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Attitudes to the Green Transition and Willingness to Pay in Emerging Markets: Concerned but Not Paying*

Pablo García Guzmán – Zsóka Kóczán

While individuals in emerging markets are concerned about climate change, such concerns do not necessarily translate into a willingness to pay for environmental policies. Using rich data for 37 economies, mostly from emerging markets in Europe, the Caucasus, Central Asia and parts of North Africa and the Middle East, we empirically examine correlations with willingness to pay for environmental policies. We show that, beyond ability to pay, people who expect to be better off in the future, who are more patient and who trust the government are all more likely to be willing to pay for policies that mitigate climate change. Our results thus suggest that measures that increase people's incomes, build trust in government, reduce corruption and increase the transparency and efficiency of government spending could help boost support for green policies. Policies may also receive greater support if they take the form of subsidies, where the costs in terms of higher taxes are less salient.

Journal of Economic Literature (JEL) codes: Q01, Q54, Q56, Q58

Keywords: climate change, willingness to pay, trust, discount rate

1. Introduction

Climate change poses a significant threat to global development, affecting lives and livelihoods through channels such as the increased frequency of extreme weather events, negative impacts on agricultural productivity, loss of water resources, and damage to infrastructure and other assets. While such effects are felt in both higher-income and lower-income economies, lower-income economies – and lower-income households within those economies – are less equipped to deal with them.

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Public support for environmental policies depends not only on their ecological benefits, but also on their perceived economic implications (see also *EBRD 2023*). Major economic transitions of the past (such as the rollout of digital technologies, the globalisation of trade and investment and the phasing-out of coal) offer important lessons for the transition to a less carbon-intensive economy (*EBRD 2023*; *OECD 2023*). Such transitions entail a reallocation of employment across sectors and industries, as well as changes to job requirements. They bring substantial opportunities and benefits for workers, but also new risks. Crucially, their impact varies across geographical areas and demographic groups, which can potentially exacerbate existing disparities in the economy.

Furthermore, recognition of the risks associated with climate change does not always translate into broad-based support for environmental policies. For instance, some of the most economically effective climate change policies, such as comprehensive pricing of carbon emissions, often face political resistance (see *Douenne and Fabre 2022* for a discussion of the Yellow Vest movement in France; see also *Klenert et al. 2018*).

Motivated by these considerations, this essay examines attitudes towards climate change and willingness to pay for policies that mitigate it. While public support for environmental policies has received increasing amounts of attention in economic literature, the analysis of its determinants has tended to focus on advanced economies, rather than emerging markets and developing economies.

We hope to contribute to the literature by examining various correlates of willingness to pay for environmental policies empirically, relying on rich micro-level data spanning a large set of emerging markets. We hope that gaining a better understanding of the factors inhibiting willingness to pay for environmental policies at the individual level will help guide policy initiatives and broaden public support for environmental protection.

The essay explores the following specific questions: Which individual characteristics are correlated with higher willingness to pay for policies mitigating climate change? In particular, how do factors such as concerns about climate change, ability to pay, expectations about the future, discount rates and trust affect willingness to pay?

The analysis draws on rich data on attitudes to climate change from the latest, fourth wave of the Life in Transition Survey (LiTS), a large representative survey covering 37 economies, mostly emerging markets, ranging from Europe, the Caucasus, Central Asia and parts of North Africa and the Middle East, and deep dive surveys, which were conducted as add-ons to LiTS in Albania, Armenia, Georgia, the Kyrgyz Republic and Tajikistan.

Our results should not be interpreted as causal – there may be reverse causality or omitted variables affecting both willingness to pay and, for instance, discount

rates or trust. Further research could examine such effects in an economic model, or try to identify clearer causal effects. Nonetheless, we believe that we highlight a number of interesting stylised facts.

The results of the survey suggest that most respondents in emerging markets are concerned about climate change and damage to the environment. However, such concerns do not necessarily translate into a willingness to pay more tax or forgo economic growth and job creation in order to prioritise environmental policies.

Respondents in higher-income households generally express greater willingness to pay in order to protect the environment. Willingness to pay is also generally higher among people with more positive expectations about the future (such as those who expect to be better off in four years' time than they are now). People who are more patient (valuing future income more highly relative to funds available today) are also more willing to pay for environmental policies, as are those who trust the government more.

Strikingly, results from the deep dive surveys suggest that only a small percentage of respondents believe that all proceeds from a carbon tax or an increase in electricity tariffs aimed at addressing climate change would end up being spent on the transition to a green economy. At the same time, participants in those surveys tend to underestimate the percentage of their country's energy production that currently comes from renewables. The results also suggest that environmental subsidies receive greater support than taxes (as the eventual costs of subsidies in terms of higher taxes are less salient).

These results could point to the importance of effectively communicating green policies and building awareness of the progress made to date. Efforts to build trust in government, reduce corruption and increase the efficiency and transparency of government spending could help to boost support for climate change policies in emerging markets. Highlighting the local environmental benefits of green policies (such as improved air quality, health benefits and potential job creation) could also help to leverage popular support for such measures.

This essay is structured as follows: Section 2 provides a brief overview of the related literature, Section 3 introduces the Life in Transition Survey (LiTS) and deep dives, Section 4 explores the correlates of willingness to pay and Section 5 concludes with policy implications.

2. Related literature

There is a growing body of literature looking at attitudes towards climate change, how environmental policies are perceived and what determines their level of support (see *Bergquist et al. 2022*; *Bumann 2021*; *Drews and van den Bergh 2016*

and *Fairbrother 2022* for reviews). Most of those studies focus on a single country or a subset of advanced economies: see, for instance, *Kotchen et al.* (*2013*) on the United States, *Veronesi et al.* (*2014*) on Switzerland, *Sergi et al.* (*2018*) on Pennsylvania and *Graham et al.* (*2019*) on the United Kingdom.

Comparative cross-country surveys looking at the drivers of support for different climate change policies in emerging market economies are relatively scarce. Notable exceptions include *Dechezleprêtre et al.* (*2022*), *Dabla-Norris et al.* (*2023*) and *Andre et al.* (*2024*). *Chaikumbung* (*2023*) provides a comprehensive analysis of the effects of institutions and cultures on people's willingness to pay for climate change policies by conducting a meta-regression analysis across studies in 47 countries.

Existing research points to several other attributes that shape willingness to pay beyond the simple ability to pay (see, for instance, *Dabla-Norris et al. 2023*; *Drews and van den Bergh 2016*; *Fairbrother 2022*; *Ziegler 2017* and *Carattini et al. 2018*). These include the perceived effectiveness of the policy and the expected benefits (for both the individual in question and society as a whole), the costs associated with its implementation and the perceived fairness of the policy (how outcomes will be distributed across all parties involved). Broader economic and political attitudes also shape policy support. For instance, right-leaning views have been associated with reduced support for publicly financed climate change policies, particularly in the United States and the United Kingdom (*Ziegler 2017; Fairbrother 2022*).

Other studies find that respondents who do not support subsidies for low-carbon technologies and renewable energy tend to cite the cost to taxpayers and concerns about corruption and the effectiveness of policies as the primary reasons for their views (*Dabla-Norris et al. 2023*). Previous studies have shown that countries with higher perceived corruption tend to have weaker environmental policies and higher greenhouse gas emissions after relevant political and economic factors have been taken into account (*Klenert et al. 2018*).

This essay contributes to the literature by drawing on rich, harmonised data across a large set of emerging markets on attitudes to climate change, willingness to pay for climate change mitigation as well as information on respondents' expectations about the future, discount rates and levels of trust.

The focus in this essay is on households' views and willingness to pay; for a review of the determinants of firms' decisions to invest in energy efficiency and pollution reduction, see, for instance, *De Haas* (*2024*). Recent work in this journal has also highlighted the growing importance of considerations of climate risk in financial markets (*Boros 2020*; *Németh-Durkó and Hegedűs 2021*; *Kolozsi et al. 2022*; *Ritter 2022*; *Szendrey and Dombi 2023*; *Várgedő 2023*) and on the insurance sector (*Pandurics and Szalai 2017*). Some central banks already have a green mandate or are focusing on environmental issues (*Matolcsy 2022; Bartók 2019*).

The paper is also related to the emerging literature on biodiversity finance – the use of private capital to finance biodiversity conservation and restoration – a new practice in sustainable finance (*Flammer et al. 2025; Jonäll et al. 2025; Naffa and Czupy 2024*).

3. Data

The analysis in this essay draws on a rich set of data on climate change and attitudes towards the green transition derived from the latest wave of the Life in Transition Survey. The Life in Transition Survey is a large representative household survey that has been carried out by the European Bank for Reconstruction and Development (EBRD) in collaboration with the World Bank since 2006. The latest wave, conducted in 2022–2023, expanded on earlier waves (conducted in 2006, 2010 and 2016) with an in-depth module on attitudes to climate change and willingness to pay. The survey included face-to-face interviews in local languages with 1,000 randomly selected households in 50 locations in each of 37 economies,[1] spanning Europe, the Caucasus, Central Asia and parts of north Africa and the Middle East. While most of these economies are emerging markets and developing economies, it also included some advanced comparators, such as Germany. For further information on the survey see *EBRD* (*2024*).[2]

As part of the new climate change module in the latest wave of the Life in Transition Survey (LiTS IV), respondents were asked about their views on climate change and its consequences. Participants were also asked whether they would prioritise the environment at the expense of economic growth and jobs, and whether they would be willing to pay more tax in order to fund policies that addressed climate change and its effects.

The survey thus provides unique insights into attitudes to and willingness to pay for climate change mitigation across a very large set of mostly emerging markets, based on large representative samples of households and a harmonised questionnaire.

The data are complemented by the results of deep dive surveys conducted by the World Bank in Albania, Armenia, Georgia, the Kyrgyz Republic and Tajikistan. The deep dive surveys included further questions on specific climate change policies, which were put to the 1,000 LiTS IV respondents in each of those five countries as part of their face-to-face interviews. In addition, they also included telephone interviews with 1,000 business managers in each economy. The companies

[1] Albania, Algeria, Armenia, Azerbaijan, Bosnia and Herzegovina, Belarus, Bulgaria, Croatia, Czechia, Estonia, Georgia, Germany, Greece, Hungary, Jordan, Kazakhstan, Kosovo, the Kyrgyz Republic, Latvia, Lebanon, Lithuania, Moldova, Mongolia, Montenegro, Morocco, North Macedonia, Poland, Romania, Russia, Serbia, the Slovak Republic, Slovenia, Tajikistan, Tunisia, Türkiye, Uzbekistan and the West Bank and Gaza.

[2] See also https://www.ebrd.com/sites/Satellite?c=Content&cid=1395236498263&d=Touch&pagename=EBRD%2FContent%2FContentLayout

in question were chosen at random from national registers of firms and were a representative sample in terms of firm size and sector.

4. Willingness to pay more to protect the environment

In most of the economies surveyed, a large percentage of respondents believe that climate change is real and are concerned about its consequences. On average, around 79 per cent of respondents in the economies surveyed believe that climate change will seriously affect the children of today, while around 65 per cent of respondents believe it will seriously affect them, with the difference between the two figures suggesting that people expect climate change shocks to become more severe in the more distant future (*Table 1*). This is in line with the results of other recent surveys, with such studies consistently finding that most people regard climate change as a serious problem (*Dabla-Norris et al. 2023*, *2024*; *Leiserowitz et al. 2021*).

Table 1
Descriptive statistics

Variable	N	Min	Max	Mean	SD
Age	37,389	18.00	95.00	45.82	17.28
Female (=1)	37,389	0.00	1.00	0.53	0.50
Has children (=1)	37,389	0.00	1.00	0.56	0.50
Married (=1)	37,236	0.00	1.00	0.58	0.49
Secondary education (=1)	37,389	0.00	1.00	0.66	0.47
Tertiary education (=1)	37,389	0.00	1.00	0.26	0.44
Urban (=1)	37,389	0.00	1.00	0.60	0.49
Employed (=1)	37,180	0.00	1.00	0.47	0.50
Consistently patient (=1)	34,629	0.00	1.00	0.48	0.50
Trusts the government (=1)	34,282	0.00	1.00	0.33	0.47
Experienced natural disaster(s) (=1)	37,167	0.00	1.00	0.18	0.38
Climate change will seriously affect me (=1)	35,435	0.00	1.00	0.65	0.48
Climate change will seriously affect children (=1)	35,130	0.00	1.00	0.79	0.41
Concerned about extreme weather events (=1)	37,389	0.00	1.00	0.70	0.46
Concerned about air pollution (=1)	37,389	0.00	1.00	0.67	0.47
Concerned about waste disposal (=1)	37,389	0.00	1.00	0.66	0.47
Concerned about loss of plant or animal species, or biodiversity (=1)	37,389	0.00	1.00	0.64	0.48
Concerned about rising temperatures (=1)	37,389	0.00	1.00	0.66	0.47
Concerned about the lack of action to address climate change (=1)	35,408	0.00	1.00	0.51	0.50
Prioritises environment over jobs (=1)	35,362	0.00	1.00	0.45	0.50
Willingness to pay: prevent environmental pollution (=1)	37,389	0.00	1.00	0.43	0.50
Willingness to pay: fight climate change (=1)	37,389	0.00	1.00	0.37	0.48
Willingness to pay: prevent biodiversity loss (=1)	37,389	0.00	1.00	0.41	0.49

Concerns are generally more pronounced when it comes to readily observable implications of climate change and environmental harm. For instance, 70 per cent of respondents are concerned about extreme weather events (such as droughts, floods, landslides and wildfires) and other natural disasters, while 64 to 67 per cent are concerned about waste disposal, air pollution, rising temperatures, the loss of plant or animal species, or biodiversity. At the same time, fewer respondents (51 per cent in total) are concerned about the lack of action to address climate change.

At the country level, environmental concerns are more pronounced in lower-income economies and economies where agriculture makes a larger contribution to employment and value added. This may reflect the fact that poorer economies are less able to cope with extreme weather than advanced economies (*Dabla-Norris et al. 2023*).

At the individual level, women, respondents with children and those with higher levels of education are more likely to think that climate change will significantly affect them or the children of today, based on regressions controlling for country fixed effects with standard errors clustered at the primary sampling unit (PSU) level.

Willingness to bear the economic costs of the green transition is significantly lower than the levels of concern about environmental damage. On average, 45 per cent of respondents in the economies surveyed would prioritise the environment at the expense of economic growth and jobs, with particularly strong support for this viewpoint in Moldova, Morocco, Slovenia and a number of economies in Central Asia.

At the individual level, women, older respondents, those with a tertiary education and people in higher-income households are more likely to think that protecting the environment should be the priority, based on regressions controlling for country fixed effects with standard errors clustered at the PSU level.

Fewer than half of all respondents say that they would be willing to pay more tax if it was used to fight global warming, prevent biodiversity loss or reduce pollution.

4.1. Empirical analysis

The following analysis examines various correlates of willingness to pay at the individual level in a simple linear regression setup. Willingness to pay to (1) prevent environmental pollution, (2) fight climate change or (3) prevent biodiversity loss (dummy variables y_i) are respectively regressed on the variable of interest (Int_i) – whether the respondent expects to climb the income ladder, is consistently patient, trusts the government, experienced natural disaster(s) and whether they think climate change will seriously affect them (one at a time as well as jointly) – as well as individual characteristics ($\boldsymbol{X_i}$: a female dummy, whether the respondent has

children and an interaction of the two, age, age squared to account for possible nonlinearities, education, marital status, urban/rural location, equivalised household income decile and a dummy for whether the respondent is employed) and country fixed effects (α_c):

$$y_i = \beta_0 + \beta_1 Int_i + \boldsymbol{X_i}'\boldsymbol{\beta_2} + \alpha_c + \varepsilon_i$$

Standard errors are clustered at the primary sampling unit level. Results are reported in *Table 2.* We examine the variables of interest both one at a time and jointly, and the results are very similar across specifications.

While the relationship between willingness to pay and the variables of interest may not be causal, for instance, picking up reverse causality or omitted variables affecting both, we believe these correlations are nonetheless interesting. Future research could examine them in a more causal setting, for instance, relying on instrumental variables (for instance, cultural attitudes towards saving and investment, which are unfortunately not available in our dataset).

Individual characteristics point to expected correlations: those with higher levels of education and, in some specifications, those with children, are more likely to express willingness to pay. Those who believe that climate change will seriously affect them are, as expected, more likely to express a willingness to pay to protect the environment and the effect is economically large (around 16 percentage points), controlling for individual characteristics and country fixed effects (*Table 2*).

Beyond attitudes, willingness to pay also reflects people's ability to pay (see also *Graham et al. 2019*). People in higher-income households are generally more able – and, accordingly, more willing – to pay for the green transition than those in lower-income households. For example, people in the top household income decile are, on average, around 10 percentage points more likely to be willing to pay to protect the environment than those in the bottom income decile (controlling for individual characteristics and country fixed effects).

