the related reserve ratio/ratios; (2) reserve maintenance period; (3) amount of the minimum reserve; (4) interest rate; (5) the possibility of averaging; and (6) settlement of vault cash.

The focus of our study is the regulation and level of the interest paid on the minimum reserve. Our primary question, therefore, is what criteria determine the amount of interest paid on the minimum reserve and interest payment itself. There has been fierce professional debate in the literature on whether interest should be paid on the minimum reserve and whether the central bank setting a non-interest-bearing minimum reserve can be considered a tax. Analysis of this issue goes back a long time: *Friedman* (*1960*) suggested that the central bank should pay interest on the minimum reserves at the rate of safe and liquid assets, since the marginal

cost of creating bank reserves in a fiat money system is zero, and the central bank will be able to reduce the opportunity cost of holding bank reserves to zero if it pays market interest on the reserves.

Based on the rationale behind the interest-free minimum reserve, if banks do not pay interest on the demand deposits they hold, similarly, the central bank does not need to pay interest on commercial bank's money held with the central bank primarily for liquidity purposes. In simple terms, this argument claims that since the interest paid on the minimum reserve essentially enriches the bank – as commercial banks will not pass it on to other agents in the economy – in the case of interest-bearing reserves, central banks channel part of the profits from their monopoly position to the private sector, in particular, to the financial sector (*De Grauwe – Ji 2023a*).

At present, the interest-free reserve requirement is not a dominant theory. Critics note that, although it sounds simple and obvious, the explanation is not necessarily true in all situations. On the one hand, banks' non-interest-bearing liabilities do not necessarily correspond to the required reserves. On the other hand, the banking sector may claim the income thus lost on another asset or liability item, even if it is not 'earned' income. *Tovar et al.* (*2012*), for example, demonstrate that the effect of an interest-free reserve requirement depends, to a large extent, on which market is competitive in the banking sector. If banks face strong competition in the credit market, but due to their market power they can set rates in the deposit market, they will ultimately reduce the interest rate paid on deposits. Conversely, if there is competition between banks on the deposit side while they can set prices on the loan side, the interest rate on deposits will not change, but the cost of credit will increase, which lowers loan issuance. Obviously, these models simplify reality to a large extent, as the loan and deposit sides of banking decisions cannot be separated.

Similar considerations are outlined by *Della Valle et al.* (*2022*): the authors assert that the key issue for banks regarding the interest rate on the minimum reserve is the way in which the interest paid on the reserve relates to the interest rate on the 'competing product', which in practice may be the key policy rate. A very large deviation may cause significant distortion. Of course, the extent of this also depends on the level of banks' costs of borrowing. Furthermore, there may be other considerations in interest rate setting, such as the issue of financial stability. In some cases, the payment of interest may also become particularly important to ensure that the regulation does not impose additional costs on the financial sector, which – of course, depending on the circumstances – may jeopardise the capital or liquidity position of some institutions.

De Grauwe and Ji (*2023b*) propose that central banks raise the non-interest-bearing reserve ratio, which would eliminate the subsidy paid by the central bank, i.e. the transfer of central banks' profits to commercial banks. The authors argue that there is a way to raise market yields even if the central bank does not pay interest on the reserve requirement. By raising the reserve requirement, banks' demand curve for the reserves would shift, and the central bank can continue to shape interbank yields through the supply of reserves. In addition, as the reserve requirement may be considered as a form of implicit tax, banks would respond by raising lending rates, which benefits the fight against inflation. Profits from the central bank's monopoly should be transferred to the government rather than the banking sector. A similar argument is proposed by Claudio Borio (*Centralbanking 2023*), who underlines the political and economic dimensions of the issue and points out that the tightening may appear to be a central bank subsidy to the banks, which is an easy source of profit for them. The author proposes a tiering system where – similar to the system in Switzerland – central banks pay interest only up to a certain point and not beyond, which stimulates interbank trading.

De Grauwe and Ji (*2023c*) also proposed a two-tier reserve system for the European Central Bank (ECB), with no interest paid on the minimum reserve and the excess reserve remunerated at a rate similar to the current rate. Raising the reserve ratio from the current 1 per cent to 5 per cent would reduce the central bank's interest payments to banks by EUR 30 billion; if the ratio was raised to 10 per cent, it would lower these transfers by EUR 60 billion, while the amount of excess reserves would still remain EUR 2,000 billion. *De Grauwe and Ji* (*2024a*) argue that such a change would still allow central banks to maintain an operational framework and make monetary policy even more effective in combatting inflation.

According to *De Grauwe and Ji* (*2024b*), interest payments also undermine the transmission of monetary policy as banks' improving capital position increases their willingness to lend. Thus, while interest rate increases reduce demand for bank credit, transfers from the central bank to banks increase the supply of credit via higher capital, which in turn reduces banks' lending rates. *Fricke et al.* (*2023*) find that banks with substantial central bank reserves – and thus access to more interest income from the central bank – are less sensitive to monetary policy tightening than others. Central bank policymakers should take this into consideration, and one option may be the introduction of a two-tier minimum reserve system, increasing the non-interest-bearing reserve requirement. *Whelan* (*2021*) argues for partial interest payments citing the tiering system applied by the ECB and the Bank of Japan, where the central bank pays a lower interest rate up to a certain reserve level, above which it pays the key policy rate; consequently, the marginal cost of funds in the economy is the policy rate, and the central bank is still capable of shaping market interest rates. *Buetzer* (*2022*) proposes a method for reducing the

interest paid on reserves whereby the ECB would absorb liquidity in a long-term reverse repo facility at a lower interest rate, and encourage recourse to the repo facility by making the interest rate on the short-term deposit facility inversely proportional to its volume. The resulting losses for banks would be covered by profits from previously raised lending margins (the difference between lending and deposit rates).

Bindseil (*2014*) argues against the elimination of the interest rate on the minimum reserve. The non-interest-bearing reserve requirement can be considered as a tax levied by the central bank on deposits placed by non-banks with banks. This tax increases the cost of funding banks with deposits. A non-interest-bearing minimum reserve system may give rise to substantial capital outflows from the relevant deposit types and may also affect international capital flows. Retail depositors are unlikely to leave the euro area, but they may leave the banking system, flowing into the shadow banking system. Similarly, *McCauley* (*2023*) stresses the threats to financial stability, with euro area depositors moving their deposits to offshore accounts; the tax would be paid only by 'immobile' depositors, and the tax base and revenue would fall short. Undercapitalised, low-liquidity shadow banks that are not subject to the lender-of-last-resort rule would gain an edge over banks, which could undermine the financial stability of the euro area. *Kwapil* (*2023*) also stresses the disadvantages of the adjustment. Banks may replace retail deposits with wholesale deposits that are not subject to required reserves. Consequently, circumventing the reserve requirements is likely, which increases refinancing costs, thereby affecting the monetary policy stance. There are also financial stability risks. In the current environment of falling credit demand, banks are less likely to pass the tax burden on to their customers in full, which reduces banks' profitability and weakens financial stability in the euro area banking system. Likewise, *Kosonen* (*2023*) argues that a change in reserve requirements would negatively affect the stability of the euro area banking system at a crucial moment. In addition, the central bank can penalise certain types of funds if it considers them a stability risk.

Charnay and Hollegien (*2023*) find that a potential hike in the ECB's reserve ratio would also affect banks' profitability and liquidity. Such an increase would reduce banks' Liquidity Coverage Ratio (LCR), as in the euro area only the excess reserves are considered a liquid asset, while the minimum reserve part cannot be withdrawn at any time during stress conditions.[8]

There has been no consensus, overall, on the interest rate of the minimum reserve in recent debates. The arguments in favour of reducing or eliminating the interest paid on the required reserve are mainly based on the fact that interests thus paid

[8] At a reserve ratio of 10 per cent, the LCR ratio for some Member States would fall to levels approaching 100 per cent. Raising the reserve ratio to 9–10 per cent – also taking into consideration the maturity of targeted longer-term refinancing operations (TLTROs) – would deplete excess reserves by 50 per cent.

are unjustified and that the central bank will be able to keep market interest rates at the targeted level even after the reduction of interest payments. Critics arguing for the maintenance of the reserve requirement claim mostly that a reduction in the reserve requirement may lead to capital outflows, damage monetary policy transmission, deteriorate banks' liquidity and capital position and increase financial stability risks.[9]

The theoretical literature and professional debate presented above either examines the interest rate on minimum reserves in general terms, or provides suggestions for developed central banks only. Interest payments on the minimum reserves may have vastly different effects and consequences for developed and emerging central banks. In developed countries, for example, more mature capital markets and more widespread non-bank financial intermediation make it easier for banks to circumvent the regulation.[10]

In the empirical literature, we have not found any comprehensive analysis on recent changes implemented by developed market central banks in the minimum reserve system. However, in relation to the ECB's adjustment of the remuneration of minimum reserves in autumn 2023 market participants noted that overnight yields fell by 2–3 basis points at the end of September, and since this was the largest decline since 2020, it was related to the remuneration on the minimum reserve (*Gledhill 2023*).

Tovar et al. (*2012*) studied the results of reserve ratio hikes (and other macroprudential instruments) implemented in Latin American countries to curb excessive credit dynamics. In the countries concerned, central banks paid only partial interest on reserve requirements. Using the examples of Brazil, Colombia and Peru in the 2000s, the authors found that credit dynamics decelerated somewhat overall in the short term following the measures, but that the changes were not suitable to smooth the credit cycle in the longer term. *Reinhart and Reinhart* (*1999*) examined the practice of central banks in Latin America and Southeast Asia which, by raising the reserve ratio, sterilised the liquidity-boosting effect of central bank foreign currency purchases associated with the capital inflows observed in the 1990s. In the vast majority of the countries under review, spreads between lending and deposit rates rose following the reserve ratio increases; in more than half of the cases lending rates rose or deposit rates fell, consistent with the theoretically justified trends.

[9] According to some of the authors cited, the financial stability risk arises from the deteriorating capital position. It should be noted that in order to pose a stability risk, the drop in capital would require extreme reserve ratios and/or market interest rates, and banks not passing on, or only partially passing on, their tax burden.

[10] There may be differences between developed and emerging countries in terms of financial intermediation by banks, capital market intermediation and shadow banking; moreover, there may be divergences between emerging countries in respect of the Central and Eastern European region (*Bethlendi – Mérő 2020*; *Mérő – Bethlendi 2022*).

3. Adjustment of the minimum reserve system of the Magyar Nemzeti Bank (2022–2024) – a case study

In this section, we summarise the changes in international practice in respect of the reserve requirement before presenting in detail the past practice of the Magyar Nemzeti Bank (the central bank of Hungary, MNB) and the adjustment of the minimum reserve regulation imposed by the MNB between 2022 and 2024, with a focus on its implications for banks' behaviour and monetary transmission.

3.1. International practice

According to the IMF's 2018 survey, two thirds of central banks worldwide did not pay interest on the minimum reserves. Moreover, countries that did not pay interest applied a higher rate, on average, than those that paid. In the developed world as well, the practice of central banks paying interest on the minimum reserve has become widespread over the last two decades.

Prior to 1999, most European central banks did not pay interest on the minimum reserve. The European Central Bank started to pay interest after 1999, primarily under pressure from the Bundesbank, since the German central bank was one of the few that had previously paid interest on funds held with the central bank on a statutory basis. More significant changes to the ECB's minimum reserve were adopted after the 2007–2008 crisis, and in 2012 the ECB reduced the reserve ratio from 2 per cent to the current 1 per cent. Subsequently, during the period of negative interest rates, a tiering system was introduced in euro area countries, enabling banks to deposit up to 6 times their required reserves at a rate of 0 per cent, which was more favourable than the negative interest rate then in force. This is a good example of taking prudential considerations into account when paying interest on the minimum reserve. From autumn 2022, the ECB paid the O/N deposit rate on the minimum reserve, and the previous two-tier reserve requirement system was eliminated upon the introduction of positive interest rates. Prior to the decision, the amounts held in the reserve account were almost 25 times the reserve requirement, i.e. the amounts deposited were equivalent to a reserve ratio of around 30 per cent. The last change came in summer 2023, when the ECB reduced the interest rate paid on the minimum reserve to 0 per cent.

In the case of the Federal Reserve, the practice of unremunerated minimum reserves lasted even longer than at the ECB, as the Fed made no payments on banks' reserve balances until 2008 (*De Grauwe – Ji 2023a*). Before that, statutory limitations had not allowed the Fed to pay interest. Subsequently, from March 2020, the Federal Reserve lowered its previous two-tier reserve ratio of 10 per cent and 3 per cent to 0 per cent. The measure abolished the minimum reserve requirement for all depository institutions.

Similar significant changes have taken place in recent years in the Swiss National Bank's (SNB) regulation on minimum reserves. In autumn 2023, the SNB decided not to pay interest on the minimum reserve, in response to a sharp rise in interest expenses stemming from the tightening cycle. In 2024, it tightened the rules on the minimum reserve requirement further by raising the reserve ratio from 2.5 per cent to 4 per cent and by increasing the weight of certain liabilities within the reserve base. This move was clearly aimed at improving the cost-effectiveness of monetary policy.

As regards the CEE region, after the regime change central banks actively used the minimum reserve regulation to achieve various objectives. In many cases, reserve ratios were applied at or close to 10 per cent, which is significantly higher than the ECB's practice. The Bulgarian central bank applies a ratio of 10 per cent on funds raised by banks from residents and 5 per cent on funds raised from non-residents, while there is no minimum reserve requirement for liabilities deriving from the state and municipalities. The differentiation of liabilities by residence was justified by the central bank's efforts to curb excessive domestic lending in the second half of the 2000s. As described earlier, in the early 2000s, the Romanian central bank imposed different reserve ratios for liabilities denominated in the domestic currency and in foreign currency in order to prevent a surge in foreign currency lending. Even today, a different ratio is applied depending on denomination, with a reserve ratio of 8 per cent prescribed for leu-based liabilities and 5 per cent for foreign currency liabilities. The former ratio was reduced from 10 per cent in 2015. At 0.77 per cent for leu and 0.16 per cent for euro, the interest paid on the minimum reserve is particularly low for all denominations. The Croatian central bank lowered the reserve ratio from 12 per cent to 9 per cent in spring 2020, during the Covid-19 crisis. Following its accession to the euro area, the reserve ratio was gradually harmonised with the ECB: initially it was reduced to 5 per cent in summer 2022, and since the beginning of January 2023 Croatia, as part of the Eurosystem, applies a reserve ratio of 1 per cent.

Among the regional countries with lower reserve ratios, the Polish central bank sterilises a substantial part of excess liquidity through the reserve requirement, with objectives similar to the Hungarian approach. The National Bank of Poland (NBP) raised the reserve ratio in November 2021 and March 2022. The NBP set a rate of 0.5 per cent until October 2021, which was then raised to 2 per cent in November and to 3.5 per cent in March 2022. One of the objectives of the move was to facilitate the implementation of monetary policy, i.e. to stabilise the overnight interbank yield, the POLONIA, close to the reference interest rate. Moreover, the increase in the reserve ratio was also justified by the monetary tightening objective. The sterilisation role of the reserve requirement in the Czech banking system is somewhat more limited. The Czech central bank did not alter the reserve

requirement regulation for a very long period of time, applying a 2-per cent ratio since 2000. Because of this stability, it was of particular interest that in autumn 2023 Czech policymakers decided to abolish interest payments on the minimum reserve and subsequently increased the non-interest-bearing reserve ratio from 2 per cent to 4 per cent in autumn 2024.

Table 1
International examples of the size of the reserve requirements and the corresponding interest rates (percentage)

Country	Minimum reserve ratio	Interest paid on the minimum reserve	Key policy rate
Euro area	1	0	3.25
Switzerland	4	0	1
Czech Republic	4	0	4.25
Iceland	3	0	9
Poland	3.5	5.75	5.75
Romania	8	0.78	6.5
Bulgaria	10–12	0	3.4
Hungary	10	Base rate on a quarter of minimum reserve	6.5

Note: Values as at October 2024. In the Czech Republic, the 4-per cent reserve ratio will come into effect in January 2025.
Source: central bank websites

Among the emerging countries, numerous Latin American countries have applied the reserve requirement. Brazil sought to curb the credit boom that followed the 2007–2008 crisis by tightening its reserve requirements and by using the regulation as an incentive for larger banks to finance smaller ones. In a rather complex and frequently changing system, the Brazilian central bank set ratios of 20 per cent or more for many balance sheet items and only paid interest on a limited number of these. The current ratio is still 20 per cent for most liability items. Peru and Colombia have also actively used this instrument. In the case of Peru, along with curbing excessive credit dynamics, the explicit objective was to dampen dollarisation; consequently, the level of the reserve ratio for dollar liabilities has been significantly higher, even above 50 per cent, over the past decade.

3.2. Evolution of the reserve requirement system in Hungary from the 1990s to the present

Due to the relative underdevelopment of financial markets, in the early 1990s the central bank's ability to use market-type instruments was limited; therefore, application of the reserve requirement instrument had special importance. Through its effect on money multiplication, by altering the reserve ratio the central bank retained its control over liquidity. The central bank raised the ratio several times in

order to offset the acceleration of multiplication and tighten liquidity (*MNB 2002*). The regulation on the reserve requirement was changed, refined and consolidated almost continuously throughout the 1990s and beyond, but it did not become the main instrument for short-term monetary regulation (*Ábel forthcoming*).

As markets developed, as a result of the averaging mechanism of the reserve system, the main function of the minimum reserve was to reduce the volatility of yields (*MNB 2002*). The buffer offered by the minimum reserve makes it easier for the banking system to adjust to liquidity shocks. Owing to the averaging mechanism, reserve balances are allowed to fluctuate, and acting as a buffer, the required reserves reduce the volatility of O/N interbank lending rates.