At the same time, the relationship between household income and willingness to pay more to protect the environment is in line with the relationships observed for other policies. When it comes to paying for physical and digital infrastructure, education and healthcare, households in the top income decile are between 8 and 11 percentage points more likely to be willing to pay than households in the bottom decile. As one would expect, the income gradient is less pronounced when it comes to income redistribution policies. For instance, those at the top of the income distribution are only 4 percentage points more likely to be willing to pay to assist the poor and/or reduce inequality and 3.9 percentage points more likely to be willing to pay to create jobs.

4.2. Expectations and discount rates

Policies aimed at mitigating climate change will be costly today, but the pay-offs will stretch into the future, so the value that individuals place on the future relative to the present day can affect their willingness to pay for environmental policies.

Beyond current ability to pay, people's willingness to pay can thus also be expected to depend on their expectations of their own economic situation in the future, as well as how highly they value income in the future relative to the present.

People's expectations of their own economic situation in the future are captured here using questions on which rung of a ladder respondents think their household is today, and on which rung their household will be in four years' time, with the poorest in society on the bottom rung and the richest on the top rung. Respondents who think that their household will be on a higher rung of the income ladder in four years' time are 4.6 percentage points more likely to be willing to pay to reduce pollution, fight global warming and prevent biodiversity loss than similar individuals with no expectations of upward mobility in the future (controlling for individual characteristics and country fixed effects, see *Table 2*).

To measure the value that individuals place on future income relative to today's – that is to say, their discount rates – respondents were asked whether they would prefer to receive (i) an amount corresponding to around 55 per cent of the median household's daily income immediately or (ii) around 85 per cent a month later (in the case of Germany, around EUR 55 today or around EUR 85 one month later). Later in the survey, respondents were asked to choose between (i) 55 per cent of the median household's daily income six months later and (ii) 85 per cent seven months later. The analysis in this section defines respondents as 'consistently patient' if they prefer to wait for the larger amount in both situations, while 'consistently impatient' individuals are those who prefer to receive the smaller amount sooner in both situations. Those who choose to receive a smaller amount immediately in the first situation but are happy to wait seven – rather than six – months in order to receive a larger amount in the second situation are deemed to exhibit present bias.

Consistently patient respondents (those who value future income more highly) are 3–4 percentage points more likely to be willing to pay to reduce pollution, fight climate change or prevent biodiversity loss than consistently impatient individuals (those who value the present more highly), controlling for individual characteristics and country fixed effects (see *Table 2*). Similar results can be seen when it comes to willingness to pay for measures aimed at preventing biodiversity loss and fighting global warming. People's discount rates have a larger impact on willingness to pay than whether they have children.

Table 2
Correlates of willingness to pay

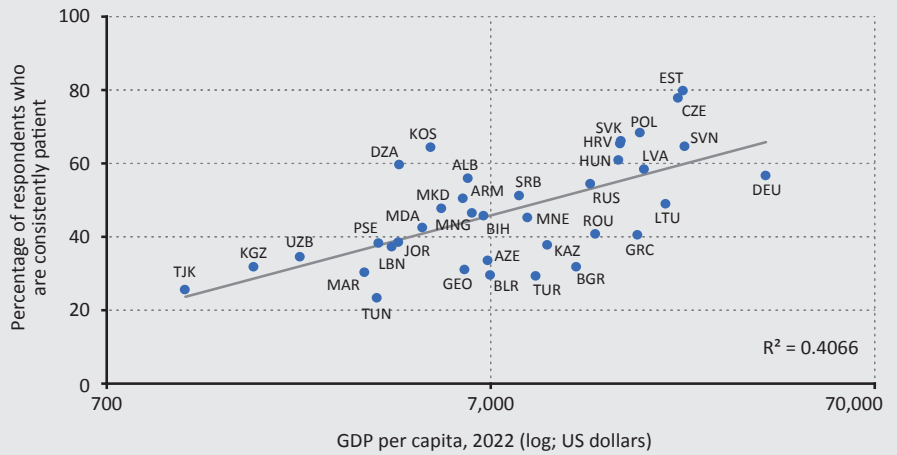
	Prevent environmental pollution					Fight climate change					Prevent biodiversity loss				
Expect to climb the income ladder	0.049***				0.042***	0.046***				0.043***	0.036***				0.033***
	–0,009				(0.010)	(0.009)				(0.010)	(0.009)				(0.010)
Consistently patient		0.036***			0.031***		0.027***			0.023**		0.031***			0.029***
		(0.009)			(0.010)		(0.009)			(0.010)		(0.009)			(0.010)
Trust the government			0.083***		0.076***			0.070***		0.065***			0.071***		0.067***
			(0.010)		(0.011)			(0.010)		(0.011)			(0.010)		(0.011)
Experienced natural disaster(s)				0.053***	0.050***				0.036***	0.031**				0.051***	0.046***
				(0.011)	(0.012)				(0.011)	(0.012)				(0.011)	(0.012)
Climate change will seriously affect me	0.170***	0.167***	0.164***	0.161***	0.159***	0.184***	0.183***	0.181***	0.178***	0.180***	0.172***	0.170***	0.169***	0.166***	0.163***
	(0.011)	(0.011)	(0.010)	(0.010)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)
Individual characteristics															
Female	0.007	0.006	0.012	0.007	0.017	–0.007	–0.009	–0.007	–0.009	–0.005	–0.009	–0.008	–0.009	–0.009	–0.004
	(0.010)	(0.010)	(0.010)	(0.009)	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)	(0.010)
Has children	0.015	0.021*	0.023**	0.019*	0.019*	–0.004	0.004	–0.000	0.001	–0.002	0.002	0.008	0.006	0.006	0.002
	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)
Female # Has children	–0.015	–0.015	–0.019	–0.014	–0.020	0.003	0.001	0.001	0.003	0.002	0.003	–0.002	–0.001	0.003	–0.001
	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)
Age	–0.001	–0.001	–0.000	–0.000	–0.001	–0.001	–0.001	–0.000	–0.000	–0.001	–0.001	–0.001	0.000	–0.000	–0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age squared	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	–0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Secondary education	0.016	0.014	0.014	0.015	0.019	0.018	0.015	0.011	0.013	0.017	0.014	0.014	0.014	0.014	0.019
	(0.016)	(0.015)	(0.015)	(0.015)	(0.017)	(0.015)	(0.015)	(0.015)	(0.014)	(0.017)	(0.016)	(0.015)	(0.015)	(0.015)	(0.017)
Tertiary education	0.052***	0.049***	0.056***	0.053***	0.057***	0.059***	0.054***	0.060***	0.056***	0.062***	0.054***	0.051***	0.058***	0.052***	0.062***
	(0.018)	(0.017)	(0.017)	(0.016)	(0.019)	(0.017)	(0.016)	(0.017)	(0.016)	(0.018)	(0.017)	(0.017)	(0.017)	(0.016)	(0.018)

	Prevent environmental pollution					Fight climate change					Prevent biodiversity loss				
Married	–0.003	–0.009	–0.011	–0.012	–0.006	–0.004	–0.007	–0.009	–0.008	–0.007	0.002	–0.002	–0.003	–0.005	0.001
	(0.011)	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.011)	(0.010)	(0.011)	(0.010)	(0.012)
Other	–0.029**	–0.030**	–0.035***	–0.034***	–0.037***	–0.020	–0.020*	–0.027**	–0.024*	–0.025*	–0.017	–0.016	–0.017	–0.020	–0.018
	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)	(0.013)	(0.012)	(0.013)	(0.012)	(0.013)	(0.013)	(0.012)	(0.013)	(0.012)	(0.014)
Urban	–0.003	–0.001	–0.002	0.001	–0.000	–0.016	–0.017	–0.018	–0.013	–0.020	–0.018	–0.018	–0.019	–0.015	–0.018
	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)	(0.013)	(0.012)	(0.013)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)	(0.014)
Equivalised income decile	0.009***	0.009***	0.009***	0.009***	0.010***	0.009***	0.008***	0.008***	0.008***	0.009***	0.008***	0.007***	0.007***	0.007***	0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Employed	–0.023**	–0.024***	–0.024***	–0.024***	–0.024**	–0.031***	–0.033***	–0.032***	–0.032***	–0.033***	–0.024***	–0.023***	–0.027***	–0.022**	–0.030***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of outcome	0.45	0.45	0.45	0.45	0.45	0.39	0.38	0.39	0.39	0.39	0.43	0.42	0.43	0.43	0.43
R^2	0.13	0.13	0.14	0.13	0.13	0.13	0.12	0.13	0.13	0.13	0.12	0.12	0.13	0.13	0.12
No. of economies	37	37	36	37	36	37	37	36	37	36	37	37	36	37	36
No. of observations	26,677	28,066	27,393	29,634	23,477	26,677	28,066	27,393	29,634	23,477	26,677	28,066	27,393	29,634	23,477

*Note: OLS regressions of being willing to pay to prevent environmental pollution, to fight climate change or to prevent biodiversity loss on individual characteristics (the omitted categories are 'primary education or below' and 'never married'; 'other' includes divorced, widowed and separated), the variable of interest and country fixed effects. Standard errors are clustered at the primary sampling unit level. *** denotes statistically significant at the 1 per cent level, ** at the 5 per cent level and * at the 10 per cent level. Based on LiTS IV.*

The rates at which future income is discounted by individuals are generally higher in poorer economies (see *Figure 1*; see also *Yesuf and Bluffstone 2019*; *De Lipsis 2021*). In the economies surveyed here, Tunisia and Tajikistan have the smallest shares of consistently patient respondents (at 24 and 26 per cent, respectively), while Estonia and Czechia have the largest shares (at 78 and 80 per cent, respectively).

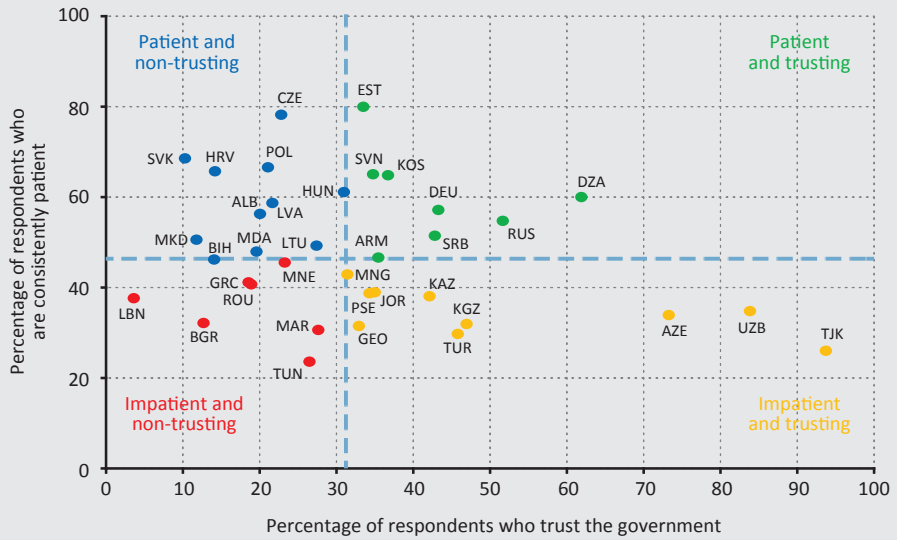
Figure 1
Richer economies generally tend to have larger shares of consistently patient respondents



Note: The horizontal axis shows the log of GDP per capita in 2022 in US dollars at market exchange rates.
Source: LiTS IV, World Bank and authors' calculations

This could, in part, be because discount rates reflect respondents' lack of trust that the promise of future pay-offs will be kept. Empirically, however, the relationship between discount rates and the degree of trust that respondents have in governments is relatively weak (see *Figure 2*).

Figure 2
Discount rates and measures of trust capture related but distinct concepts



Note: The horizontal axis shows the percentage of respondents who, when asked whether the government/cabinet of ministers can be trusted, express either some trust or complete trust. The dotted lines denote medians based on all economies covered by LiTS IV.

Source: LiTS IV and authors' calculations

The next section explores the relationship between trust and environmental attitudes in greater detail on the basis of the deep dive surveys that were conducted as add-ons to the Life in Transition Survey and among business leaders by the World Bank in Albania, Armenia, Georgia, the Kyrgyz Republic and Tajikistan.

A caveat is required. The five economies that were studied in the deep dive surveys are not necessarily representative of the 'typical' economy included in the survey, or a typical emerging market. For example, the quality of their economic institutions is below the average for the other economies included in the survey, while expressed willingness to pay for climate change mitigation policies, as well as for education, healthcare, housing, pensions, social welfare and infrastructure are considerably higher.

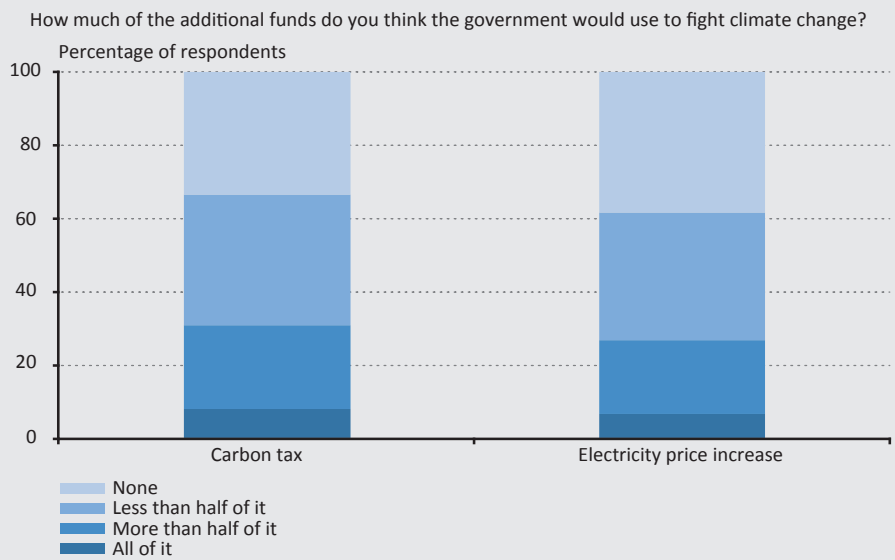
4.3. Trust

As part of those deep dive surveys, respondents were presented with a hypothetical scenario in which the government introduced a carbon tax of EUR 30 per tonne of CO_2 in order to raise funds to address climate change. Respondents were then asked how much of these additional funds they thought the government would use to fight climate change. A similar question was asked about a 20-per cent increase in the price of electricity.

Only 6 to 8 per cent of respondents believed that all of the funds earmarked for fighting climate change would be spent as advertised. A further 20 to 23 per cent thought that at least half of those funds would be spent on mitigating climate change, while the majority were highly sceptical about the actual use of those funds (see *Figure 3*).

While money is fungible and some scepticism about tax revenues being earmarked for particular purposes is understandable, the extent of that scepticism probably points to broader concerns about the transparency of government spending.

Figure 3
Widespread scepticism that tax revenues earmarked for environmental policies will be used as advertised



Source: World Bank deep dive surveys and authors' calculations

Nonetheless, it should be added that even if revenues from carbon taxes or higher electricity tariffs are not channelled to protect the environment, putting a price on emissions would already reduce the overconsumption of goods with negative externalities.

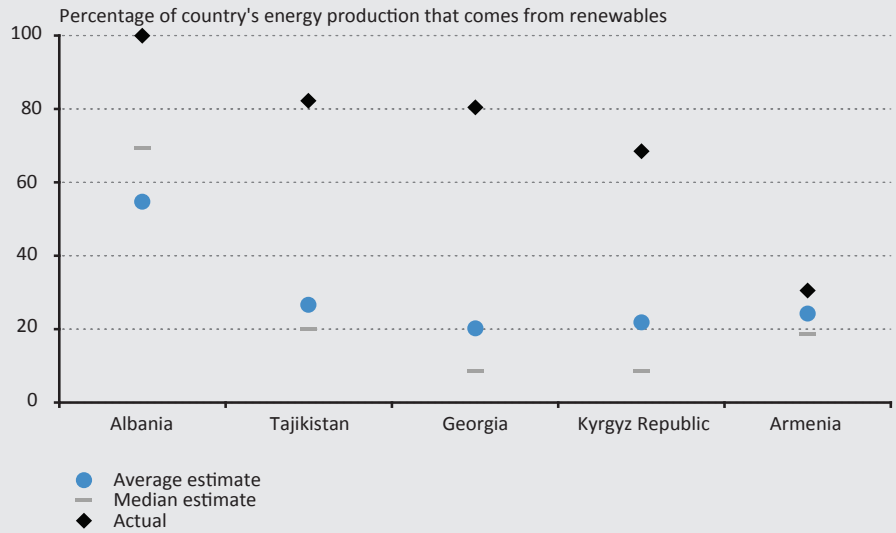
At the individual level, respondents who express higher levels of trust in the government tend to be more willing to pay for environmental policies when controlling for individual characteristics and country fixed effects (*Table 2*). In particular, respondents who express some trust or complete trust in the government (that is to say, respondents scoring 4 or 5 on a trust scale ranging from 1 to 5, where 1 indicates 'complete distrust' and 5 indicates 'complete trust') are, on average, 7–8 percentage points more likely to express a willingness to pay to protect the environment, fight climate change or prevent biodiversity loss than respondents who do not believe that their government can be trusted, that is those who score 1 or 2 on the trust scale above (see *Table 2*).