The reserve ratio was gradually reduced by the MNB in the first half of the 1990s before it was raised, in several steps, to 17 per cent in 1995, the highest level during the period under review. The central bank explained the increase by the need to narrow domestic liquidity with the goal to achieve monetary tightening and stabilisation (*MNB 1996*). The central bank considered the increase in the reserve ratio as a temporary measure and gradually reduced the ratio to 12 per cent during 1996, in order to avoid putting the banking system at a competitive disadvantage in relation to OECD accession. In the early 2000s, to reduce implicit taxes, the central bank gradually lowered the reserve ratio further in the context of EU harmonisation, moving closer to the 2-per cent ratio applied by the ECB at the time. The rate was 5 per cent at the time of Hungary's accession to the EU in 2004 and remained at that level in the years to follow. In order to ease liquidity management in the banking system following the Lehmann crisis, the central bank reduced the reserve ratio to 2 per cent. Between 2010 and 2015, the MNB applied an optional reserve ratio, with banks voluntarily opting for a 5-per cent ratio, instead of the minimum ratio of 2 per cent. In December 2015, the reserve ratio was reduced to 1 per cent in connection with the quantitative limitation of the MNB's 3-month deposit facility, and the ratio remained unchanged until autumn 2022.

The central bank has been paying interest on the minimum reserve since September 1990 in order to partly compensate for the loss of income caused by the ratio, which was considered high by international standards. The interest paid on the reserve requirement was significantly below market rates in the 1990s. The interest paid on foreign currency liabilities (deposited in forints) was higher than the interest on forint liabilities, a distinction made necessary by the maintenance of a fixed exchange rate regime and the foreign exchange deficit. There has been no such difference in interest rates by denomination since 1998. When the minimum reserve was higher and the interest paid on it did not cover the holding costs, banks found several ways to circumvent the reserve requirement. The interest paid on minimum reserves fell short of the base rate until 2004, and the deviation from the base

rate – in other words, the implicit tax imposed on banks – was still high at over 5 percentage points when inflation targeting was introduced in 2001. Starting from 1 May 2004, the date of Hungary's accession to the EU, the interest rate paid on the required reserve was set at the base rate, on the grounds that the domestic banking system should not suffer a competitive disadvantage.

3.3. Reform of the MNB's minimum reserve system in 2022–2024, impact assessment

The prominent place of the reserve requirement in the domestic regulatory framework is demonstrated by the fact that it is one of the monetary policy instruments specified in the Act on the Magyar Nemzeti Bank currently in effect.[11] The Act also stipulates that the MNB 'may pay interest' on the minimum reserves and that the interest may be paid at different rates in accordance with the different types of reserve ratio elements and their different characteristics.

Another specificity of the minimum reserve is that the governor of the Magyar Nemzeti Bank is authorised to regulate in a decree – in accordance with the decision of the Monetary Council – 'the interest rate payable on the minimum central bank reserve, and the interest determined on the amount of money deposited with the MNB in excess of the level of the reserve ratio', as well as 'the calculation, the method of allocation and placement of the minimum central bank reserve, and the measures to be taken in the event of non-compliance', which, except for the base rate, is not a feature of other monetary policy instruments.

In the following, we describe the MNB's actions, the banking system's adjustment and the central bank's responses to such. Our analysis makes assumptions about possible bank reactions based on financial market developments.[12]

3.3.1. Raising the reserve ratio and reforming the interest rate

The MNB commenced a tightening cycle in summer 2021. In its decisions, the central bank has repeatedly stressed that the key to monetary transmission is to keep short-term interest rates consistent with the short-term rate considered optimal by the Monetary Council in all submarkets and in all periods. This was one of the reasons behind the introduction of the daily swap instrument in the summer of 2022 to replace the previous swap tender that provided euro liquidity only at the end of each quarter.

The reform of the minimum reserve system announced in summer 2022 was also aimed at improving the efficiency of monetary transmission through the long-term absorption of banking system liquidity. From October 2022, the reserve ratio was raised to 5 per cent from 1 per cent, and while previously it was sufficient to meet

[11] *Act CXXXIX of 2013 on the Magyar Nemzeti Bank.*
[12] Due to scope limitations, we do not examine potential effects on deposit and lending rates.

the reserve requirement as a monthly average, the minimum reserve ratio was now applicable at the end of each day. In addition, banks were allowed to opt for a reserve ratio of 6 per cent to 10 per cent – higher than the minimum 5 per cent – with interest rates corresponding to the base rate. As a result of these measures, the amount of liquidity absorbed in the reserve account over the long term increased significantly from around HUF 400 billion to HUF 2,700 billion. The MNB announced the reform as part of a package of measures aimed at the sustainable absorption of liquidity with a view to reducing the volatility of short-term yields and improving monetary transmission through the longer average maturity of the sterilisation stock:

- Discount bond auctions, previously used on an ad-hoc basis, were made regular with a maturity of one week.
- Starting from October 2022, a variable-rate deposit was announced with a maturity of more than one week (*MNB 2022*).

In spring 2023, the MNB introduced additional changes to the minimum reserve regulation:

- In order to increase the liquidity absorbed over the long term, the minimum reserve ratio was raised to 10 per cent from April 2023; consequently, by April 2023 the liquidity absorbed in the reserve base rose to HUF 4,400 billion. The optional reserve ratio above 10 per cent was increased to 11–15 per cent.
- The MNB modified the remuneration of the minimum reserve by introducing a stepped interest rate regime. On the one hand, it set the interest rate on the optional reserve component at a higher level than the previous base rate: the new rate corresponded to the overnight deposit tender rate, which encouraged banks to opt for the higher ratio. On the other hand, the interest rate on the minimum reserve component was also modified: the MNB pays no interest on 2.5 per cent of the reserve base, i.e. one quarter of the minimum reserve.[13] The stated purpose of the measure was to dampen the liquidity expansion resulting from the interest payments made by the central bank, which boosts liquidity as a snowball effect due to subsequent interest payments on central bank interest payments. In determining the level of the unremunerated portion of the reserve, the MNB also considered financial stability aspects (*Kolozsi 2023*).

[13] Paying interest on a part of the required reserve, the MNB followed a rarely used method. Many central banks have completely abolished the remuneration of the minimum reserves, paying zero interest on the total reserve requirement (e.g. ECB). In countries with partial central bank remuneration, the central bank typically sets a fixed nominal interest rate – that is lower than the base rate – for the total amount of the minimum reserve (e.g. Romania).

3.3.2. Under-remuneration of banks resulting from the reform of the interest on minimum reserves

If the central bank does not pay market interest on all or part of the required reserve, the resulting costs can be quantified.[14] The so-called '*under-remuneration*' resulting from the minimum reserve requirement may divert the pricing of eligible liabilities. Under-remuneration per unit of eligible liability can be quantified using the following formula:

$$\frac{T}{D} = (r_M - r_R) * R \quad (1)$$

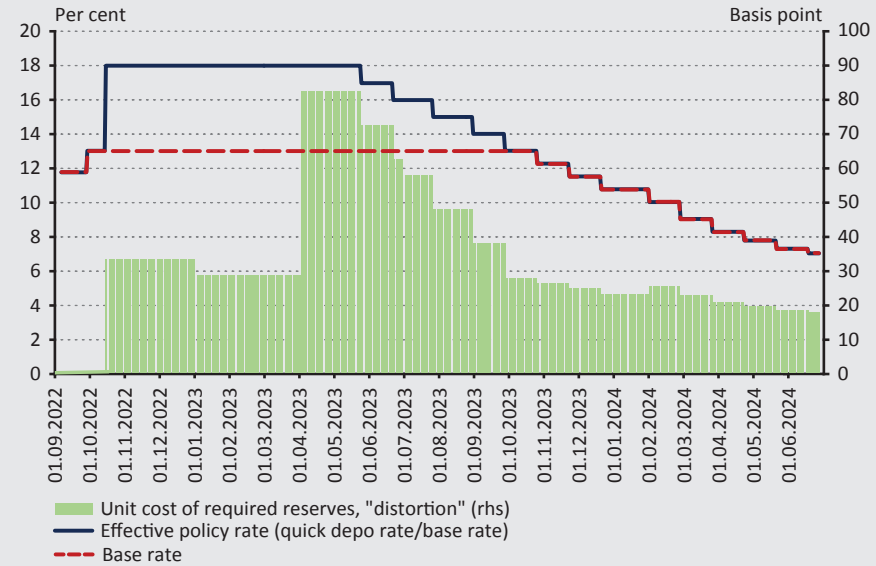
where *T* is the nominal amount of under-remuneration, *D* is the amount of eligible liabilities, r_M is the market interest rate, r_R is the interest paid on the minimum reserve, *R* is the reserve ratio (based on *Árvai* (*1995*), who uses the term 'income deduction' instead of 'under-remuneration'; we consider the latter term more appropriate for the indicator under review). Under-remuneration depends on the spread between the market interest rate and the interest rate on the required reserve, as well as the reserve ratio.

Under-remuneration per unit is the amount by which the bank would have to reduce the interest rate on the eligible liability in order to maintain profitability. This can also be understood as how much the interest rates on eligible liabilities would have to be reduced if banks were to pass the full cost on the eligible liabilities. This cost can also be approximated as follows: if a bank raises a unit amount of eligible liabilities and from that amount it deposits an amount that corresponds to the reserve ratio (*R*) in reserve, and deposits the remainder (*1–R*) in the central bank's deposit facility, it will lose the spread between the market interest rate and the reserve ratio only on that part of its liquidity from the eligible liability that covers the reserve ratio.

When quantifying under-remuneration in respect of the MNB's minimum reserve, in addition to the reserve ratio and the interest rate on the minimum reserve, we also took into account that from October 2022 the MNB introduced a deposit quick tender, the interest rate on which was the effective policy rate, which was higher than the base rate up until autumn 2023, while the remunerated part of the minimum reserve remained at the base rate. The MNB's decision to raise the reserve ratio again from April 2023 and to introduce tiered interest rates implied a substantial increase in under-remuneration (*Figure 2*). Our calculation is based on the average interest rate paid on the minimum reserve which, from April 2023, was 75 per cent of the base rate. This was modified between July 2023 and January 2024 by the eligibility of deposits longer than two weeks, which reduced the rate of under-remuneration, resulting in an effective non-interest-bearing reserve ratio

[14] In the literature, this concept is often referred to as an 'implicit tax'.

Figure 2
Estimated rate of under-remuneration of the MNB's minimum reserve



Note: Under-remuneration is obtained by multiplying the spread between the market interest rate and the interest paid on the minimum reserve by the reserve ratio.

Source: MNB, authors' calculations

of 2.13 per cent, instead of 2.5 per cent. Under-remuneration peaked in April 2023, when both the reserve ratio and the effective policy rate were at their highest. After the effective interest rate and then the base rate were lowered, the rate of under-remuneration decreased considerably. From the end of January 2024, the MNB phased out its long-term deposit tenders and accordingly, they are no longer considered in the calculation of the minimum reserve, which also altered the rate of under-remuneration somewhat. In summer 2024, under-remuneration amounted to around 20 basis points, lower than in autumn 2022. The dynamics will differ somewhat if the under-remuneration is measured in relative terms, in comparison to the effective policy rate. At over 4 per cent, this rate was highest in spring 2023 before gradually declining to 2.5 per cent. Accordingly, in relative terms the decline was smaller than in the case of nominal under-remuneration. In summer 2024, the relative indicator was slightly higher than in autumn 2022 (1.6 per cent versus 1.8 per cent).

3.3.3. Adjustment of the banking system to the unremunerated minimum reserve

There are several ways in which banks may adjust to the reform of the interest rates on minimum reserves. One way is to reduce the interest rate on eligible liabilities. If it corresponds to the abovementioned rate of under-remuneration, the banks will be able to restore their earlier profitability. However, this requires a permanent reduction of the interest rate on eligible liabilities, e.g. in the case of overnight deposits, for each day which can lead to the loss of customers thus cannot be applied in an unlimited way.

Another form of adjustment – that may be more expedient for banks – is to reduce their eligible liabilities. The reserve base comprises the liabilities of credit institutions operating in Hungary and of the Hungarian branches of foreign credit institutions with a maturity of less than 2 years. Since the central bank set the reserve base on the basis of balance sheet data as at the last day of the second month before the end of the review period, banks can temporarily reduce their eligible liabilities even for one day at the end of the month, thus reducing the cost of the minimum reserve. They can do this by applying a penalty pricing that is only applied for one day. It is also important that their customers are also willing to adapt. On the one hand, they need to be flexible in responding to interest rate conditions. On the other hand, to make the adjustment temporary, banks only need to reduce their minimum reserves at the end of the month. To do this, customers must also be aware that the interest rate conditions are only temporary, and the bank should inform their customers in this regard. Communication between the banks and their customers is important; the banks may also try to persuade the customers to reduce their bank deposit by means other than interest. Of course, this can be applied only for a limited range of key customers.

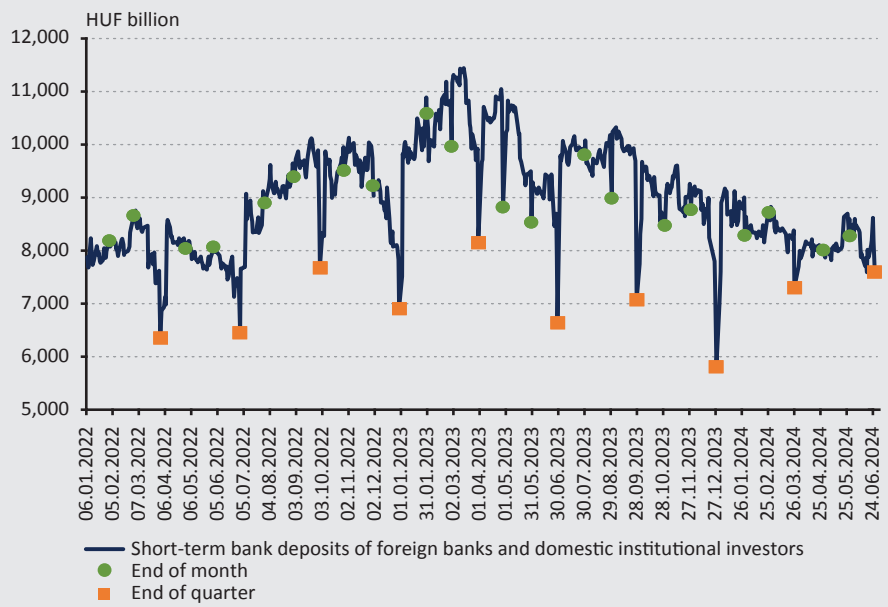
Banks will have to make up for the temporary withdrawal of eligible liabilities, which may lead to a decline in swap market yields on foreign currency liabilities. When customers temporarily take foreign currency deposits and transfer them to foreign credit institutions, the domestic banking sector will have foreign currency demand. Thanks to sufficient liquidity in the domestic FX swap market, they can obtain foreign currency from non-residents in the FX swap market and offer forints (see *Banai et al.* (*2015*) on the structure of the domestic swap market). The demand for such deals can represent an excess demand on the market segment key for FX price developments and, if FX supply is not increasing, and the swap market is not perfect, it can reduce the implied forint yield on FX swaps.

It may also have a transmission effect if non-residents withdraw forint liabilities rather than foreign currency liabilities. If a non-resident does not wish to undertake on-balance sheet exposure in the Hungarian banking sector, but does not want to change its exchange rate position, it can use the swap market to lend HUF to the

domestic banking system. The emergence of forint supply/FX demand in the swap market may also lead to a decline in FX swap implied yields.

Even before the modifications to the minimum reserve system in autumn 2022 and spring 2023, banks had tended to temporarily reduce some of their eligible liabilities significantly on the last day of the quarter. This was mainly related to the balance sheet adjustment of foreign banks, as foreign banks typically reduce their deposits with domestic banks in the days before the end of the quarter in order to avoid on-balance sheet exposure on key days.

Figure 3
Daily changes in specific eligible liabilities of domestic banks



Source: MNB 4LAN report

Following the reform of the minimum reserve system, banks carried out balance sheet adjustments even in months that were not at the end of a quarter. In January 2023, the MNB announced an increase in the reserve ratio, effective from April 2023, and on the last day of February it announced a restructuring of the interest rate, also effective from April. Thereafter, for the first time from the end of February 2023, banks reduced their eligible liabilities for one day at the end of each month. Adaptation now took place not only at the end of the quarter, but also at the end of other months. In addition to the change in the pattern of foreign bank deposits,

there was also a limited and temporary adjustment in the deposits of domestic institutional investors at the end of the month, the market effect of which was eliminated by the regular FX swap instrument of the MNB (*Figure 3*). We looked at short-term bank deposits from foreign banks and domestic institutional investors, as these were found to be the most volatile items at the end of the month. There was a decline of around 5 per cent in eligible liabilities in February 2023.