4.4. Information

Knowledge and understanding of climate change policies can boost support for environmental spending. However, there is still a sizeable information gap to be filled in most countries. The percentage of respondents reporting awareness of their government's measures to tackle climate change tends to be higher on average in advanced economies, although there is significant cross-country variation. In some emerging market economies (such as Azerbaijan, Colombia, the Philippines and Vietnam), where governments' environmental commitments have received extensive media attention at the domestic level, respondents report higher levels of awareness (*Dabla-Norris et al. 2023*).

The deep dive surveys suggest that people typically underestimate the percentage of their country's total energy production that comes from renewables. Respondents were asked to estimate the share that came from renewable sources in their country, and in all five economies both the mean and the median were well below the actual figure (see *Figure 4*). Albania, for instance, is entirely dependent on renewable sources for its energy, but the average answer in that country was 56 per cent.

Figure 4
People typically underestimate the percentage of their country's energy production that comes from renewables



Note: For Albania and the Kyrgyz Republic, actual data relate to 2022; for Armenia, Georgia and Tajikistan, they relate to 2021.

Source: IEA, World Bank deep dive surveys and authors' calculations

Better awareness of environmental risks also plays a role. Respondents who have personally experienced disruption or damage caused by flooding, drought or other natural disasters are, on average, around 3–5 percentage points more likely to be willing to pay to prevent environmental pollution, fight climate change and prevent biodiversity loss than those who have not had such personal experiences (controlling for individual characteristics and country fixed effects; see *Table 2*).

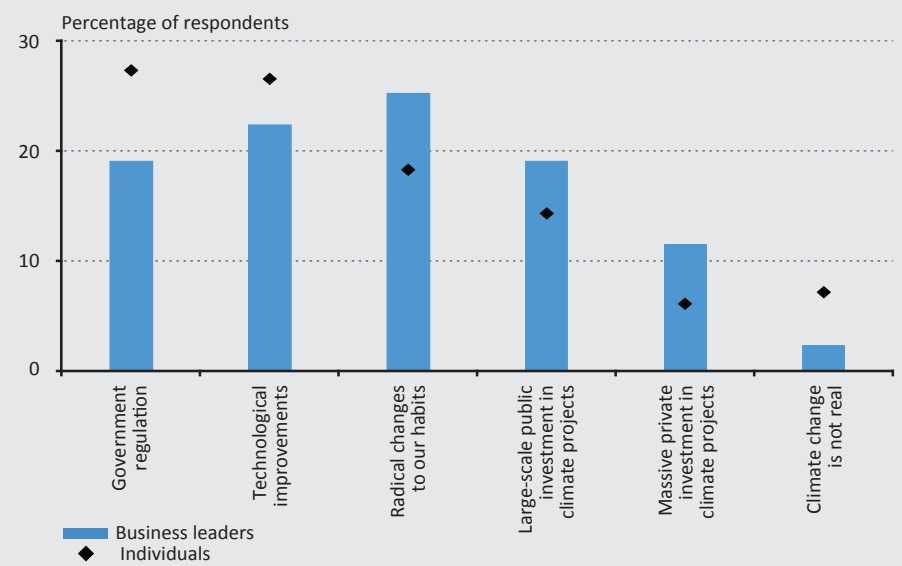
4.5. Attitudes towards climate change policies

Governments frequently invoke the principle of distributive justice in climate negotiations and public debate in order to justify their position on sharing the cost of reducing carbon emissions. Such stances are typically aligned with their countries' economic interests. Some arguments are based on the 'polluter pays' principle, with costs apportioned on the basis of current greenhouse gas emissions or cumulative emissions over time (*Dabla-Norris et al. 2024*); other arguments are based on the 'ability to pay' principle, with higher-income economies expected to pay higher costs.

In line with this, respondents in the deep dive surveys felt that all countries should, to some extent, pay to help address climate change, but the burden of financing climate change policies should increase with the level of economic development and personal income (*Dabla-Norris et al. 2023*). These views were also shared by a sample of business leaders – managers of manufacturing or service companies that had been selected at random from national registers of firms.

As regards policy design, individual respondents taking part in the deep dive surveys felt that government regulation and technological improvements were the most important means of tackling climate change (see *Figure 5*). Both were chosen by around 27 per cent of respondents from a list of six different options (with other options including radical changes to habits, large-scale public investment and massive private investment). Business leaders, by contrast, prioritised radical changes to habits over regulation and technology.

Figure 5
Most individuals see regulation and technological improvements as the best way to fight climate change, while business leaders prioritise changes to habits

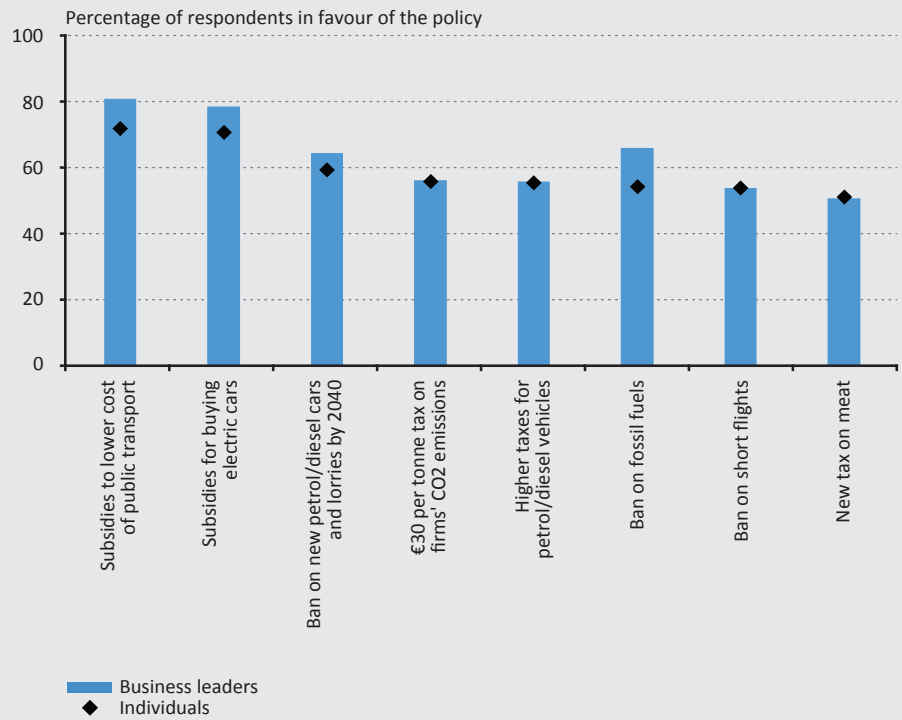


Note: This chart is based on responses to the question 'Which of the following do you believe is the most significant way to mitigate climate change?' Participants could only choose one answer.

Source: World Bank deep dive surveys and authors' calculations

Looking at respondents' support for individual measures, subsidies (for public transport or purchases of electric cars) were preferred to higher taxes (on greenhouse gas emissions, internal combustion vehicles or meat; see *Figure 6*). While the benefits of subsidies are well understood by the public, their costs (in the form of higher taxes or reduced spending elsewhere) tend to be less salient (*Fairbrother 2022*).

Figure 6
Subsidies (and some bans) are preferred to higher taxes



Note: Respondents were asked whether they favoured or opposed the adoption of these various policies in order to reduce greenhouse gas emissions. The calculations exclude respondents who replied 'don't know', as well as missing responses.

Source: World Bank deep dive surveys and authors' calculations

5. Conclusions and policy implications

The majority of people are concerned about environmental damage and the impact that climate change will have on them and their children. However, such concerns about climate change do not necessarily translate into a willingness to pay for environmental policies: the majority of the population are concerned, but those who are willing to pay higher taxes or prices to protect the environment remain a minority, albeit a large one.

Tackling climate change will require broad public support for environmental policies. Economic development may, over time, strengthen support for the green economy, since higher-income individuals tend, in general, to be more willing to pay for policies that mitigate climate change (as well as other public services). Such shifts are bound to be relatively slow, however.

A lack of trust in government and concerns about corruption can result in opposition to climate change policies, particularly in emerging markets with weaker economic institutions. For example, very few of the respondents who took part in the deep dive surveys believed that all proceeds from a hypothetical carbon tax or an increase in electricity tariffs would actually be spent on measures addressing climate change, despite those funds being earmarked for such initiatives. While this is not directly examined in this paper, our results tentatively suggest that building trust in public institutions and increasing the transparency and efficiency of government spending may help to overcome such scepticism. It should be added that even if revenues from carbon taxes or higher electricity tariffs are not channelled to protect the environment, putting a price on emissions would already reduce the overconsumption of goods with negative externalities.

The results of those surveys could also point to the importance of communicating effectively about green policies implemented to date and building awareness of progress made with the green transition, in addition to raising awareness of the cost of failing to cut pollution. For example, the deep dive surveys suggest that people vastly underestimate the percentage of their country's energy production that comes from renewables. Examining such linkages empirically, for instance, between more transparent communication or fighting local pollution and willingness to pay would be a promising avenue for further research.

Existing research suggest that better awareness of the progress made to date with the transition to a green economy can boost support for climate change policies. For instance, giving respondents information about the effectiveness of carbon pricing and the benefits of revenue recycling has been found to increase public support for those measures, with larger increases being seen in countries where there was little pre-existing knowledge of carbon taxes as an environmental policy instrument (*Dabla-Norris et al. 2023*).

Climate change policies should be designed in such a way that they are affordable and regarded as being fair to everyone. The funding of those policies needs to ensure that more of the costs are borne by higher earners, while benefits also accrue to individuals on lower incomes. The results of the deep dive surveys indicate that respondents expect to see these features in environmental policies. Social safety nets can help to protect the most vulnerable, while active labour market policies can assist with the transition process where workers are displaced by technological change.

Recycling some of the tax receipts from carbon pricing in order to subsidise investment in low-carbon technologies such as renewable energy or electric vehicles – a policy that enjoys broad-based support – could increase the availability of cleaner alternative energy sources (*EBRD 2023; IMF 2019, 2022; Shang 2021*). Subsidies tend to enjoy greater popular support, since their costs in terms of higher taxes are less salient.

Highlighting additional benefits of climate change policies, such as improved air quality, health benefits and potential job creation, can also help to reduce the public's sensitivity to their short-term costs.

Future research could examine the correlations highlighted in this paper in a more causal setting; a valuable area for further studies would also be examining the heterogeneity of such effects.

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The Evolution of Trust in Central Banks during the Covid Crisis*

Zoltán Korsós – Eszter Baranyai

This paper examines the evolution of trust in central banks during the Covid-19 pandemic in euro area countries, using the example of the European Central Bank. The study focuses on the effects of the pandemic, but also analyses the role of demographic, economic and political factors. We use a probit model with data from Eurobarometer and the Oxford COVID-19 Government Response Tracker. Our results show that the pandemic led to a decline in institutional trust, though this effect is not specific to central banks. There is a positive relationship between stricter government measures and trust in central banks. Extreme political views – both left-wing and right-wing views – are associated with lower trust in central banks. Our results highlight the co-movements of trust in particular institutions, and draw attention to the need for a deeper understanding of the trust dynamics within extremist groups.

Journal of Economic Literature (JEL) codes: E58, F33, Z13

Keywords: central bank, trust, Eurobarometer survey, Covid, crisis, European Central Bank

1. Introduction

Trust in central banks is essential for the long-term success and stability of institutions. In several countries, it has been shown that there is a correlation between the anchoring of inflation expectations and trust in the central bank: the more people trust the central bank, the more they expect inflation to be close to the level/range targeted by the central bank (*Brouwer – de Haan 2022*), and the inflation expectations of the public are critical for the success of monetary policy.

* 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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Analysis of trust in central banks is a relatively new field of research, with the study by *Ehrmann et al.* (*2013*) being one of the most influential contributions to the literature. However, trust in public institutions in the broader sense has a long history in political science (*Kiss 2018*).

Trust develops in the relationship between the principal (citizens) and the agent (central bank), where the principal trusts the agent to act in their interest, for example, in the case of central banks, by ensuring price stability (*Knack 2001*) or financial stability (*Borkó et al. 2020*). Trust in central banks depends not only on their direct performance but is also influenced by cultural and socio-economic contexts.

Various theories attempt to capture different aspects of the process of building trust in institutions (*Mishler – Rose 2001*). Cultural theories focus mainly on socialisation in the early years. The relationships formed in childhood affect the trust we have in others. This so-called interpersonal trust also has an impact on trust in institutions. By contrast, institutional theories argue that our trust in an institution is a rational reaction to the institution's performance: if an institution performs well, we trust it. Micro theories emphasise differences between individuals: our level of trust depends on our socio-economic background, personal characteristics and experiences, as opposed to macro theories which emphasise collective similarities.

Thus, trust in central banks is not only rational but may also be an automatic reaction, the result of subconscious learning processes (*Van der Cruijsen et al. 2010*). The components of trust in a central bank include its commitment to the public good, its expertise and the efficiency of its instruments. In line with the literature, in our analysis of trust in the central bank, we take into account the fact that trust derives from multiple sources (*Brouwer – de Haan 2022*).

Understanding the concept of trust is particularly important in the context of major events such as the Covid-19 crisis. Trust in public institutions is not only a key factor in institutional integrity and efficiency but also a key driver of economic development and stability (*Brouwer – de Haan 2022*). The lack of or a decline in trust can prevent or limit the effective functioning of institutions, which can lead to financial instability or failure to achieve public policy goals. Conversely, when people trust institutions, less time and energy is needed to defend themselves against possible malfunctioning of institutions, and they can thus allocate more resources to productive activities. In this context, trust in public institutions promotes economic efficiency and increases social welfare (*Ehrmann et al. 2013*).

The role of central banks in the economy is unique, as their decisions and communication directly influence market expectations and economic stability, and trust in central banks helps to achieve economic-financial stability (*Van der*

Cruijsen et al. 2010). Central bank credibility and, relatedly, trust in the central bank are particularly important in times of crisis, when central banks need to take swift and decisive action. However, a lack of trust may not only undermine the success of central banks but also puts them at risk of political interference (*Ehrmann – Fratzscher 2011*). In such cases, central banks will be less able to take independent decisions, which could undermine the effectiveness of economic policy and long-term economic stability. Therefore, trust in central banks is a cornerstone not only for the success of the institution concerned but also for the stability of the whole economy. In summary, stronger trust leads to better-functioning institutions (*Ehrmann et al. 2013*).

The global crisis of 2008–2009 and the subsequent euro area debt problems posed significant communication and trust challenges for many central banks (*Farvaque et al. 2017*). These economic problems amplified the voices criticising the effectiveness of the models, forecasts, policies and communication strategies used by the monetary authorities (*Waller 1991*). According to *Farvaque et al.* (*2017*), the loss of credibility of monetary policy brought about by these crises increased the discontent expressed not only by the public but also by politicians. Increasing public trust in central banks and developing a transparent and clear communication strategy are key to strengthening the credibility of monetary policy and institutional legitimacy. Regular, clear communication – including a detailed explanation of the central bank's objectives, limitations, instruments and effects – may increase not only the intensity of dialogues between institutions but also gain increased public support. This is particularly important at times when the popularity of central bank policies may be declining.

From 2020, the global economy faced another major challenge in the form of the Covid-19 pandemic. The Covid-19 pandemic, like previous crises, hit the world unexpectedly and had a significant impact on the global economy. During the crisis, the European Central Bank (ECB) took a number of extraordinary measures to stabilise the financial system, support liquidity and stimulate economic growth, while keeping inflation targets in mind. These measures brought the issue of trust in central banks back into focus, as the Covid crisis created widespread uncertainty and the reactions of the public and market participants may also have depended on the extent to which they trusted the policies and communication developed by the central bank(s).

The aim of this study is therefore to examine public trust in central banks in the context of the Covid crisis in the euro area countries, using the example of the ECB. Although there have been studies on trust in central banks in the context of a crisis, to the best of our knowledge none of them have examined the impact of Covid-19. We take into account both macroeconomic and individual-specific factors. The study aims to contribute to a deeper understanding of trust processes, which may prove

particularly useful for decision-making institutions in possible future crises. The results may help to maintain institutional credibility and build public trust.