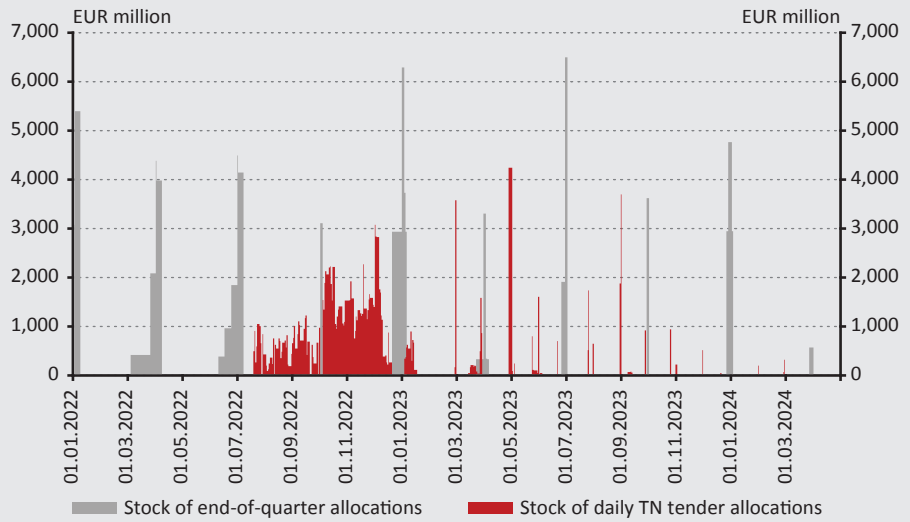
Given the coincidence in timing, it is likely that the reform of the reserve requirement may have partly contributed to the change in the behaviour of domestic banks and their customers, but this cannot be considered as unambiguous. As we will show below, the MNB fixed the reserve base from July 2023; accordingly, it would no longer have been reasonable to reduce the reserve base at the end of the month from May 2023; therefore, strictly speaking, we only have two months of end-month observations (February 2023 and April 2023). Thus, it cannot be ruled out that other factors also played a role in the change in banks' behaviour (e.g. government regulation affecting banks). At the same time, it should be noted that foreign currency liabilities played a key role in the end-of-month adjustment. In addition to the fact that foreign currency liabilities account for a larger share of the liabilities examined, the difference in currency denominations may also explain the more elastic response. Having the same reserve ratio and the same interest on the reserve for deposits denominated in domestic and foreign currency implies a relatively higher burden on foreign currency liabilities due to lower nominal foreign currency interest rates, which gives customers a greater incentive to withdraw their deposits.

The emergence of bank adjustment would not be a problem in itself from the perspective of the central bank's balance sheet: the required reserve is lower and therefore, the liquidity held in other central bank assets is higher; however, this may have a negative impact on monetary transmission as described above, especially on yield developments in the FX swap market, which is sensitive to foreign currency availability. Although the extent of this is not examined in this study due to space limitations, it is worth underlining that the swap market is a key segment of monetary transmission, given that this is the segment where foreign investors first meet the monetary conditions of a small open economy. Thus, conditions in this market can affect prices of other market segments.

Swap market conditions were also influenced by the fact that during the period of the reform, and even before, the MNB regularly announced overnight FX swap tenders to inject foreign currency into the banking system from FX reserves. In the event of a significant fall in swap market yields, banks are able to use this instrument; therefore, the decline in swap yields is only moderate. That is, the potential market effect was eliminated by the used FX swap instrument. Obviously, the FX swap instrument is not unlimited, given that it is provided from FX reserves.

While in the past banks typically took recourse to this instrument at the end of quarters, in 2023 demand was high even at the end of non-quarter-end months. The higher utilisation observed at the end of February, April and August 2023 coincided with the months in which we also observed higher quantitative adjustment in banks' balance sheets (*Figure 4*).

Figure 4
Stock of allocations in the FX liquidity providing FX swap tenders of the MNB



Note: The TN (tom-next) maturity shows transactions with the T+1 spot leg and T+2 futures leg value dates.

Source: MNB

3.3.4. Modifications concerning the calculation of the reserve base

In order to avoid adverse effects on banks' balance sheets, the MNB has adjusted the reserve base, fixing it at an earlier value. The central bank announced at the end of May 2023 that it would begin preparations for determining the reserve base on the basis of monthly average stocks and that, starting with the July 2023 maintenance period, the reserve base would be fixed on the basis of balance sheets as at 31 March 2023. It was also announced that from July 2023, deposits with the MNB with a maturity of at least 14 days would be included in the reserve requirement up to 15 per cent of the minimum reserve (*MNB 2023*). Since this deposit was interest-bearing, banks were able to reduce the unremunerated part of the minimum reserve by setting it off with these deposits. Despite the fixing of the reserve base, some balance sheet adjustment persisted in non-end-of-quarter months, with a visible, temporary decline in bank deposits at the end of August and October 2023. This may reflect, for example, the fact that although the reserve

base was fixed, some banks may have assumed that at a later date the central bank would set a variable reserve base again. In addition, it cannot be ruled out that the reserve base fixing was not noticed by some banks, as the modification of the interest rate on the minimum reserve attracted more attention than the reform of the reserve base.

From the beginning of 2024, the MNB switched to determining the reserve base on the basis of daily average balance sheet data. Following consultations with credit institutions, for the first time, the minimum reserve was calculated based on monthly average bank balance sheet data for the March 2024 maintenance period. The MNB performed the calculation on the basis of average balance sheets as at January 2024. The move to averaging represents a substantial change in the incentive to circumvent the minimum reserve regulation, as banks can indeed shrink their balance sheets with overnight transactions when performing balance sheet adjustments for a single day, which frees them from setting aside reserves for one month, whereas in the case of average balances, they would be forced to shrink their balance sheets for each day. After this change, no significant balance sheet adjustment was observed.

4. Conclusions

In our study, we reviewed the theoretical bases of the reserve requirement, described the changes in international practice and presented in detail the MNB's amendments to the reserve requirements between 2022 and 2024.

Our analysis is consistent with the international literature, complementing the theoretical spectrum from De Grauwe and Ji to Bindseil, with the empirical experiences of a small open economy, stressing that reserve remuneration can be decreased, but this may have strong limits, especially because such a move may lead to capital outflows from the relevant deposit types. The conclusions of this study may also be useful with respect to the hypothesis of Tovar et al., namely, that the effect of interest-free minimum reserves largely depends on the degree of market competition. The empirical evidence presented here confirms Borio's view that there are political economy dimensions to the reform of the reserve system.

As the Hungarian experience covers a relatively short period, the conclusions drawn should be treated with caution and alternative explanations cannot be ruled out; nevertheless, it suggests that although interbank market yields are determined primarily by the yield on the unlimited supply of central bank assets, depending on bank optimisation, the average sterilisation rate and hence the interest paid on the quantitatively limited minimum reserve may also play a role in the evolution of market rates. The burden arising from the minimum reserve system may encourage banks to optimise the reserve base; consequently, the interest rate on the minimum

reserve may have an indirect impact on the market environment. One way to address these effects may involve the modification of the reserve base calculation and transitioning to the consideration of average stocks. This method is rarely used in current central bank practice, even though it is recommended in the literature and was already applied by the Bundesbank before 1999.

Based on the Hungarian experience, in reforming the minimum reserve system and, in particular, upon reducing the interest paid on the minimum reserve, some constraints also need to be considered. The larger the banks' interest income losses (i.e. the under-remunerated part of the minimum reserves) and the stronger their pass-through capacity, the greater the market effects. Outlining and examining these taxonomies may be the subject of further research, along with interpreting and analysing the impact of interest payments on liquidity in nominal and real terms, and possibly, identifying the reasons behind the different responses of individual banks.

Based on domestic experiences, when determining the interest rates paid on the required reserves, special attention should be paid to how such a step affects the foreign exchange inflow from abroad, the country's foreign exchange availability, and what impact this may have on the FX swap market and the general interest rate environment. Examining these is also important because it shows what macro-level costs the interest savings achieved on the required reserves may entail. Therefore, in the case of the decision on the optimal interest rate, this potential trade-off situation must always be considered, ensuring in a kind of iterative process that the expected and realised benefits exceed the unintended costs. The extent of unintended costs may vary over time and space, and is particularly dependent on bank reactions, the vulnerability of the given country and the nominal interest rate level. It is intuitive that in a vulnerable economy, operating with high interest rates and not using reserve currency, characterised by a less competitive banking system, the options are more limited than in an economy that is considered stable, maintaining a relatively low interest rate environment and using money that also fulfils an international function, where banking competition is also more intense. Analytical work on the factors influencing optimal interest rates is an area towards which research can be further developed.

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China-Hungary Green Bond Cooperation: A Review and Promising Prospects*

Bin Hu – Chaoyi Chen – Yueran Zhang

Amid increasing climate change challenges, the European Union (EU) aims to reduce net greenhouse gas emissions by 90 per cent by 2040, necessitating substantial green financing, which aligns with China's commitment to carbon neutrality by 2060. This shared objective creates opportunities for deeper collaboration in green finance and technology. Hungary, a key partner in China's green finance initiatives within the EU, has significantly strengthened its economic ties with China. This paper reviews past China-Hungary green bond collaborations and offers recommendations to enhance future cooperation. Key suggestions include improving communication and coordination to manage financial risks, advocating for bidirectional green bond market openings, establishing mutual recognition mechanisms for green bond standards and enhancing transparency through improved information disclosure systems.

1. Introduction

Amid the increasing frequency of extreme weather events and the growing urgency to address climate change, the EU proposed a climate target in February 2024 to reduce net greenhouse gas emissions by 90 per cent compared to 1990 levels by 2040 (*European Commission 2024*). Achieving this ambitious goal requires significant green financing and investment to facilitate adjustments and transitions in areas such as energy structure and the decarbonisation of industrial sectors. As shown in *Figure 1*, the EU will need to invest approximately EUR 660 billion annually across all scenarios. In the preferred scenario (S3), annual investments will amount to EUR 710 billion during the first decade (2031–2040), gradually decreasing in the period from 2041 to 2050. The 2040 target also provides regulatory certainty for long-term investments needed to meet the 2030 target.

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

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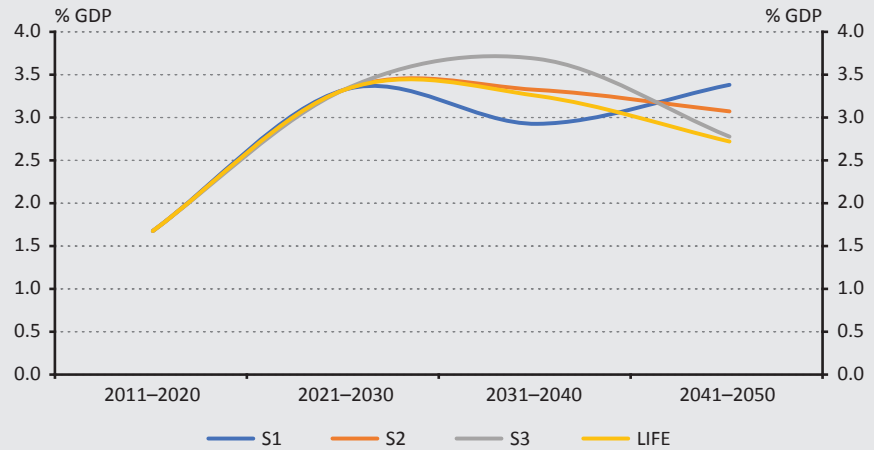
The views expressed here are the authors' and not necessarily those of the Tsinghua University, Renmin University or the Magyar Nemzeti Bank (Central Bank of Hungary).

Figure 1
Average Annual Energy System Investment Needs (Percentage of GDP)



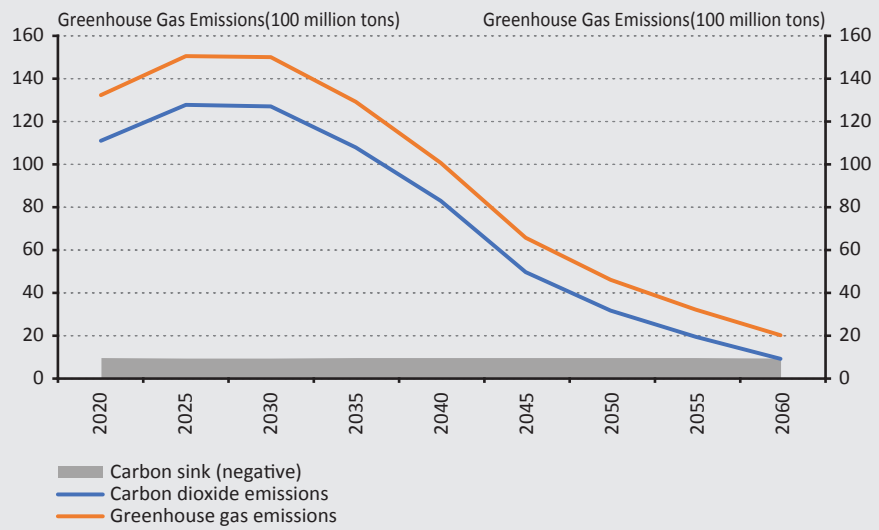
Note:
S1: a net GHG reduction target in 2040 of up to 80 per cent;
S2: a net GHG reduction target in 2040 of 85–90 per cent;
S3: a net GHG reduction target in 2040 of at 90–95 per cent;
LIFE: assessing the impact of a shift in consumption patterns to more sustainable alternatives leading to a more efficient use of natural resources

Source: European Commission

As a global leader in renewable energy, China is the largest driving force behind the world's energy transition. *Figure 2* illustrates China's roadmap to achieving carbon neutrality by 2060, with investments in energy and energy-related industries projected to reach more than RMB 250 trillion.[1] Both China and the EU are currently on the fast track toward low-carbon transitions, with many complementary areas in low-carbon technologies and green finance, offering immense potential for cooperation. Given current global geopolitical uncertainties, China and the EU, as stabilising forces, should collaborate to address challenges, deepen their green sector cooperation and develop a model of mutual benefit and win-win outcomes.

[1] Tsinghua University Press: *China's Carbon Neutrality Transformation Research Report (2035 and mid- to long-term)*, forthcoming

Figure 2
China's Path to Carbon Neutrality



Source: China's Carbon Neutrality Transformation Research Report (2035 and mid- to long-term), Tsinghua University Press, forthcoming

Hungary, a key partner in China's efforts to build an electric vehicle industry chain and enhance its green finance presence within the EU, has seen its economic and political trust with China deepen significantly. The two countries have become reliable and cooperative partners on the path to national development and revitalisation, as well as in maintaining global peace and stability. The Hungarian government consistently upholds independent domestic and foreign policies, firmly supporting East-West connectivity and opposing bloc confrontation (*Team et al. 2018*). Back to 2012, the "16+1" Cooperation between China and Central and Eastern European Countries was established, with Hungary as one of the participating countries (*Kong – Wei 2017*). On 7 July 2018, the 7th China Central and Eastern European Countries Leaders' Meeting was held, and the "Sofia Guidelines for the Cooperation between China and Central and Eastern European Countries" was released, proposing to carry out RMB financing and green bond cooperation with China, and to inject more capital into the green sectors of Central and Eastern European countries.[2]

Since China and Hungary announced their carbon neutrality timetable to the world in 2020, the two countries have continued to develop a positive and stable

[2] The State Council of the People's Republic of China: *Full Text: The Sofia Guidelines for Cooperation between China and CEE Countries.* https://english.www.gov.cn/news/international_exchanges/2018/07/16/content_281476224693086.htm

cooperative relationship, using green finance as a link to promote the sharing of technological innovation and industrial transformation achievements. In 2020, when global foreign direct investment slumped, China's investment in Hungary actually increased, becoming Hungary's largest source of foreign investment for the first time, driven by green projects. In 2023, Hungary attracted foreign direct investment worth more than EUR 13 billion. China's direct investment in Hungary accounted for 58 per cent, once again becoming the largest source of foreign investment in Hungary. Hungary also continues to maintain its position as the largest investment destination country for China in Central and Eastern Europe.[3] In addition, the Chinese-Hungarian Technology Transfer Center, jointly funded by both countries, also focuses on projects in the fields of new materials, green and low-carbon, promoting the integration and green transformation of the industrial chain (*Du et al. 2024*).

There are many green finance tools, among which green bonds stand out as a top priority for international collaborations. As a key financial instrument, green bonds effectively channel capital into environmental and sustainable development projects (*Németh-Durkó – Hegedűs 2021*), aligning closely with the green development goals of both China and Hungary. Literature also supports the positive impact of green bonds on promoting green resource consumption efficiency (*Ye – Rasoulinezhad 2023*), enhancing economic growth (*Zhao et al. 2022*) and contributing to human development (*Thanh 2022*). For issuers, green bonds can provide new financing channels for their green projects, enabling them to obtain cheaper and longer term funds, better plan their development strategies, gain comparative advantages, and assist in transformation and development. For investors, green bonds not only provide opportunities to participate in emerging industries and earn more returns, but also help them avoid environmental risks. For the government, green bonds can guide idle funds from society to flow into green industries, effectively achieve public policy goals, and promote the sustainable development and transformation of growth mode of the country's economy (*Hong 2017*). In this context, cooperation between China and Hungary in the green bond sector aligns well with their shared interests.

Notably, following the National Assembly's decision on 28 May 2021, the Magyar Nemzeti Bank's mandate was extended to include support for the government's environmental sustainability policy, making it the first EU central bank to be granted a green mandate. Additionally, as the holder of the EU Council presidency in the second half of 2024, Hungary is poised to propose more constructive and pragmatic EU policies towards China,[4] creating new opportunities for China-Hungary

[3] China Briefing: *China-Hungary Bilateral Relations: Trade and Investment Outlook*. https://www.china-briefing.com/news/china-hungary-bilateral-relations-trade-and-investment-outlook/

[4] The State Council of the People's Republic of China: *Chinese, Hungarian FMs hold talks on closer ties*. https://english.www.gov.cn/news/202404/25/content_WS6629a7b6c6d0868f4e8e6653.html

cooperation. As the two major issuers of green bonds, China has enormous market potential, while the EU has rich experience in issuing green bonds. The two sides can carry out multi-level cooperation in the field of green bonds, thereby expanding the scope of use of RMB and EUR as the main valuation currencies in green bonds (*Zhao – Zhang 2023*).

Therefore, it is crucial to review China-Hungary green bond cooperation and provide future recommendations, especially in light of new global climate change challenges. This paper addresses this gap by offering a comprehensive overview of past EU-China and Hungary-China green bond collaborations and suggesting ways to strengthen future cooperation. Specifically, we recommend enhancing communication and coordination to manage financial risks; advocating for bidirectional green bond market openings to increase financing opportunities and support green projects; establishing mutual recognition mechanisms for green bond standards to unify the markets; and improving information disclosure systems to enhance transparency.

The rest of the paper is organised as follows: *Section 2* reviews the history of collaboration; *Section 3* presents recommendations for future collaborations; and *Section 4* concludes the paper.