2. Literature review

In recent years, there has been increasing attention on trust in central banks. Several studies have examined the issue for the European Central Bank, as well as for other central banks such as the Bank of England, the Deutsche Bundesbank, the Reserve Bank of New Zealand, the Bank of Israel (*e.g. Bursian – Fürth 2015; Brouwer – de Haan 2022; Mellina – Schmidt 2018; Farrell et al. 2020; Hayo – Neumeier 2021*). *Baranyai et al.* (*2024*) also conducted an international study on the Magyar Nemzeti Bank (MNB), examining the factors of trust in the Hungarian central bank, including the green central bank orientation. The wide range of research shows that trust in central banks is a key issue not only from an academic but also from a practical point of view.

Our research draws on the literature, but it is worth highlighting the following:

- Most of the research looks at a single point in time, while the present study covers a time horizon of several years.
- Research often focuses on a single country, while this study looks at the euro area as a whole, also using country-specific macroeconomic indicators.
- The early stage of the literature often either concentrated on classical macroeconomic indicators concerning trust in the central bank, such as inflation, unemployment, real GDP growth and fiscal policies, or primarily focused on general social and demographic (individual-level) factors affecting trust. Our analysis includes both sets of variables.
- The study is also extended with a new Regulatory Stringency Index, which shows how stringent regulations were in the countries concerned during the Covid crisis.

Related early research by *Kaltenthaler – Anderson* (*2001*) analysed the popularity of European monetary policy in the pre-common currency period between 1994–1997. *Hudson's* (*2006*) article provides insights into the evolution of trust in central banks and finds that traditional socio-demographic variables have a significant impact on trust, but the data only cover 2001. The analysis by *Medve-Bálint and Boda* (*2014*) shows that the income situation and the impact of inequality in the countries of Central and Eastern Europe differ from Western European patterns. While the negative impact of social inequality can be observed in both regions, trust levels remain low in the CEE countries, even with relatively smaller income disparities. This may be attributed to the specific interaction between political-economic systems

and egalitarian attitudes, which is important when examining trust dynamics in the euro area.

Győrffy's (*2012*) study examines the links between institutional trust and long-term decision-making, with a particular focus on how compliance with the rules and trust in institutions influence the plans and decisions of social actors. The study highlights that the presence or absence of trust is a fundamental determinant of compliance with the law, which is critical for long-term economic stability. These findings are particularly relevant for understanding the processes of trust in the central bank, as institutional stability and transparency are important prerequisites for maintaining trust. *Banducci et al.* (*2009*) studied the dynamics of trust in the euro, in particular how European citizens perceived the inflationary consequences of the introduction of the new currency. *Kaltenthaler et al.* (*2010*) investigated public distrust towards the ECB and found that distrust towards the ECB is stronger when people feel that the bank has too much autonomy to take into account the opinions and needs of ordinary people. Unlike these studies, we also use several survey waves and macroeconomic explanatory variables in our analysis.

Some articles examine the macroeconomic determinants of trust in the ECB at the country level. *Fischer – Hahn* (*2008*) concluded that a high level of inflation leads to a decline in trust in the ECB. *Boda's* (*2019*) study highlights that institutional trust depends not only on economic performance but also on the ethical and normative foundations of institutions, especially in the case of procedural fairness, which is a prerequisite not only for the credibility of the decision-maker but also for the willingness of the stakeholder to cooperate. *Wälti* (*2012*) and *Gros – Roth* (*2010*) focussed on the impact of the 2008 global economic crisis on ECB support. The articles found that the banking crises and fiscal problems had a negative impact on trust in the ECB. However, they did not take into account the socio-demographic determinants of ECB support and restricted their analysis exclusively to macroeconomic variables such as unemployment, inflation or GDP per capita (*Farvaque et al. 2017*).

Ehrmann et al. (*2013*) were the first to combine micro-level data and macroeconomic indicators in an analysis similar to the one we conduct, but they studied the period 2008–2010. Their empirical results showed that trust in all European institutions generally declined as macroeconomic conditions deteriorated, and that the decline in trust in the ECB also reflected the severity of the banking sector's problems, as the ECB was also perceived as responsible for the problems of the financial system (*Wälti 2012; Gros – Roth 2010*). The study by *Ehrmann et al.* (*2013*) provides an important basis for our research, both in terms of the topic (central bank trust dynamics during a crisis) and methodology.

3. Data

3.1. Data from Eurobarometer surveys

The Eurobarometer survey is a comprehensive survey conducted at the national and individual levels, carried out since 1973 at the request of the European Commission. The standard Eurobarometer surveys are carried out twice a year, in spring and autumn. In a typical survey, around 1,000 people are interviewed personally in each Member State (this number is around 2,000 in Germany and 600 in Luxembourg), so in total more than 27,000 people are interviewed across the European Union, allowing for an analysis of trust behaviour in different economic and financial contexts. It is important to note, however, that these surveys are not panel surveys, so the participants change each time, which prevents the analysis of individual fixed effects. The persons selected represent different groups of the population proportionally, taking into account aspects such as gender, age, employment status, education level and political orientation. The results of the Eurobarometer are public and can be found on the Gesis website.[1]

In this paper, as in *Ehrmann et al.* (*2013*), we use in particular individual-level data from the European Commission's Eurobarometer surveys to analyse the determining factors of trust in the ECB, both in normal and crisis periods. The analysis of crisis periods is particularly important for the euro area, as it also provides information on economic cooperation and heterogeneity between countries.

Of the Eurobarometer surveys, the data collections between 90.3 (November 2018) and 92.3 (November 2019) covered the period before Covid, while the surveys between 93.1 (August 2020) and 95.3 (June 2021) examined the period after Covid. The surveys chosen were selected because they cover relevant questions, including levels of trust in the ECB. A key criterion for the selection of the pre- and post-Covid-19 periods was that the spring 2020 survey was cancelled due to the spread of Covid-19 in Europe, and that all of the surveys included in the analysis cover all of the countries in the euro area.

Among other things, respondents were asked about their trust in the main European institutions (e.g. Eurobarometer question 92.3 QA12.3). The question was included in the survey as follows:

'QA12. Please tell us how much you trust and how much you do not trust the following European institutions.

QA12.3 The European Central Bank'

[1] https://www.gesis.org/en/eurobarometer-data-service

The responses were recorded in three ways: 1) 'Tend to trust', 2) 'Tend not to trust' and 3) 'I do not know'. In our research, we treat trust in the ECB as a binary variable, and do not include the category 'I do not know', as these respondents did not clearly express their opinion. The resulting binary variable will be our dependent variable. Nevertheless, the exclusion of 'I do not know' responses may be problematic, as the willingness to respond may not be independent of trust in the ECB. This will be handled in the manner described later.

Table 1 presents the descriptive statistics of the variables for the full time-horizon (between 2018 and 2021). Regarding trust in the ECB, 50 per cent of respondents said they trusted the ECB, 37 per cent said they did not trust the ECB and 12 per cent said they did not know. The gender distribution of participants shows that 54 per cent of respondents are women and 46 per cent are men. Regarding marital status, the majority of respondents, 53 per cent, were unmarried, while 47 per cent said they were married. In terms of education, the largest group of respondents, 39 per cent, completed their education between the ages of 16 and 19, while 37 per cent completed their studies over the age of 20. In terms of age, the largest group of respondents, 35 per cent, is over 60, with the rest of the age groups being more or less evenly distributed. In terms of political orientation, the largest group was from the centre with 38 per cent, while 5 per cent declared themselves extreme right and more than 7 per cent extreme left. The question on political orientation was included in the survey as follows, and was to be answered on a scale of 1 to 10:

'D1. On political issues, people talk about 'left' and 'right'. How would you place your views on this scale?'

Our study grouped the responses into 5 categories. The extreme left group was made up of respondents who gave a score of 1 or 2 on the scale, while the left-wingers chose scores of 3 or 4. Respondents from the centre gave themselves a score of 5 or 6, while the right-wingers gave the scores of 7 or 8. Finally, the extreme right category includes those who chose a score of 9 or 10 on the scale.

When it comes to satisfaction with life, the majority of respondents, 60 per cent, are satisfied, while only a small proportion, 3 per cent, are not satisfied. Of the respondents, 75 per cent are not retired, so the proportion of retired people is 25 per cent.

Table 1
Descriptive statistics of variables for euro area countries and for the whole period

Answers	N	(%)	Answers	N	(%)
Trust in the ECB			**Trust in the Commission**		
Tend to trust	58,376	50.12	Tend to trust	59,198	50.83
Tend not to trust	43,820	37.63	Tend not to trust	42,514	36.5
Do not know	14,269	12.25	Do not know	14,753	12.67
Total	116,465	100	Total	116,465	100
Gender			**Married**		
Male	53,485	45.92	Married	55,277	47.46
Female	62,945	54.05	Not married	61,178	52.53
No answer	35	0.03	Other	10	0.01
Total	116,465	100	Total	116,465	100
Employment			**Educational attainment**		
Working	43,919	37.71	At the age of 15	15,500	13.31
Contractor	8,402	7.21	Between 16 and 19 years	45,697	39.24
Not working	48,374	41.54	Over 20 years	42,851	36.79
Other	15,770	13.54	Other	12,417	10.66
Total	116,465	100	Total	116,465	100
Age			**Political orientation**		
<23	9,180	7.88	Extreme left	8,911	7.65
24–35	17,294	14.85	Left wing	22,693	19.48
35–45	17,809	15.29	Centre	43,698	37.52
45–59	29,038	24.93	Right wing	17,999	15.45
60<	40,669	34.92	Extreme right	6,334	5.44
No answer	2,475	2.13	Other	16,830	14.45
Total	116,465	100	Total	116,465	100
Satisfaction with life			**Retired**		
Very satisfied	25,921	22.26	Not retired	86,886	74.6
Satisfied	70,159	60.24	Retired	29,579	25.4
Not very satisfied	16,842	14.46	Total	116,465	100
Not satisfied at all	3,363	2.89			
Do not know	180	0.15			
Total	116,465	100			

Source: Based on individual-level data from Eurobarometer surveys

Table 2 summarises the responses of Eurobarometer surveys' respondents before and after the Covid-19 crisis in terms of their trust in the ECB, by different demographic groups. It can be observed that, following the start of the Covid-19

pandemic, trust in the ECB declined for a number of demographic groups, such as the youngest, 45–59-year-olds, the least educated and the non-right-wingers.

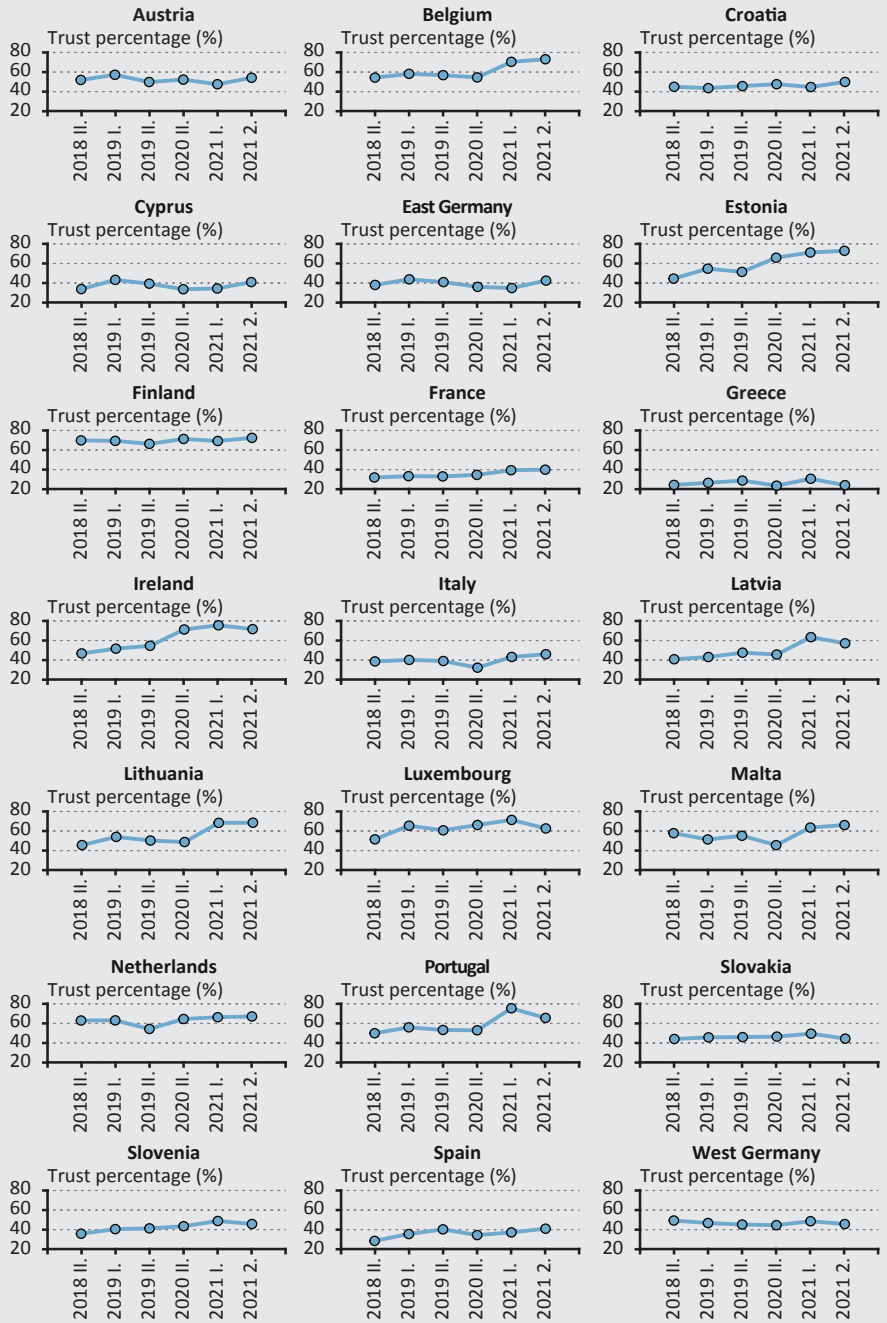
Table 2
Summary statistics on trust in the ECB (%)

Variables		Before Covid				After Covid			
		Persons	Trust	Do not trust	Do not know	Persons	Trust	Do not trust	Do not know
Gender	Women	21,046	45.5	37.0	17.5	10,484	47.6	38.0	14.5
	Men	17,458	49.7	38.7	11.6	8,885	50.1	40.8	9.1
Age	<23	3,184	53.1	28.6	18.3	1,547	51.7	29.8	18.5
	24–35	5,528	48.7	38.4	12.9	2,796	50.2	40.2	9.6
	35–45	5,610	48.0	39.8	12.3	2,865	49.2	42.0	8.9
	45–59	9,285	47.8	40.2	12.0	4,908	47.0	43.3	9.7
	60<	14,897	46.8	35,1	18.2	7,254	48.5	37.1	14.4
Marital status	Married	20,103	48.4	38.9	12.7	10,039	50.5	39.2	10.3
	Not married	18,401	46.4	36.4	17.2	9,330	46.8	39.3	13.9
Educational attainment	<15	5,870	35,8	44.2	20.0	2,562	33.5	45.2	21.3
	16–19	16,226	44.4	40.1	16.0	7,776	44.4	43.0	12.6
	20<	13,018	56.6	31.9	11.5	7,038	58.0	34.6	7.3
Employed	Working	16,260	50.1	37.9	12.1	8,533	51.3	39.4	9.3
	Unemployed	22,244	45.0	37.1	17.9	10,836	46.4	38.4	15.2
Retired	Retired	12,501	45.1	36.8	18.1	5,692	47.8	37.5	14.7
	Not retired	26,003	48.6	38.2	13.2	13,677	49.1	40.0	10.9
Political orientation	Extreme left	3,234	46.6	41.8	11.6	1,382	45.5	43.7	10.8
	Left wing	7,270	53.0	35,5	11.5	4,003	52.7	37.1	10.3
	Centre	13,518	51.0	35,4	13.6	8,236	48.3	40.0	11.8
	Right wing	5,200	54.5	35,2	10.4	3,238	55.8	37.7	6.5
	Extreme right	2,167	48.9	38.9	12.2	1,032	49.2	41.0	10.2

Source: Based on Eurobarometer surveys

Figure 1 shows the changes in trust in the ECB in each euro area country from 2018 H2, including the emergence of the Covid-19 pandemic in 2020, to the middle of the pandemic period. The evolution of trust varies considerably between individual countries: In Cyprus, Malta and Italy, there was a noticeable drop in trust immediately after the outbreak, while in France, West Germany and Slovakia, trust remained stable or increased slightly. One possible assumption from the line charts is that the crisis negatively affected trust in the ECB in many countries, but the differences between countries may suggest that the impact of the crisis was heterogeneous across the euro area.

Figure 1
Evolution of trust in the ECB in individual euro area countries



Note: The figure shows the percentage of respondents who said they tend to trust, and not that they tend not to trust the ECB or do not know.

Source: Based on Eurobarometer surveys

3.2. Data from Eurobarometer surveys and macroeconomic data

The Oxford COVID-19 Government Response Tracker (OxCGRT)[2] provides a systematic, comparable database that gives a comprehensive picture of government responses to the Covid-19 pandemic in different countries. The database comprises data from 185 countries and includes data on school and workplace closures, restrictions on public gatherings, health policies, economic support measures, and information on vaccination priorities and requirements. A total of 25 different measure indicators are used to categorise government responses, which are also used to create indices for easy comparison. The database aims to help researchers, decision-makers and the public understand and evaluate the responses to Covid-19, thus helping to prepare for future epidemics and crisis management. The data are accessible and publicly available.

The stringency index is a key indicator used by OxCGRT to measure the stringency of government action during the Covid-19 pandemic. This index provides a quantified picture of how stringently different countries responded to the epidemic. The stringency index takes into account a range of government response measures, such as school and workplace closures, restrictions on public gatherings, traffic restrictions, curfews and travel restrictions. The index measures the stringency of the response measures on a scale from 0 to 100, with higher values indicating more stringent responses. For the calculation, the OxCGRT team assigns data to different response measures, which are then averaged to obtain a daily stringency index for countries or regions. The index allows researchers, decision-makers and citizens to monitor the extent to which countries' measures are changing as the pandemic intensifies and to compare their effectiveness.

It is important to note that the stringency index does not measure the quality of measures, the effectiveness of their implementation or their economic and social consequences. It merely provides information on how stringently countries tried to take steps to prevent the spread of the pandemic. When assessing the index, it is therefore important to take into account the different social, economic and political contexts of the countries (*Table 3*).

Macroeconomic data were taken from the Eurostat database. The data include the inflation rate based on the annual consumer price index and the unemployment rate (*Table 3*). The methodology followed by Eurostat involves the collection of data from the national statistical offices of the Member States, ensuring the comparability and reliability of the data.

[2] https://www.bsg.ox.ac.uk/research/covid-19-government-response-tracker

Table 3
Descriptive statistics: macroeconomy and stringency index

	Before Covid			After Covid		
Variables	**Number**	**Mean**	**SD**	**Number**	**Mean**	**SD**
Unemployment rate	42	7.040	3.808	42	7.250	3.181
Inflation	42	1.607	0.734	42	1.345	1.514
Stringency index	38,504			19,369	44.12	5.391

Note: The table summarises the data from the 2019 and 2020 Eurobarometer surveys in the form of descriptive statistics. The period before Covid-19 reflects 2018 and 2019 data, and the period after Covid-19 reflects 2020 and 2021 data. The stringency index was established in response to the Covid-19 outbreak, so data are only available for the follow-up period in that regard. Further details on the definition of variables and data sources are given in Table 6 in the Annex.

The strength of the association between each variable and trust in the ECB is shown in Tables 7 and 8 in the Annex.

4. The empirical model

In this study, we estimated the following probit model, also applied by *Ehrmann et al.* (*2013*), at time *t* for individual *i* from country *j*:

$$trust_{it}^{j} = \alpha x_{it}^{j} + \beta z_{it}^{j} + \gamma\, crisis_{t} + \delta D^{j} + \varepsilon_{it}^{j} \quad (1)$$

Trust is a binary variable indicating trust in the ECB. x_{it}^{j} indicates individual-specific variables (e.g. gender, age, married, retired and political orientation vector). z_{it}^{j} are country-level variables such as inflation and unemployment rates. $crisis_t$ is the dummy for the Covid-19 crisis and, in another specification, the stringency index variable. D^j is the vector of country-specific dummy variables, which is one dummy for each euro area country except our reference country.

The need to deal with selection bias arose in the course of our research, requiring the use of the Heckman correction model based on *Ehrmann et al.* (*2013*). On the one hand, the number of respondents who do not express an opinion on trust in the ECB – i.e. the 'I do not know' category – is not insignificant. This phenomenon may distort the results of the analysis if the non-response is not random. For example, the willingness to respond may be lower among those who lack trust in the central bank. If this is the case, we would overestimate the proportion of people who trust the ECB and find biased associations between trust in the ECB and other variables. On the other hand, the number of people who are willing to express their opinion on trust in the ECB changes in times of crisis: the proportion of 'I do not know' answers decreases. On average, the share of 'I do not know' answers decreased by 3 percentage points across countries, although with significant variations – for example, Estonia and Finland saw a decrease of 31 per cent and 12 per cent, respectively. Estimates from our standard probit model may be biased by

these changes in response willingness, as the group of survey respondents is not necessarily representative of the population as a whole. Interestingly, for the 2008 crisis *Ehrmann et al.* (*2013*) also found an increased willingness to voice opinions. Further research is needed to understand why exactly the willingness to voice opinions increases in these two crises, and whether this is true in general for periods of crisis.

The Heckman correction model aims to correct for selection bias using a two-step method. In the first step, a probit model is used to estimate the probability of being included in the sample (in this case, the respondents' decision whether to express an opinion on the ECB). In this step, we examine the relationship between those who express an opinion and those who do not. In the second step, we use the probit model to model opinions about the ECB, taking into account the estimates of the response probability of the survey respondents from the first step. Heckman's correction is based on the assumption that the selection equation includes a variable which affects selection (and, as a result, is positively and significantly related to trust in the ECB), beyond this channel, however, the instrument should have no effect on trust in the ECB.

In our selection strategy, we use an instrumental variable similar to the study by *Ehrmann et al.* (*2013*) the willingness to express an opinion on the issue of trust in the European Parliament. We assume that anyone who is willing to express an opinion on the European Parliament is likely to express an opinion on the ECB as well. However, it is also assumed that whether someone answers a question about the European Parliament is essentially independent of whether they trust the ECB. The results of the analysis show that this instrument is positively and significantly correlated with trust in the ECB (Annex *Table 9: European Parliament opinion variable – 0.686 – positive and statistically significant coefficient*).

5. Findings

Our findings show that the Covid-19 pandemic had an overall negative impact on trust in the ECB (*Table 4*, specifications 1–4), which is in line with the literature that trust in institutions often declines in times of crisis (*Ehrmann et al. 2013; Wälti 2012; Gros – Roth 2010*). Controlling for demographic and macroeconomic factors, the period of the Covid crisis reduces the probability of a 'tend to trust' response (*Table 4*, specifications 1–4, coefficients 0.04–0.06). The differences between the first four specifications (1–4) in *Table 4* are due to the variables they include as controls. The specifications with increasing sequence numbers include more and more demographic and economic variables, such as gender, age, marital status, education level, employment level and retirement status.

One question is whether the negative impact of Covid-19 on trust in the central bank is part of a loss of trust in institutions in a broader sense or whether it is more due to central bank-specific reasons. To answer this question, specifications 5 and 6 include a proxy for general institutional trust – trust in the European Commission. In these specifications we no longer see a statistically significant Covid dummy (at the 0.05 level) with a negative sign. The results, therefore, suggest that the loss of trust caused by the crisis is not specific to central banks but is part of a general change in trust in European Union institutions.

This may be because the crisis caused by the Covid-19 pandemic was primarily a public health crisis, although it also had significant economic consequences. Thus, it is different, for example, from the global economic crisis of 2008, which had its origins directly in the economic and financial system. It is possible that the public did not fully appreciate the (further) serious problems that could have arisen in the economic and financial system during the Covid-19 crisis if central banks and other institutions had not intervened. Given the nature of the crisis, it is therefore possible that people's perceptions were mainly about public health measures rather than about measures aimed at financial (or economic) stability, and this also affected the development of trust in individual European institutions.

The coefficient of trust in the European Commission is positive and significant in all three specifications where it is included (*Table 4* specifications 5 and 6 and *Table 5* specification 8). This means that trust in the Commission and the ECB moves together. The link between trust in the different institutions of the European Union is logical.

The effect of political orientation on trust in the ECB is statistically significant. Extremist views – whether extreme right or extreme left – are associated with lower central bank trust. Interestingly, in specifications controlling for general EU institutional trust, left-wing political orientation variables are statistically significant and negative, while right-wing ones are not. This is in line with the literature, which also found that left-wing respondents have less trust in the ECB. This phenomenon was linked to the fact that inflation is a relatively more important issue for right-wing parties, as their voter base would be worse off with high inflation than with some increase in unemployment (*Brouwer – de Haan 2022*). And the public follows the parties' positions.

Inflation is included in the model based on *Ehrmann et al.* (*2013*), but in our case the period under consideration does not include the rise in inflation, as it ends before. Omitting inflation from the equations does not materially change the conclusions.

Table 4
Determinants of trust in the European Central Bank with Covid dummy

	(1)	(2)	(3)	(4)	(5)	(6)
Covid	–0.055***	–0.049***	–0.036***	–0.049***	0.003	0.008*
Gender: Women		0.056***	0.054***	0.052***	0.001	–0.000
Age		0.002***	0.002***	0.002***	0.001***	0.001***
Married		0.010*	0.013**	–0.010*	0.009**	0.004
Educational attainment		0.039***	0.039***	0.042***	0.014***	0.011***
Employment		0.030***	0.029***	0.031***	0.008*	0.007
Retired		0.040***	0.042***	0.040***	0.001	0.002
HICP inflation (annual)			–0.005	–0.010	0.011**	0.011**
Unemployment rate (annual)			–0.000	0.000	0.001	0.001*
Political orientation (basic group: centre):						
Extreme left		–0.087***		–0.089***	–0.047***	
Left wing		0.014*		0.014**	–0.010**	
Right wing		–0.009		–0.008	0.004	
Extreme right		–0.049***		–0.043***	–0.007	
Trust in the European Commission					0.642***	0.660***
Country dummy?	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	115,755	88,938	102,485	85,571	83,221	96,922
Pseudo-R-squared	0.079	0.091	0.122	0.118	0.477	0.502
Rho	–1.269	–1.331	–1.187	–1.289	–0.673	–0.592
LR statistics	22,623	5,330	3,247	38,478	31,321	38,478
p-value	0	0	0	0	0	0
Inverse Mills ratio	–0.825	–0.838	–0.717	–0.788	–0.255	–0.219

*Note: In specifications 1–6, the effect of Covid-19 is modelled with a dummy variable. The significance levels are denoted as *** p<0.001, ** p<0.01, * p<0.05. All models use robust standard errors to handle heteroskedasticity. Censored observations mean that the censored data from the full sample cannot be fully observed in the model. The rho, LR statistics and the associated p-value provide information on the value of the correlation coefficient between the error terms in the selection and regression equation, rejecting the null hypothesis that this value is zero, thus justifying the need for the Heckman model.*

Table 5
Determinants of trust in the European Central Bank with a stringency index

	(7)	(8)
Stringency index	0.028***	0.039***
Gender: Women	0.058***	0.004
Age	0.002***	0.001***
Married	0.009	0.008**
Educational attainment	0.034***	0.011***
Employment	0.030***	0.008*
Retired	0.044***	0.003
HICP inflation (annual)	–0.040***	–0.002
Unemployment rate (annual)	–0.000	0.001*
Political orientation:		
Extreme left	–0.089***	–0.048***
Left wing	0.012*	–0.010**
Right wing	–0.014*	0.001
Extreme right	–0.044***	–0.008
Trust in the European Commission		0.641***
Country dummy?	Yes	Yes
Number of observations	85,571	83,221
Pseudo-R-squared	0.118	0.477
Rho	–1.360	–0.757
LR statistics	4,408	29,701
p-value	0	0
Inverse Mills ratio	–0.871	–0.292

*Note: In specification 7, the impact of Covid-19 on the stringency of government measures during the pandemic is directly assessed using the stringency index, which ranges between 0 and 1. The significance levels are denoted as *** p<0.001, ** p<0.01, * p<0.05. All models use robust standard errors to handle heteroskedasticity. The rho, LR statistics and the associated p-value provide information on the value of the correlation coefficient between the error terms in the selection and regression equations, rejecting the null hypothesis that this value is zero, thus justifying the need for the Heckman model.*

The Covid dummy is replaced by the stringency index in specifications 7 and 8. The stringency index coefficient is statistically significant and positive. This means that a higher stringency index is associated with a higher level of trust in the central bank. This can be interpreted in several ways. It is possible that in countries where stricter measures were introduced to combat Covid-19, people's trust in the ECB increased – either because active, appropriate action is valued by the public, or

because stricter measures reflect a worse public health situation (higher infection levels, etc.) and there is greater support for action to tackle the worse situation. But it is also possible that higher institutional trust made it possible to announce more stringent Covid measures (i.e. causality is reversed). It is beyond the scope of this study to explore possible explanations.

Specification 8 expands specification 7 by general institutional trust (in the Commission). The results of specifications 8 and 6 also show that trust between the institutions of the European Union is correlated and that trust in the European Commission moves in conjunction with trust in central banks.

In *Tables 4* and *5*, we can see that the level of education is significantly positive across the models, suggesting that higher educational attainment is associated with higher levels of trust. The literature also tends to find a positive relationship in general (*Ehrmann et al. 2013*; *Mellina – Schmidt 2018*), which is often explained by the information channel: highly educated people are better informed. In addition, our results also show that higher age is associated with higher levels of trust. This is in line with the results of *Ehrmann et al.* (*2013*) and *Farvaque et al.* (*2017*). As concluded by *Farvaque et al.* (*2017*), there is also a positive correlation between employment and trust. In our sample, women's trust levels are higher than men's in most specifications, controlling for other factors. The literature is not consistent with respect to gender, with some studies documenting higher trust levels among women, while others find the opposite (*Ehrmann et al. 2013*; *Farvaque et al. 2017*; *Brouwer – de Haan 2022*; *Hayo – Neuenkirch 2014*). It is also interesting to note that some of the demographic variables are not significant as more and more variables are included in the model (specification 5–6), especially when controlling for general trust in EU institutions. This may suggest that some demographic variables are more relevant from the aspect of overall trust than central bank-specific trust. Similar to *Brouwer – de Haan's* (*2022*) study of Dutch data, we find that employment (unemployment) loses its statistical significance when controlling for overall (EU) institutional trust. However, the Hungarian data show that the gender variable behaves similarly, whereas in the Dutch sample of *Brouwer – de Haan* (*2022*), gender becomes significant at the 0.05 level when EU trust is included.

The matrix describing goodness of fit shows that the model performs well in predicting 'trust', but does not perform well in identifying 'do not trust' (a value lower than 0.5 probability is assigned to the 'do not trust' category). Regardless of this, the study's analyses of the relationship between each variable and the greater likelihood of 'trust' are valid (Annex *Table 10*).

6. Conclusions

In this study, we examined the impact of the Covid-19 crisis on the trust of euro area residents in the central bank. We found that this effect is negative, which is in line with the literature that trust levels generally decline in times of crisis. However, the negative impact is not specific to the central bank but stems from a general decline in institutional trust.

Our results also highlight the relationship between trust in the individual European institutions. Trust in the ECB moves in conjunction with trust in the European Commission, for example. When taking measures, especially during crises, coordination between institutions that also reflects this aspect may be beneficial. Presumably, it is not only trust in individual European supranational institutions that is correlated but also the measures taken by individual governments may have a trust effect extending beyond governments. We find a positive correlation between stringent government measures during the crisis and public trust in the central bank.

Interestingly, among other factors, political orientation was also found to be a determinant of trust in the central bank. Those at both ends of the political orientation scale have less trust in the central bank, which for right-wing respondents is not related to the central bank but rather to general trust in the EU institutions. However, the lower level of trust among left-wing respondents is directly related to the central bank. Furthermore, in our sample, as in some of the literature, we find that the unemployed, the younger and the less educated are more likely to have lower levels of trust.

These results show that trust in central banks is a complex phenomenon that depends not only on the direct actions of the central bank but also on the general economic and political environment, the credibility of other institutions and demographic factors.

The results of the study highlight the complex nature of trust in central banks in times of crises such as Covid-19. However, the dynamics of trust can differ significantly in other types of crises, such as the 2008 financial and economic crisis, which affected the financial system itself more directly. Future research could be useful for comparative analysis of trust dynamics across crises, in order to better understand how trust-building strategies should be adapted to different crisis situations.

Looking ahead, it may be useful to analyse in more depth the spill-over effects of trust between institutions, for example by looking at the decisions taken in a crisis as a starting point. It may also be interesting to explore in more detail the trust dynamics of groups with extreme political orientations toward institutions, especially in times of crisis. Our results may contribute to a better understanding at central banks of changing trust levels, thus helping them to plan and implement crisis management measures more effectively.