2. Comprehensive Review of Green Bond Cooperation: China-EU and China-Hungary

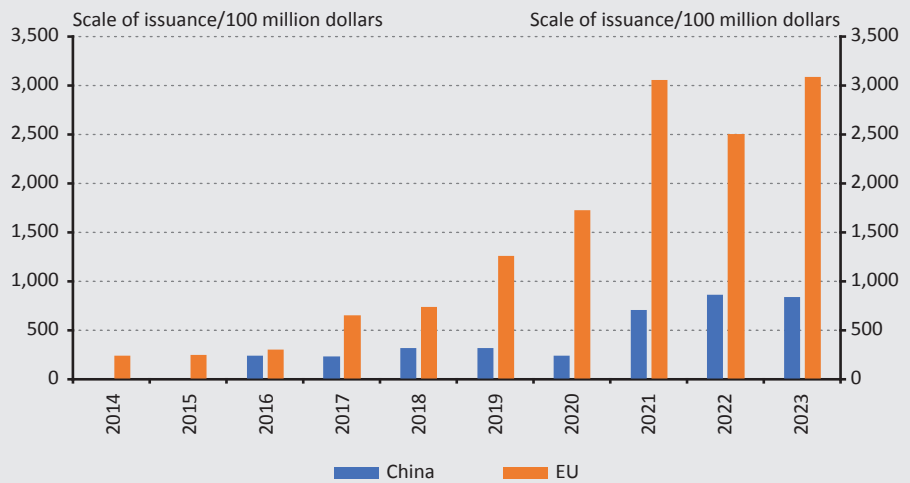
2.1. Historical Overview of China-EU Green Bond Cooperation

The global green bond market began in 2007 with the issuance of the first "Climate Awareness Bond" by the European Investment Bank, positioning the EU as a leader in green bond development. Since then, Europe has gradually become one of the largest green bond issuance markets globally (*Pan et al. 2024*). As shown in *Figure 3*, in 2023, the EU's green bond issuance amounted to USD 309.6 billion, accounting for 52.69 per cent of the global total. Green bonds have provided essential funding for Europe's green and low-carbon development, with funds primarily directed toward renewable energy, energy efficiency and emissions reduction projects, thus driving the EU's green and low-carbon transition (*Sun 2022*).

China's green bond market was established in 2016. Although it started relatively late, it has developed rapidly. As shown in *Figure 3*, from 2016 to 2023, the issuance scale of green bonds in China has steadily increased, and by 2023, China had become the world's largest issuer of green bonds. Key focus areas for green bond investments include clean energy and green transportation, which are important for supporting the "dual carbon" goals and contributing to China's green, low-carbon, and high-quality economic and social development (*Chen – Zhang 2022*).

China and EU have accumulated mature experience in green finance development, particularly in policy framework construction and market practices. As global attention to environmental protection and sustainable development intensifies, green finance is becoming a new cornerstone of China-EU cooperation, propelling their comprehensive strategic partnership to new heights. Cooperation between China and the EU in the field of green bonds not only reflects their shared commitment to green development, but also injects new vitality into their economic and trade relations.

Figure 3
Scale of Green Bond Issuance in China and EU



Source: The Climate Bonds Initiative

As China's green finance policies and markets continue to evolve, the country is actively expanding its green bond business with Europe, enhancing its ability to attract European green capital. Since the Agricultural Bank of China's issuance of the first offshore green bond on the London Stock Exchange in 2015, domestic financial institutions have been actively engaging in green bond activities in Europe (*Zhao – Zhang 2023*). In 2021, the International Platform on Sustainable Finance (IPSF), co-initiated by China and other economies, released the "Common Ground Taxonomy Instruction for Sustainable Finance," which includes economic activities jointly recognised by China and the EU as contributing to climate change mitigation goals. This marks the initial establishment of green bond standards aligned with international practices in China (*Ma – Wang 2021*). To bolster the role of the Common Ground Taxonomy Instruction in supporting the development of the green finance market and cross-border flow of green capital, the Green Finance Professional Committee of the Chinese Finance Society has organised a group of

experts to label certain green bonds issued in the domestic interbank bond market.[5] As of 4 June 2024, China has successfully labelled 282 green bonds.[6]

2.2. Historical Overview of China-Hungary Green Bond Cooperation

Since Hungary's introduction of its "Opening to the East" policy and China's proposal of the "Belt and Road" initiative (BRI), cooperation between China and Hungary in the bond market has been notably prominent. Currently, Hungary is the only country to issue bonds simultaneously in both the onshore and offshore Chinese markets (*Fu – Gao 2023*). With the assistance of underwriters such as Bank of China, Hungary has issued bonds totalling RMB 7 billion, thereby expanding its financing channels (*Table 1*).

In the onshore market, Hungary issued RMB-denominated panda bonds in 2017 and 2018, becoming the first European sovereign issuer to return to the interbank market. This move facilitated financial cooperation between domestic and international institutions and enhanced connectivity in the bond market.[7] In the realm of green bonds, Hungary issued green sovereign panda bonds in 2021 and 2022. These bonds were used for qualified green expenditures under its green bond framework, which includes areas such as renewable energy, energy efficiency improvements, sustainable management of biological land resources, water and wastewater management, clean transportation and climate adaptation. These bond issuances support Hungary's transition to a low-carbon, climate-resilient and environmentally sustainable economic model.

In the offshore market, in 2015, the Magyar Nemzeti Bank launched the "Budapest Renminbi Initiative" to strengthen economic cooperation between China and Hungary, strongly enhance the international influence of the renminbi (RMB) and establish Budapest as the centre of the RMB offshore financial market in Central and Eastern Europe. As a result of this initiative, in 2016, with the assistance of Bank of China, Hungary issued RMB-denominated dim sum bonds in Hong Kong. This issuance attracted enthusiastic subscriptions from high-quality investors in Asia and Europe, making Hungary the first Central and Eastern European country to issue sovereign bonds denominated in RMB.[8]

[5] Financial News of China: *193 bonds selected for Common Ground Taxonomy, more convenient for foreign investors to invest in China's green bond market*. https://www.financialnews.com.cn/sc/zq/202307/t20230719_275209.html

[6] Sina Finance: *The construction of Common Ground Taxonomy between China and Europe has achieved results, and the coverage will continue to expand*. https://finance.sina.com.cn/money/bond/2024-06-04/doc-inaxqhff7982158.shtml

[7] Bank of China *Bank of China successfully assists Hungary in issuing sovereign panda bonds again*. https://www.boc.cn/aboutboc/bi1/201812/t20181218_14424250.html

[8] Bank of China: *Bank of China successfully assisted the Hungarian government in issuing the first sovereign bond.* https://www.bankofchina.com/aboutboc/bi1/201604/t20160415_6725739.html

Table 1
History of Hungary's Bond Issuance in China

	Time	Content
Onshore Market	26 July 2017	Hungary issued RMB 1 billion in panda bonds
	17 December 2018	Hungary issued RMB 2 billion in panda bonds
	14 December 2021	Hungary issued RMB 1 billion in green sovereign panda bonds
	16 November 2022	Hungary issued RMB 2 billion in green sovereign panda bonds
Offshore Market	14 April 2016	Hungary issued RMB 1 billion in dim sum bonds in Hong Kong

Source: Authors' work

In recent years, Hungary has leveraged its business-friendly environment, lower tax burden and automotive industry cluster effects to attract attention and investment from Chinese new energy companies seeking to expand into international markets, solidifying its position as a key hub for BRI cooperation (*Zhao 2024:92–95*).

In addition, Chinese banks are expanding their international bond issuance presence in the Hungarian market, continuously expanding and deepening financial cooperation with Hungary and the Central and Eastern European region, contributing to the development of China-Hungary economic and trade relations. Banks such as Bank of China, China Construction Bank and the Export-Import Bank of China have established branches in Hungary to provide follow-up services for Chinese enterprises entering the Hungarian market.[9]

In 2022, the Bank of China's Hungarian branch successfully completed an international issuance of USD 300 million in green bonds. This issuance advanced cooperation under the "Memorandum of Understanding on Promoting Investment Cooperation in the Field of Green Development" between China and Hungary and raised funds for green and sustainable projects such as photovoltaic power generation and wastewater treatment.[10]

In 2024, the Bank of China's Hungarian branch successfully issued the world's first BRI sustainable development bonds. These bonds are intended to support eligible project categories including renewable energy, sustainable water resources and wastewater management, affordable basic infrastructure and essential services.[11] The issuance of green bonds by the Bank of China in Hungary aims to actively promote green transformation and upgrading in the Central and Eastern European

[9] GuangMing Daily: *Hungary builds the demonstration zone for high-quality BRI development*. https://news.gmw.cn/2024-05/11/content_37315860.htm
[10] China Economic Net: *Chinese institutions in Central and Eastern Europe successfully issue their first green bond.* http://intl.ce.cn/sjjj/qy/202202/16/t20220216_37334046.shtml
[11] Bank of China: *Bank of China successfully issued the world's first batch of "the Belt and Road" sustainable development bonds.* https://www.boc.cn/aboutboc/bi1/202406/t20240619_25094972.html

region, offering high-quality financial services to support regional clients in implementing green strategies.