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Annex

Table 6
Coding of variables

Variables	Source	Coding
Countries	Eurobarometer survey	We used country dummy, the reference country being: Germany
Trust in the ECB	Eurobarometer survey	1 if the answer is 'Tend to trust', 0 if 'Tend not to trust', missing value for 'I do not know'
Gender: Women	Eurobarometer survey	1 if female, otherwise 0
Age	Eurobarometer survey	Age in years
Married	Eurobarometer survey	1 if married, otherwise 0
Educational attainment	Eurobarometer survey	1 if they completed their education before the age of 16, 2 if they completed it between the ages of 16 and 19, and 3 if they completed it after the age of 19
Employment	Eurobarometer survey	1 if employed, otherwise 0
Retired	Eurobarometer survey	1 if retired, otherwise 0
HICP inflation (annual)	Eurostat	The Harmonised Consumer Price Index (HICP) is the annual inflation rate Set as a dummy: 1 if annual inflation in the year and country is above 2.5 per cent (ECB inflation target), otherwise 0
Unemployment rate (annual)	Eurostat	Annual unemployment rate for the given year and country
Stringency index	Oxford Covid-19 Government Response Tracker (OxCGRT)	The average stringency index over the six months preceding the period in question was taken for each country
Overall satisfaction with life	Eurobarometer survey	1: very satisfied 2: quite satisfied 3: not very satisfied 4: not at all satisfied
Political orientation	Eurobarometer survey	Declared themselves to be 1: extreme left, 2: left, 3: right, 4: centre, 5: extreme right Set as dummy, the reference is centre (code 3)
Trust in the European Commission	Eurobarometer survey	1 if the answer is 'Tend to trust', 0 if 'Tend not to trust', missing value for 'I do not know'

Table 7
Strength of association between variables and trust in the ECB

Variables	Cramer's V
Gender: Women	0.0009
Married	0.1928
Educational attainment	0.1480
Employment	0.0265
Retired	0.0020
Political orientation	0.0616
Trust in the European Commission	0.6892

Table 8
Average inflation and unemployment rates by trust in the ECB

ECB trust	Inflation	Unemployment
Trust	1.76	6.81
Do not trust	1.54	7.85
I do not know	1.64	7.04

Table 9
Determinants of trust in the European Central Bank with Covid dummy – Selection equation of model (3)

	(3)
Covid	0.270***
Gives opinion on the European Parliament	0.686***
Gender: Women	–0.258***
Age	–0.001***
Married	0.101***
Educational attainment	0.201***
Employment	0.052***
Retired	–0.054**
HICP inflation (annual)	0.082***
Unemployment rate (annual)	–0.000
Country dummy?	Yes
Number of observations	102,485
Pseudo-R-squared	0.122

Table 10
The goodness of fit of the model

	Actual 0	Actual 1
Predicted 0	97	598
Predicted 1	12,400	83,827

Note: The table is based on specification (6).

20 years of EU Membership: What Explains the Accession Bonus?*

Maxim Chupilkin – Zsóka Kóczán – Alexander Plekhanov

2024 marked the 20th anniversary of the EU accession of ten economies. Their experience was characterised by rapid growth in per capita incomes. Of the 23 percentage points of average convergence observed between the EU-10 and Germany between 2003 and 2023, 6 percentage points are shared with other emerging markets with similar characteristics, while the remaining 17 percentage points can be thought of as an 'EU accession bonus', facilitated by rapid growth in exports relative to GDP as they became deeply integrated into supply chains. Looking at the impact of EU accession in earlier waves, 20 years after joining, we also estimate a large 'EU accession bonus' for Spain and Portugal (which joined in 1986). Austria, Finland and Sweden (which joined in 1995) outperformed their synthetic controls only in the longer term and when comparators exclude Iceland, Liechtenstein, Norway and Switzerland – non-EU economies with access to the internal market.

Journal of Economic Literature (JEL) codes: F15, F43, F63, O47

Keywords: European Union, accession bonus, income convergence, trade integration

1. Introduction

1 May 2024 marked the 20th anniversary of the European Union (EU) accession of ten economies: Cyprus, Czechia, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Slovak Republic and Slovenia. They were followed by Bulgaria and Romania in 2007 and Croatia in 2013. This study examines the experience of these economies over the last 20 years and compares it to experiences during the earlier accession

* 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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waves, in particular those of Austria, Finland and Sweden (joining in 1995), Spain and Portugal (joining in 1986) and Greece (joining in 1981).

We rely on a synthetic control approach to estimate the 'EU accession bonus' – the additional benefit from EU accession beyond what could be expected purely based on income convergence. In particular, we use a combination of other countries which did not join the EU to construct a synthetic control, which resembles the country joining the EU before accession. We then compare the subsequent economic evolution of this 'counterfactual' country to the actual experience of the country which joined the EU. While EU accessions are non-random (with selection on variables we are unable to control for) and our estimates cannot be interpreted as strictly causal, the stylised facts that emerge from the analysis, including heterogeneity of experiences across different waves of accession, are nonetheless informative.

Our analysis relies on the synthetic control method developed by *Abadie and Gardeazabal* (*2003*) and is most closely related to *Campos et al.* (*2019*), who look at the effects of EU accessions from 1973 to 2004, but consider a shorter post-accession horizon.

In general, our results suggest that economies with lower income and weaker institutions at the time of accession experienced a substantial and lasting convergence dividend, while this does not appear to be the case for economies with higher income and stronger institutions at the time of accession.

The 'EU accession bonus' – the additional benefit from EU accession beyond what could be expected purely based on income convergence – amounted to around 17 percentage points for the 2004 accession economies 20 years on and around 33 percentage points for Spain and Portugal. Austria, Finland and Sweden outperformed their synthetic controls only when the latter group excludes Iceland, Liechtenstein, Norway and Switzerland – economies outside the EU with access to the EU's internal market.

If the convergence boost from accession is largest where income and institutional differentials are large, the remaining convergence potential for many economies from the recent accession waves is now limited. On the other hand, economies in the broader EU neighbourhood (the Caucasus, Moldova, the southern and eastern Mediterranean, Türkiye, Ukraine and the Western Balkans) could benefit substantially from continued economic integration with the EU.

This study is structured as follows: *Section 2* reviews the empirical literature on the economic benefits of EU accession, *Section 3* presents the empirical approach and data, and *Section 4* presents the results by accession wave. *Section 5* concludes.

2. Literature review

The early literature on the effects of European integration on growth argues that the effects of integration on growth worked mostly through the effects of trade integration. *Baldwin and Seghezza* (*1996*) survey the evidence and find that the main channel through which European integration accelerated European growth was through the boost to investment in physical capital, induced by efficiency gains brought about by trade integration (see also *Slaughter 2001*).

Despite the large body of literature on the benefits from trade liberalisation associated with the EU, from the Single Market, and from the euro, there is a relative dearth of econometric estimates on the benefits from EU membership. Many of the early studies suffered from the lack of a clear counterfactual, as highlighted by *Boltho and Eichengreen* (*2008*) and *Campos et al.* (*2019*). Most of these studies also openly warned against the lack of robustness of their results. *Henrekson et al.* (*1997*) estimate the benefits from membership to be about 0.6 to 0.8 per cent per year, but note that such estimates are "not completely robust" (p. 1551). *Badinger* (*2005*) estimates that "GDP per capita of the EU would be approximately one-fifth lower today if no integration had taken place since 1950", but cautions that the results are "not completely robust" (p. 50). *Crespo Cuaresma et al.* (*2008*) find large growth effects from EU membership, but warn that country heterogeneity remains a severe concern. *Ben-David* (*1993, 1996*) studies European integration as an engine for income per capita convergence. In his 1993 paper, he concludes that European trade integration leads to a reduction of income dispersion. To overcome identification problems, *Ben-David* (*1996*) contrasts the "trade-integration club" with alternative random clubs of the same size, in terms of number of countries involved and finds that, indeed, convergence is observed only for the trade integrated clubs. A related literature looks at the roles of various institutions in supporting convergence (see, for instance, *Szapáry and Vonnák 2024* on the role of monetary policy*).*

This study is most closely related to *Campos et al.* (*2019*), who use synthetic controls to construct counterfactuals for countries that joined the EU between 1973 and 2004. They find that growth effects from EU membership are large and positive, with Greece as the exception. Overall, their estimates suggest that, in the absence of the institutional integration, per capita European incomes would have been about 10 per cent lower on average in the first ten years after joining the EU (see also *Campos et al. 2022* on the productivity effects of the 1995 enlargement of the EU).

A recent study by the *IMF* (*2024*) also points to substantial income gains for the 2004 accession countries. After 15 years, GDP per person was more than 30 per cent higher on average than it would have been without EU accession. While all regions in the new EU countries gained, some gained more than others. Those already better integrated into value chains with the existing member states increased GDP

per person nearly 10 percentage points more than those which were less integrated pre-accession, irrespective of geographic distance. Regions with firms that had easier access to long-term financing gained close to 15 percentage point more than others (*IMF 2024*).

Similarly, *Grassi* (*2024*) finds that without joining the EU the GDP per capita of the ten new joiners in the 2004 accession wave would have been 24 per cent lower in 2019. At the same time, the same synthetic control approach does not identify a robust effect on countries that were already members of the EU before 2004. Furthermore, the analysis points to convergence in investment, consumption, government spending, export/import shares, employment rates, foreign direct investment and regulations indices (*Grassi 2024*).

Existing estimates of the benefits of EU accession thus fall in a wide range, from 5-per cent gains in per capita income from EU accession (*Boltho and Eichengreen 2008*) to 20-per cent (*Badinger 2005*), 24-per cent (*Grassi 2024*) and 30-per cent gains (*IMF 2024*).

3. Empirical approach and data

The synthetic control method was originally proposed by *Abadie and Gardeazabal* (*2003*), estimating the economic effects of the terrorist conflict in the Basque Country, and *Abadie et al.* (*2010*), examining the effects of aggregate interventions for policy analysis. It has since become widely applied in empirical research.

Synthetic controls are well suited to situations where no single unit alone may provide a good comparison (*Abadie 2021*) and where the series examined are not too volatile (*Abadie and Vives-i-Bastida 2022*). They can have important advantages relative to comparative case studies, regression or time series analysis or when aiming to estimate the effects of aggregate interventions affecting a small number of large units. While a drawback of comparative case studies is that the selection of the comparison units is not formalised, the synthetic control methodology formalises the selection of the comparison units using a data driven procedure (*Abadie 2021*). Synthetic controls may also allow for more flexibility than regression analysis (*King and Zeng 2006*), restrict weights to be between zero and one, explicitly illustrate the similarities and differences between the pre-trends of the treated and the control group (*Abadie et al. 2010*) and make explicit the contribution of each comparison unit to the counterfactual of interest. Time series analysis may be confounded by the presence of other shocks to the outcome of interest, and the arbitrary choice of a particular pre-trend time period.

Synthetic controls compare outcomes to a counterfactual based on other economies selected on pre-defined criteria. Using such weighted averages of many similar

economies also reduces the effects of other country-specific shocks which may confound the analysis. They also implicitly take year fixed effects into account by comparing economies joining the EU with other economies in the same year. For instance, while the global financial crisis could be expected to affect most economies (including economies joining the EU as well as their comparators), the synthetic control method selects comparators within a given year, thus allowing us to separate the effects of accession without picking up the impact of global confounding factors.

Synthetic controls offer a set methodology for the selection of comparators based on pre-defined criteria for pre-accession similarity. They are less sensitive to the time period examined and integrate both the economy's performance pre-accession (country-specific factors) as well as year fixed effects (global influences).

We use a combination of other countries not in the EU to construct a synthetic control country, which resembles relevant economic characteristics of the acceding country before accession. We examine similarity in terms of their pre-accession GDP in US dollars (USD), GDP per capita in USD, GDP per capita at purchasing power parity (PPP) and real GDP per capita growth. The subsequent economic evolution of this 'counterfactual' country without EU accession is then compared to the actual experience of the country joining the EU.

More formally, we observe countries (index *j*) for a number of periods (indexed *t*). The first unit joins the EU (the 'treatment') at time $T_0 + 1$. The remaining countries do not join the EU (no 'treatment'). We aim to estimate the effect of EU accession on GDP per capita during the accession year and subsequent years, ($T_0 + 1$, …, T).

The effects of EU accession are examined using a model of potential outcomes (*Rubin 1974*). Y_{jt}^N denotes the outcome observed for unit *j* at time *t* in the absence of EU accession. Y_{1t}^I denotes the outcome observed for the country joining the EU (the 'treated' unit). For the treated unit, we are interested in the potential outcome in the absence of treatment (Y_{1t}^N) and the treatment effect on the treated unit:

$$\tau_t = Y_{1t}^I - Y_{1t}^N \tag{1}$$

A synthetic control estimator of Y_{1t}^N is a weighted average of the outcomes of the 'donor pool' of *J* untreated units,

$$\hat{Y}_{1t}^N = \sum_{j=2}^{J+1} W_j Y_{jt} \tag{2}$$

where W_2,…,W_{J+1} are non-negative weights that sum up to one and represent the contribution of each untreated observation to the estimate of the counterfactual of interest. The weights are selected in a way that the resulting synthetic control resembles the affected unit before the intervention along the values of the predictor variables (*Abadie 2021*).

Specifically, we match on GDP in USD (economic size), GDP per capita in USD and PPP (level of development) and real GDP per capita growth in the years before EU accession (from 1995 for the 2004 accession wave and from 1990 for the 1995 accession round). Data are taken from the World Economic Outlook database[1] of the International Monetary Fund, covering the period 1980–2023.

The mean country has 104 synthetic controls, with an average weight of a comparator below 1 per cent. For instance, the synthetic counterpart of Poland is an average of many economies with larger weights assigned to China, Equatorial Guinea, India, Moldova, Saudi Arabia and Ukraine. Hungary has a relatively higher share of Gulf countries and former republics of the Soviet Union. Switzerland, UAE and Norway are assigned the largest weights in Austria's synthetic control, and Iceland and Switzerland in Finland's.

The procedure relies on the statistical package developed by *Abadie et al.* (*2011*). Weights are chosen to minimise the root mean square percentage error between pre-treatment differences in the treated economies and the control group.

4. Results

4.1. The 2004 and later accession waves

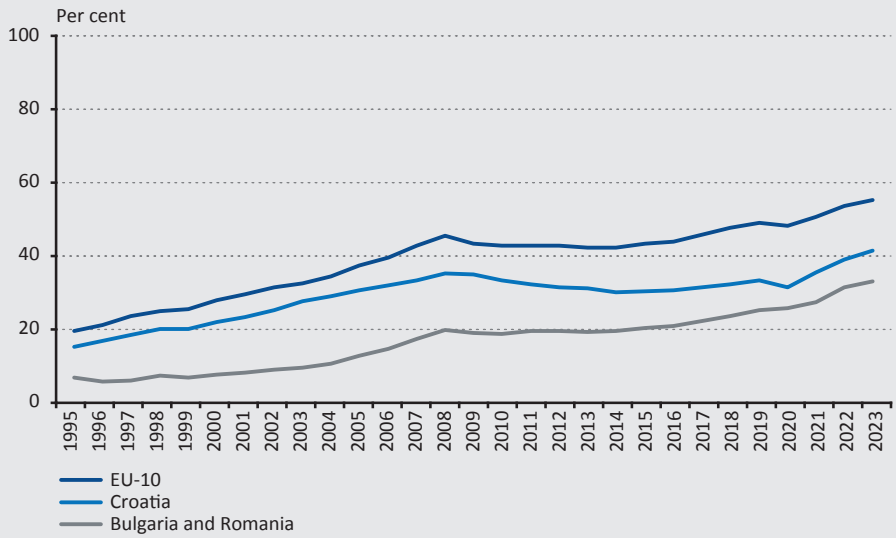
We start by looking at income per capita in nominal USD, the metric of most relevance to investors that choose a production location or exporters competing internationally. We also repeat the analysis using indices of GDP in real terms (see also *Annex, Figure 8*).

In 1995, the GDP per capita of the EU-10 economies (measured at market exchange rates) averaged 19 per cent of Germany's, only slightly above the average ratio observed today for the EU neighbourhood economies (14 per cent for the Caucasus, Moldova, the southern and eastern Mediterranean, Türkiye, Ukraine and the Western Balkans). It rose rapidly to 32 per cent in 2003 and 55 per cent by 2023 (see *Figure 1*). The experience of a typical (median) economy was similar. As of 2023, GDP per capita levels of the EU-10 economies ranged from 42 per cent of Germany's in Hungary and Poland to 66–73 per cent in Cyprus and Malta.

The economies that joined in 2007 and 2013 also experienced fast rates of income convergence. Bulgaria and Romania almost doubled their per capita incomes as a share of Germany's in the period 2007–2023, from 17 to 33 per cent, while Croatia's GDP per capita increased from 30 to 41 per cent of Germany's in the period 2013–2023.