3. Strategic Recommendations for Enhancing China-Hungary Green Bond Cooperation

Green development and economic growth are not contradictory, but are instead dialectically unified. Green development establishes an "ecological red line" that guides economic advancement, driving the comprehensive transformation and upgrading of economic and social systems. This, in turn, fosters a green, low-carbon industrial structure, promoting high-quality development that ensures harmony between humans and nature. Optimising industrial structures can lead to the creation of green production methods characterised by high technological content, low resource consumption and minimal environmental pollution, thereby generating new growth points for economic and social development (*Shi et al. 2020*).

Since the BRI was proposed, China has made significant contributions to the coordinated economic, social and environmental development of the countries involved in its green development efforts. Green finance has driven cooperation in key areas such as green infrastructure and green energy, encouraging Chinese enterprises to support the green development of BRI countries through foreign investment and collaboration. This approach not only promotes the low-carbon transformation of their economies and energy systems but also helps alleviate their financial challenges, accelerating their economic development (*Wang – Chen 2021*).

In recent years, investment cooperation between China and Hungary in green development sectors such as electric vehicles and clean energy has continued to gain momentum, injecting new vitality into mutually beneficial cooperation between the two countries. Companies such as CATL and BYD have invested in building factories in Hungary, bringing advanced manufacturing techniques and highly automated production lines for electric vehicles into the Hungarian market. This has helped enhance Hungary's competitive edge in the global new energy vehicle market (*Du et al. 2024*).

Additionally, companies such as China Machinery Engineering Corporation (CMEC) and Shanghai Electric have invested in constructing a 100-megawatt photovoltaic power plant in Hungary.[12] This has significantly improved Hungary's clean energy utilisation, while also boosting local employment and economic development.

[12] People's Daily: *Green development injects new impetus into China-Hungary mutually beneficial cooperation.* http://en.people.cn/n3/2024/0513/c90000-20168869.html

Today, Hungary is China's top investment destination and a key trading partner in the Central and Eastern European region.[13]

On 10 May 2024, China and Hungary issued a joint statement on establishing an all-weather comprehensive strategic partnership for the new era. Both parties recognised the positive role of the BRI in promoting economic growth and green development in both countries. They also expressed their commitment to encouraging financial institutions from both sides to provide financing support and financial services for trade and investment cooperation, further exploring the potential for cooperation in areas such as green finance, and continuing their collaboration on issuing green sovereign panda bonds.[14] Given the solid foundation and significant achievements in green bond cooperation between China and Hungary, the prospects for future collaboration in this area are promising.

3.1. Enhancing Communication and Coordination to Mitigate Financial Risks

Since 2024, the EU has launched multiple investigations against Chinese enterprises under the Foreign Subsidies Regulation, increasing regulatory barriers for Chinese investments in Europe and significantly impacting the operations of Chinese banks within the EU.[15] As Hungary is set to assume the EU Council Presidency, it will play a leading role in EU-China cooperation. In the face of uncertainties in the financial cooperation environment, Hungary might assist in facilitating dialogue and consultation between China and the EU on critical issues such as financial regulatory policies, playing a positive and constructive role in fostering healthy interaction between the two sides. Additionally, Chinese banks operating within the EU should leverage their geographical advantages to effectively identify and mitigate potential risks associated with bond issuance, ensuring the provision of high-quality financing services.

3.2. Promote Bidirectional Opening of the China-Hungary Green Bond Market to Expand Financing Channels and Support Green Projects

China possesses the world's largest green bond issuance market and extensive experience in green bond issuance (*CBI 2024*), while Hungary holds a significant financial position and influence in Central and Eastern Europe. By developing a bidirectional green bond market, both countries can share resources, exchange markets and create more development opportunities. Against the backdrop of the deepening alignment between China's BRI and Hungary's "Opening to the East" strategy, China and Hungary should enhance cooperation in emerging fields

[13] China Economic Net: *China-Hungary economic and trade cooperation is expanding day by day*. http://www.ce.cn/xwzx/gnsz/gdxw/202405/09/t20240509_38995850.shtml
[14] The State Council of the People's Republic of China: *Full text: China-Hungary Joint Statement on the Establishment of an All-Weather Comprehensive Strategic Partnership for the New Era*. https://english.www.gov.cn/news/202405/10/content_WS663d3b83c6d0868f4e8e6eb0.html
[15] Global Times: *China launches probe into EU's actions on Chinese firms under FSR*. https://www.globaltimes.cn/page/202407/1315812.shtml

such as clean energy, improving the quality and effectiveness of financial services for new productive development (*Wang – Wang 2023*). On the one hand, China and Hungary should continue their collaboration on issuing green sovereign panda bonds, providing more financing convenience for Hungary's sustainable development projects, and introducing more mature green bonds to the domestic market. On the other hand, China should explore a sovereign green bond issuance framework with Chinese characteristics, encouraging domestic financial institutions and enterprises to issue sovereign green bonds in Hungary as appropriate. This would demonstrate China's commitment to combating climate change, attract more international investors and align Chinese green bonds with global standards.

In addition, China and Hungary can continue to expand their green cooperation under multilateral mechanism, such as the framework of "16+1" Cooperation. Furthermore, on 18 October 2023, the BRI International Green Development Coalition (BRIGC) and its cooperation partners launched the Green Investment and Finance Partnership (GIFP), aiming to provide adequate, predictable and sustainable financing for green development in developing countries.[16] GIFP can leverage the professional advantages of its partners, actively promote green development investment and financing cooperation, help developing countries find climate adaptive growth paths and also benefit Chinese enterprises. The first list includes BRIGC and 16 institutions from China, the United Kingdom, the United States and Indonesia. Currently, no EU countries or regions participate.[17] If Hungary joins GIFP as the next group of members, China and Hungary can find the right combination of debt, equity, investment and grants, and Hungary can engage in productive financing in the energy and infrastructure sectors.

3.3. Establish a Mutual Recognition Mechanism to Standardise and Unify Green Bond Markets in Both Countries

Due to differences in resource endowments, stages of economic development and other factors between China and Europe, there are still significant discrepancies in the standards for supporting green finance, including scope, technical identification and information disclosure (*Han 2022*). These differences increase the cost of aligning green finance and can create information gaps in the market. China's green standards focus on improving energy efficiency and reducing greenhouse gas emissions, while the EU concentrates on mitigating climate change, laying the groundwork for its 2050 carbon neutrality goals, and includes aspects such as carbon capture and storage. The limited overlap in standards between China

[16] The State Council of the People's Republic of China: *Full text: Chair's Statement of the Third Belt and Road Forum for International Cooperation*. https://english.www.gov.cn/news/202310/20/content_WS6531d31cc6d0868f4e8e0769.html

[17] Ministry of Ecology and Environment of the People's Republic of China: *The Green Investment and Finance Partnership launched in Beijing.* https://www.mee.gov.cn/ywgz/gjjlhz/lsydyl/202310/t20231029_1044244.shtml

and the EU raises the costs of aligning green finance and introduces uncertainty into green bond cooperation. Unifying green bond standards would facilitate the issuance of green bonds across different markets, simplify comparisons between green bonds in various markets and reduce the barriers and costs associated with identifying green bonds (*IIGF 2022*). In the future, issuers of green bonds in China and Hungary should proactively align their bond designs with the "Common Ground Taxonomy Instruction for Sustainable Finance" to attract more institutional investors (*Wen – Fan 2022*).

At the same time, China and Hungary should establish green finance product standards that meet both countries' environmental goals based on the common classification standards and regularly update them. This would include incorporating more projects with actual green contributions and gradually expanding the mutual recognition boundaries of China-Hungary green bonds. Both countries can lead this effort with financial technology, innovatively using blockchain, big data and other technological tools to more precisely identifying, labelling and monitoring green bonds that meet the standards, thereby reducing the certification costs for green bonds.

3.4. Enhance the Information Disclosure System to Improve Green Bond Transparency

Green bond information-sharing platforms play a crucial role in aggregating information and improving market efficiency, facilitating the standardisation of green bond disclosures and increasing transparency and comparability of information. Issuers of green bonds can use these platforms to publicly disclose documents such as green bond frameworks, fund allocation reports and external review reports, which helps international investors access information more efficiently (*Kolozsi et al. 2022*). To enhance the quality of information disclosure and effectively prevent risks such as "greenwashing" and "green disguising," China and Hungary should establish unified standards for disclosing the environmental benefits of green bonds. Creating a green bond information-sharing platform will enable standardised and measurable disclosure of environmental benefits, thus improving the overall transparency and reliability of green bond information.

4. Conclusion

This paper provides a comprehensive review of the background and history of China-Hungary cooperation in green bonds and offers recommendations for deepening this collaboration. By strengthening mutual trust and fostering mutually beneficial cooperation in green finance, China and Hungary contribute positively to the global green bond market. Their cooperation has already achieved significant milestones and laid a solid foundation for future endeavours. To enhance their

collaboration further, China and Hungary should focus on promoting bidirectional market openings, advancing mutual recognition of green bond standards, improving transparency in information disclosure and strengthening communication and coordination in the green bond sector.

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