[1] https://www.imf.org/en/Publications/SPROLLs/world-economic-outlook-databases

Figure 1
GDP per capita in the EU-10, Bulgaria, Romania and Croatia, as a percentage of Germany's, 1995–2023



Note: Market exchange rates. Simple averages across countries.
Source: IMF October 2024 World Economic Outlook database and authors' calculations

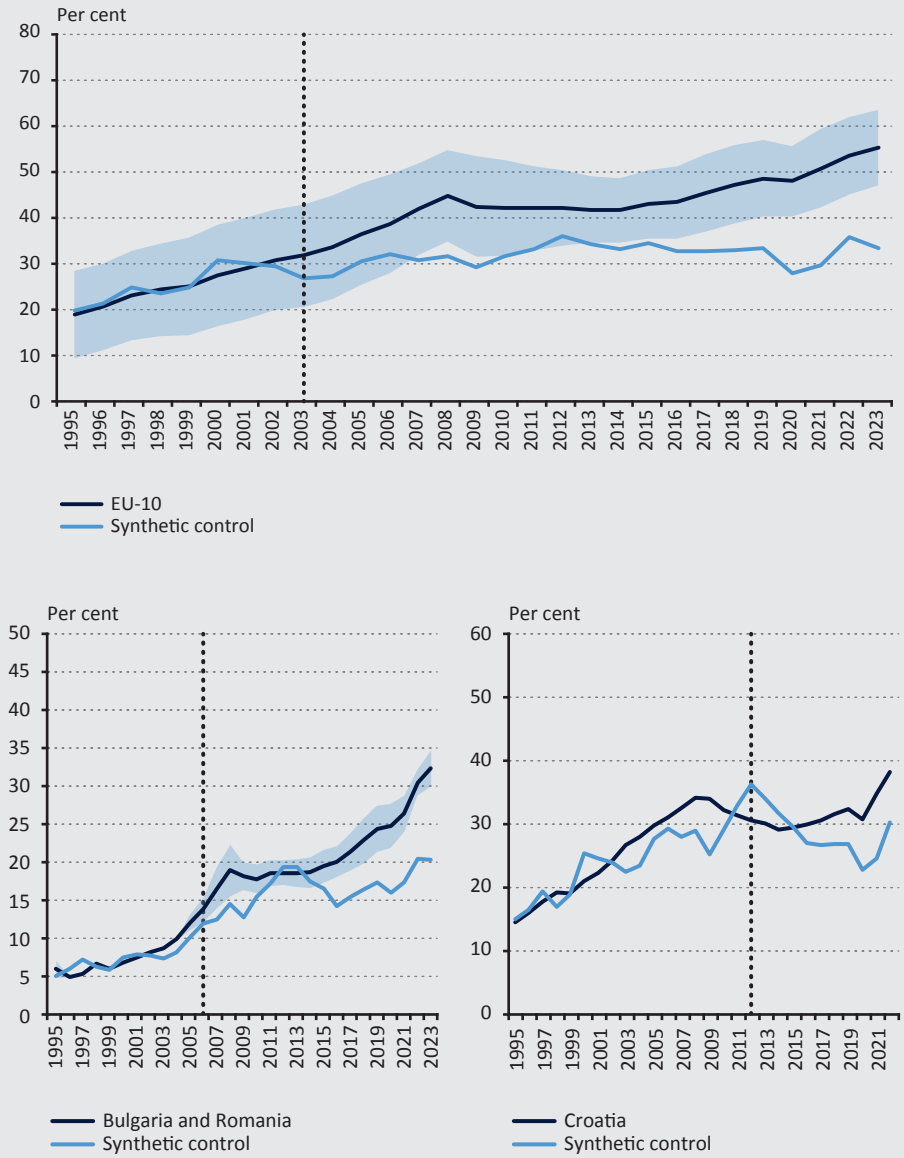
This performance is notable when compared with the income convergence observed between other emerging markets at similar levels of development and advanced economies. The synthetic control analysis suggests that of the 23 percentage points of average convergence observed between the EU-10 and Germany, 6 percentage points are shared with emerging market comparators, while 17 percentage points can be thought of as an 'EU accession bonus' (see *Figure 2*; for country-specific estimates, see *Annex, Figure 9*).

The accession bonus already started appearing around 2001–2002 as accession prospects firmed up and foreign direct investment (FDI) inflows to the EU-10 increased. At the same time, convergence in many comparator emerging markets slowed markedly after the 1997–1998 Asian financial crisis, resulting in a widening gap between incomes of the EU-10 and comparators.

While the 2008–2009 crisis took its toll, with the EU accession bonus briefly becoming statistically insignificant in 2012, growth rates above those observed for synthetic comparators returned afterwards.

The pattern is very similar in terms of GDP per capita growth in real terms. Here again, the EU-10 economies outperformed their synthetic comparators; the original positive effect was dampened by the global financial crisis, but has since re-emerged strongly.

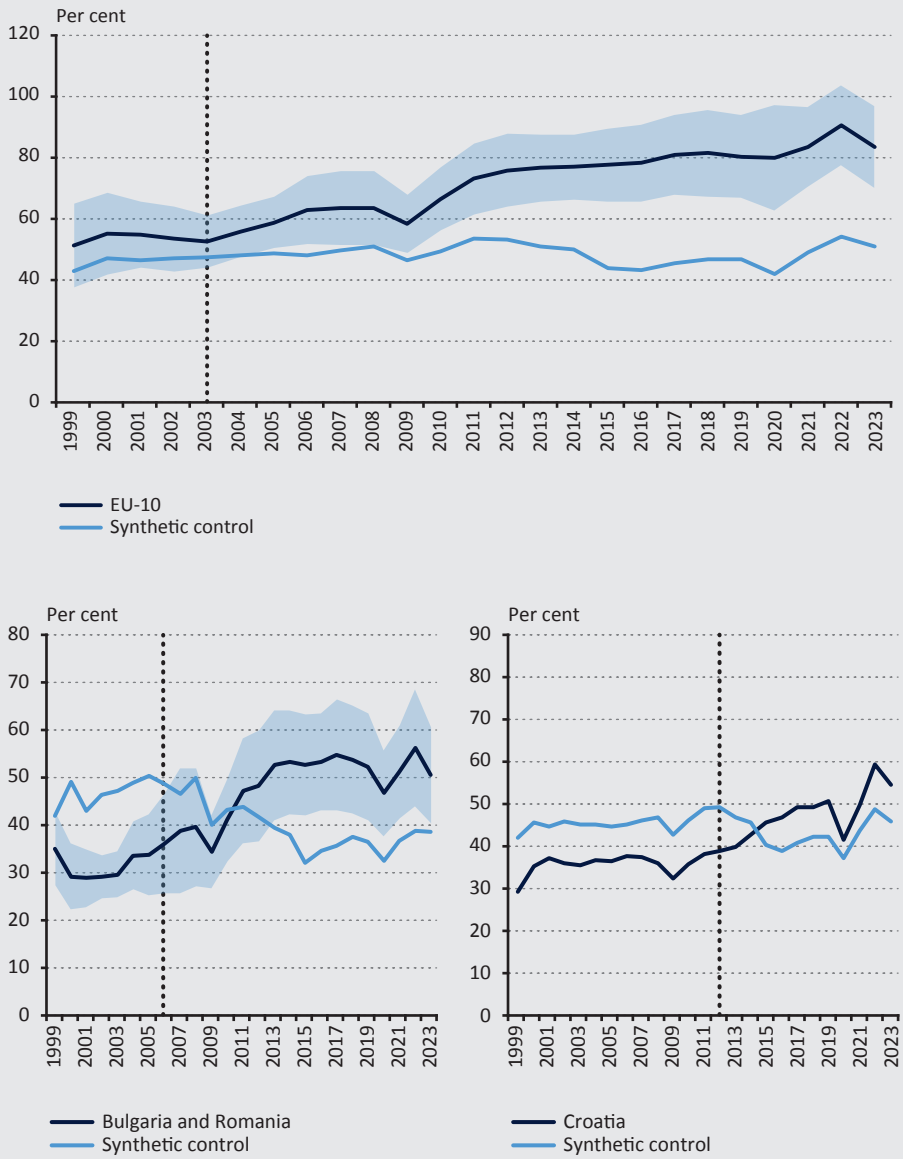
Figure 2
GDP per capita of the EU-10, Bulgaria, Romania and Croatia as a percentage of Germany's



Note: 95-per cent confidence interval shown. Synthetic controls based on GDP and GDP per capita in nominal USD, GDP per capita in PPP USD, and real GDP per capita growth. Simple averages across countries. Dashed lines denote the year before accession.

Source: IMF October 2024 World Economic Outlook database and authors' calculations

Figure 3
Exports in the EU-10, Bulgaria, Romania and Croatia as a share of GDP



Note: 95-per cent confidence interval shown. Synthetic controls based on GDP and GDP per capita in nominal USD, GDP per capita in PPP USD, and real GDP per capita growth. Dashed lines denote the year before accession.

Source: IMF October 2024 World Economic Outlook database and authors' calculations

The 'EU accession bonus' has been underpinned by strong growth in exports as a share of GDP. The average exports-to-GDP ratio increased from 51 per cent in 1999 to 52 per cent in 2003 and 83 per cent in 2023 in the EU-10 economies as they became deeply integrated into European and global supply chains. In 2023, exports-to-GDP ratios ranged from 40 per cent in Romania to 131 per cent in Malta. By contrast, exports-to-GDP have been broadly flat among comparator economies over the last 20 years (see *Figure 3*).

Most EU-10 economies, as well as Bulgaria, Croatia and Romania, signed and ratified free trade agreements with the EU in the 1990s, with accession countries given more time to lower their tariffs than EU economies and accession economies able to reimpose tariffs if sudden imports harmed local industries.

In this case, too, the pre-accession ratio of exports to GDP was only slightly higher than today's average ratio across EU neighbourhood economies, which stood at 44 per cent as of 2023.

Beyond the benefits from trade and foreign direct investment inflows (as sources of financing and technological spillovers) and additional financing from foreign direct investment and EU cohesion funds (*IMF 2024*), the 2004 accession group also benefitted from wide-ranging reforms. For instance, Hungary reduced its corporate income tax rate and adjusted the value added tax to broaden the tax base, reduced tax evasion and improved revenue collection. The Slovak Republic introduced a flat tax rate and significantly simplified the tax code. In Poland, the government strengthened the powers of antitrust authorities and privatised state-owned enterprises. Slovenia established an independent competition watchdog and liberalised the telecommunications and industry. In the 10 years prior to EU accession, reform progress in the accession economies significantly outpaced the world average in the areas of domestic finance, external finance, product markets and trade liberalisation, though in the 10 years following accession, only product market reforms continued at a pace significantly above the world average (*IMF 2024*).

In contrast to earlier enlargements, the 2004 enlargement was preceded by a long preparation process, which entailed substantial institutional changes both for entrants and for the EU itself (see *Bache et al. 2011*; *Campos and Coricelli 2002*). With that, the 2004 enlargement was the first one with a conscious effort to ensure sufficient degrees of institutional integration before the official accession date (*Bruszt and Campos 2017*; *Campos et al. 2019*).

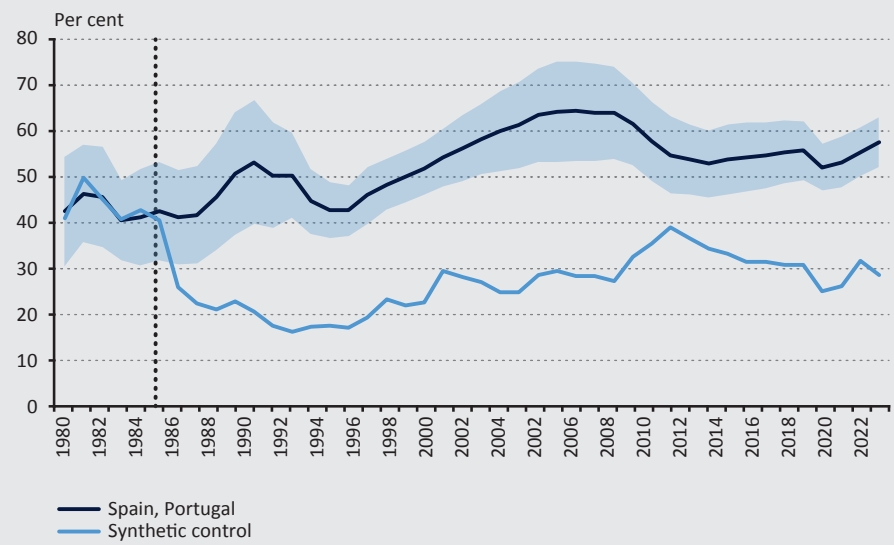
4.2. The 1986 accession wave

Spain and Portugal joined the EU in 1986 with income levels of around 40 per cent of Germany's at that time. They converged towards Germany's GDP per capita by 15 percentage points over the following 20 years, despite notable productivity challenges (see *de Souza and Diaz 2024*). The performance of their synthetic control

during that period was underwhelming, pointing to a significant accession bonus (see *Figure 4*; for country-specific estimates, see *Annex, Figure 9*).

The estimated outperformance in this case is greater in nominal USD terms than in real terms, in part reflecting a broader experience in comparator emerging markets in recent decades: while convergence with high-income economies was observed in real terms, it has been weak to non-existent at market exchange rates as the exchange rates of many emerging market economies have weakened (see *EBRD 2019*). In particular, synthetic controls for Spain and Portugal include several economies in Latin America and the Middle East which experienced depreciation in response to the Latin American debt crisis of the 1980s or the 1986 oil price collapse. By contrast, EU accession may have shielded Spain and Portugal from external turbulence by placing them under a stable institutional umbrella, providing structural and cohesion funds, and encouraging investment and trade links with existing member states (see *Annex, Figures 8* and *9*). EU accession also bestowed on Portugal, Spain (and Greece) a stronger currency than conceivably would have been the case in a counterfactual scenario.

Figure 4
GDP per capita of Spain and Portugal as a percentage of Germany's



Note: 95-per cent confidence interval shown. Synthetic controls based on GDP and GDP per capita in nominal USD, GDP per capita in PPP USD, and real GDP per capita growth. Simple averages across countries. Dashed lines denote the year before accession.

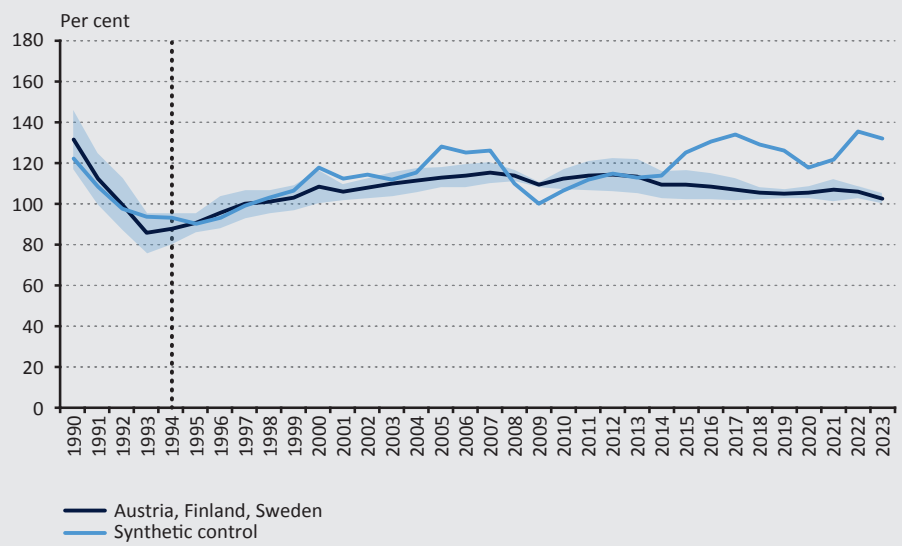
Source: IMF October 2024 World Economic Outlook database and authors' calculations

Due to data limitations, it is difficult to run a fully comparable exercise for Greece. If we attempt it with a very short pre-accession series, the results are similar to those obtained for Portugal and Spain. Most of that outperformance was undone in the 2010s, however, in the aftermath of the debt crisis, in line with the findings in *Campos et al.* (*2019*).

4.3. The 1995 accession wave

Turning to the 1995 accession wave, when Austria, Finland and Sweden joined the European Union, we find no robust evidence of an accession bonus. Over the period 1994–2023, Austria, Finland and Sweden outperformed Germany, but their synthetic controls pointed to even faster convergence (see *Figure 5*; for country-specific estimates, see *Annex, Figure 9*). In part, this reflects the inclusion of Iceland, Liechtenstein, Norway and Switzerland – countries which benefited from being part of the internal market – in the synthetic control donor pool. Excluding these countries from the synthetic control group points to a substantial accession bonus for these economies as well, albeit detectable only in the longer term (see *Annex, Figure 10*; also in line with the findings of *Campos et al. 2022*). Smaller, less robust estimates of an accession bonus may also reflect the smaller scope for convergence in terms of GDP per capita and institutions, as well as a relatively smaller size of the internal market at the time (*IMF 2024*).

Figure 5
GDP per capita of Austria, Finland and Sweden as a percentage of Germany's



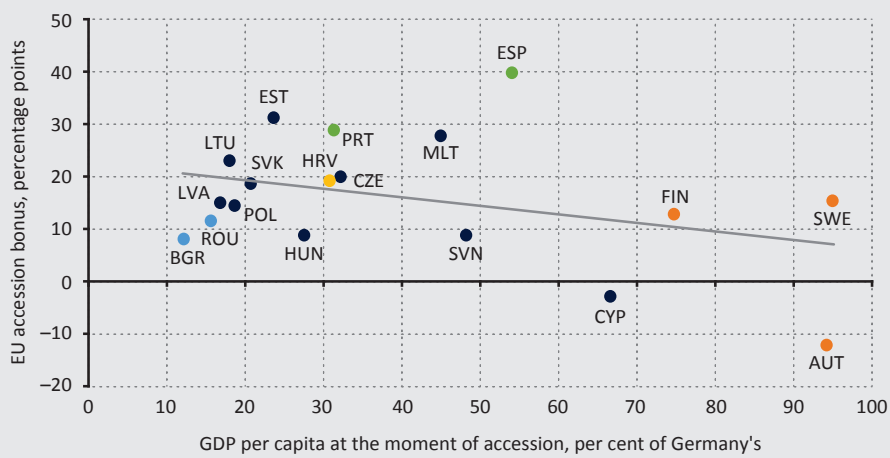
Note: 95-per cent confidence interval shown. Synthetic controls based on GDP and GDP per capita in nominal USD, GDP per capita in PPP USD, and real GDP per capita growth. Simple averages across countries. Dashed lines denote the year before accession.

Source: IMF October 2024 World Economic Outlook database and authors' calculations

4.4. Larger accession bonuses where income gaps are greater

Comparing accession bonuses across countries joining in different waves suggests that lower-income economies with weaker institutions tended to enjoy larger EU accession bonuses over the long term (see *Figure 6*; the pattern is robust to including alternative estimates for the accession bonus of Austria, Finland and Sweden, excluding Iceland, Liechtenstein, Norway and Switzerland from the donor pool). The estimated accession bonuses are particularly large for Estonia and Portugal, which joined at around 23 and 31 per cent of Germany's GDP per capita, respectively. On the other hand, Austria, Cyprus, Finland and Sweden, which joined at around 67–95 per cent of Germany's GDP per capita, enjoyed a lower accession bonus. This gradient appears to be somewhat starker than implied in *Campos et al.* (*2019*), who look at accession gains over a 10-year period and find the largest gains for Latvia, Lithuania and Estonia and much more limited gains for Greece, Sweden, Finland, Czechia and the Slovak Republic. *Figure 6* (showing gains over 20 years) points to relatively smaller gains for the Slovak Republic than in *Campos et al.* (*2019*), who look at accession gains over a 10-year period as growth slowed sharply after the global financial crisis (see *Annex Figure 9*).

Figure 6
Accession bonuses and income gaps



Note: Different colours indicate different accession waves. The EU accession bonus calculated based on 20 years after accession and the latest available data for Bulgaria, Romania and Croatia.

Source: IMF October 2024 World Economic Outlook database and authors' calculations

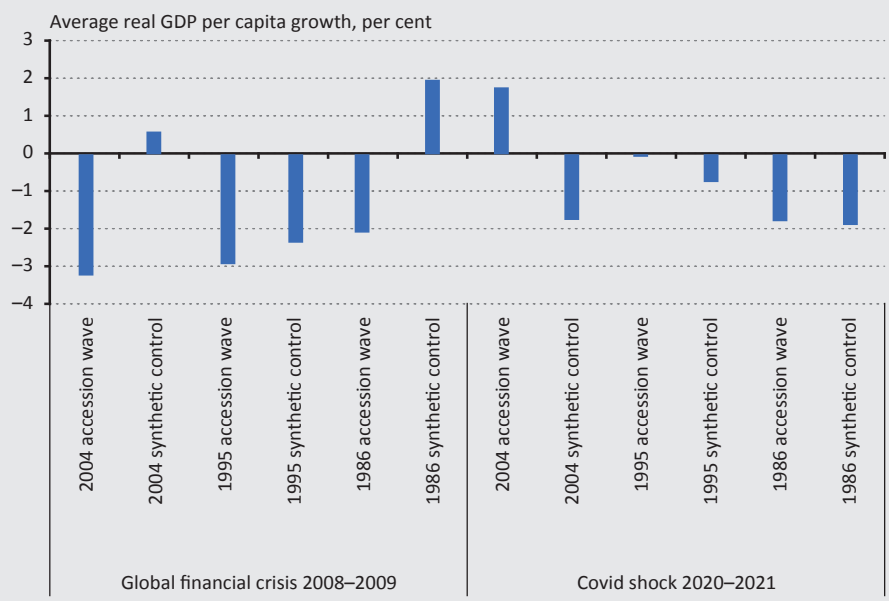
Larger gains for countries with larger GDP per capita differences relative to the rest of the bloc is consistent with the observation that economic unions are most helpful when there is arbitrage for income and institutions (*EBRD 2012*). Income arbitrage, for instance, can be leveraged through enhanced economic integration

where lower-income economies provide cost-effective assembly benefitting from manufacturing designs developed in higher-income economies as well as transfer of technology. Unlike income, the extent of initial openness to trade does not appear to be correlated with the estimated accession bonuses.

4.5. Robustness to shocks

The synthetic control methodology matches countries of interest to similar economies in the same years, hence accounting for the impact of common shocks. Nonetheless, the EU accession may also affect the economies' robustness to shocks in the long term. As illustrated in *Figure 7*, across all waves, the countries that became part of the EU were hit harder by the global financial crisis than their synthetic controls, with the crisis reducing the magnitude of the estimated accession bonus, possibly on account of stronger transmission of shocks in more open, integrated economies. On the other hand, those economies, on average, experienced smaller GDP per capita declines during the Covid-19 pandemic, in large part reflecting stronger fiscal stimulus packages compared with those of their synthetic controls.

Figure 7
The effects of global financial crisis and pandemic: EU members versus synthetic controls



Note: Average annual growth rates.
Source: IMF October 2024 World Economic Outlook database and authors' calculations

5. Conclusions

Relying on a synthetic control methodology, we find substantial gains from EU integration for many, though not all, countries which joined the EU between 1986 and 2013. In particular, we find an EU accession bonus of 17 percentage points for the 2004 wave, 11 percentage points for the 2007 wave and 20 percentage points for the 2013 wave, compared to 33 percentage points for the 1986 joiners. Existing EU member states did not suffer and, in fact, may have gained from EU accession (*Grassi 2024*; *IMF 2024*).

In general, our results suggest that economies with lower income and weaker institutions at the time of accession experienced a substantial and lasting additional convergence dividend, while this does not appear to be the case for economies with higher income and stronger institutions at the time of accession. Further research could examine other channels through which higher-income economies with more advanced institutions may have benefited from membership, including various features of the common market for goods and services.

Overall, if the convergence boost from accession is largest where income differentials and institutional differentials are at play, this suggests that the remaining convergence potential in the existing EU member states is limited while the potential from involving the EU neighbourhood is substantial.

The EU neighbourhood economies (the Caucasus, Moldova, the southern and eastern Mediterranean, Türkiye, Ukraine and the Western Balkans) have GDP per capita levels ranging from about 10 per cent of Germany's in Ukraine to 24 per cent of Germany's in Türkiye. For Moldova and Ukraine, this corresponds broadly to the level at which Bulgaria joined, while Türkiye is around the levels of Estonia or the Slovak Republic, though with relatively lower levels of openness. Based on historical experience, this could point to a potential EU accession bonus of 10 to 20 percentage points.

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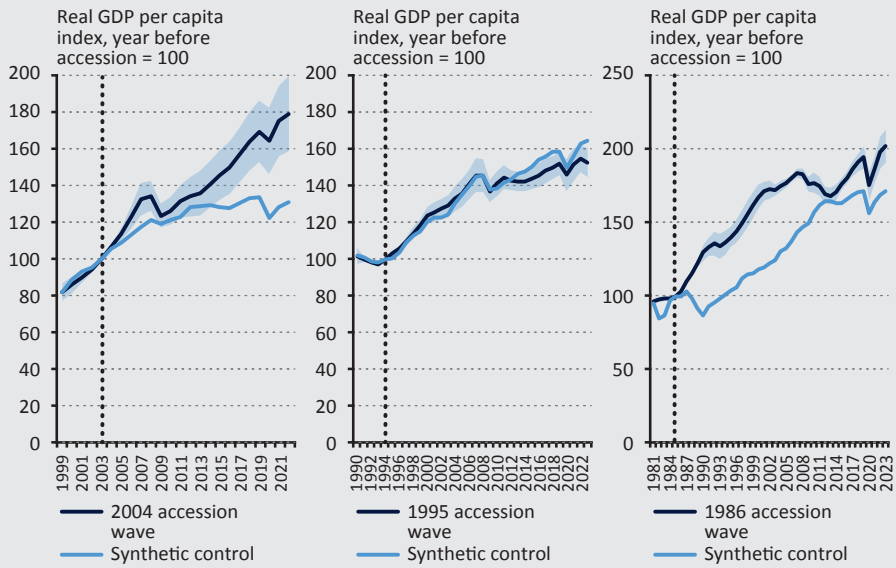
Annex

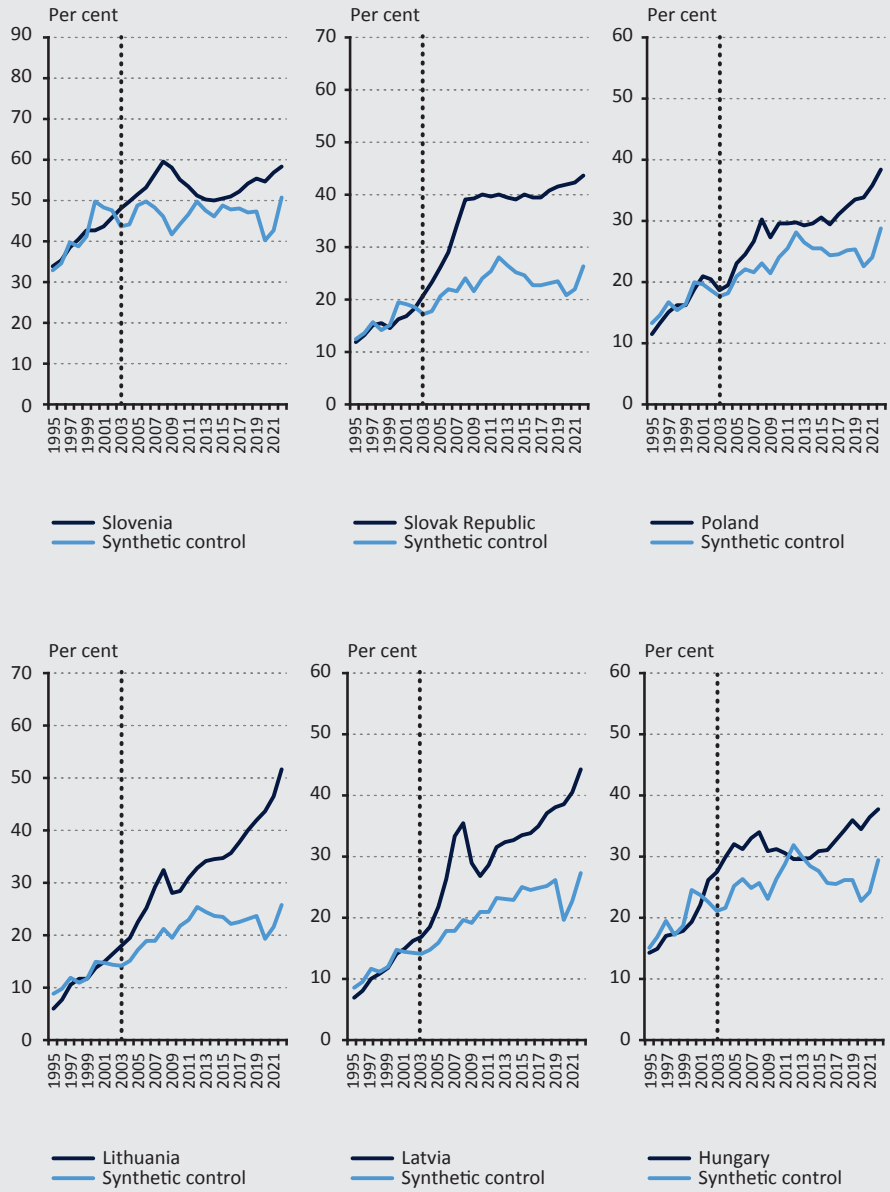
Figure 8
GDP in real terms: Synthetic control estimates



Note: 95-per cent confidence interval shown. Synthetic controls based on GDP and GDP per capita in nominal USD, GDP per capita in PPP USD, and real GDP per capita growth. Simple averages across countries. Dashed lines denote the year before accession.

Source: IMF October 2024 World Economic Outlook database and authors' calculations

Figure 9
GDP per capita at market exchange rates: Synthetic control estimates for individual economies



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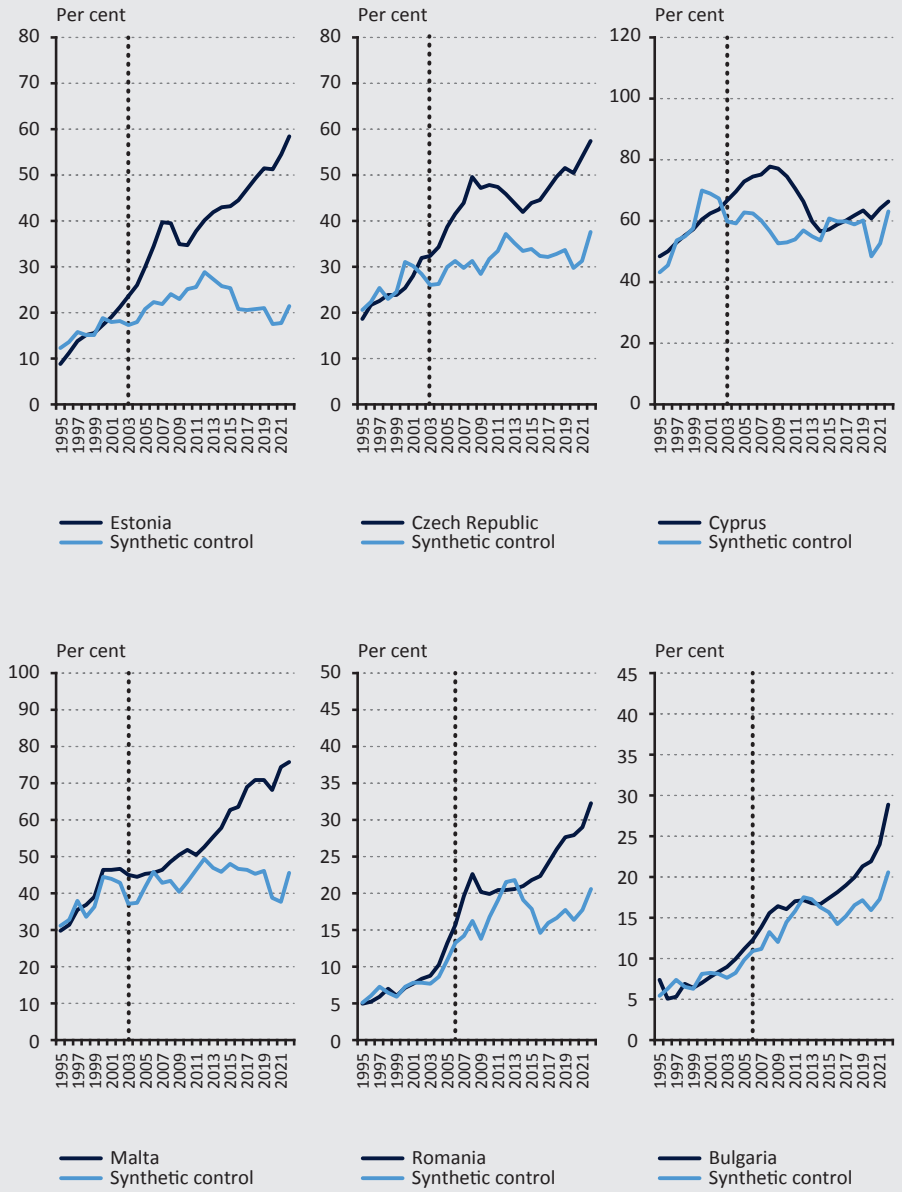

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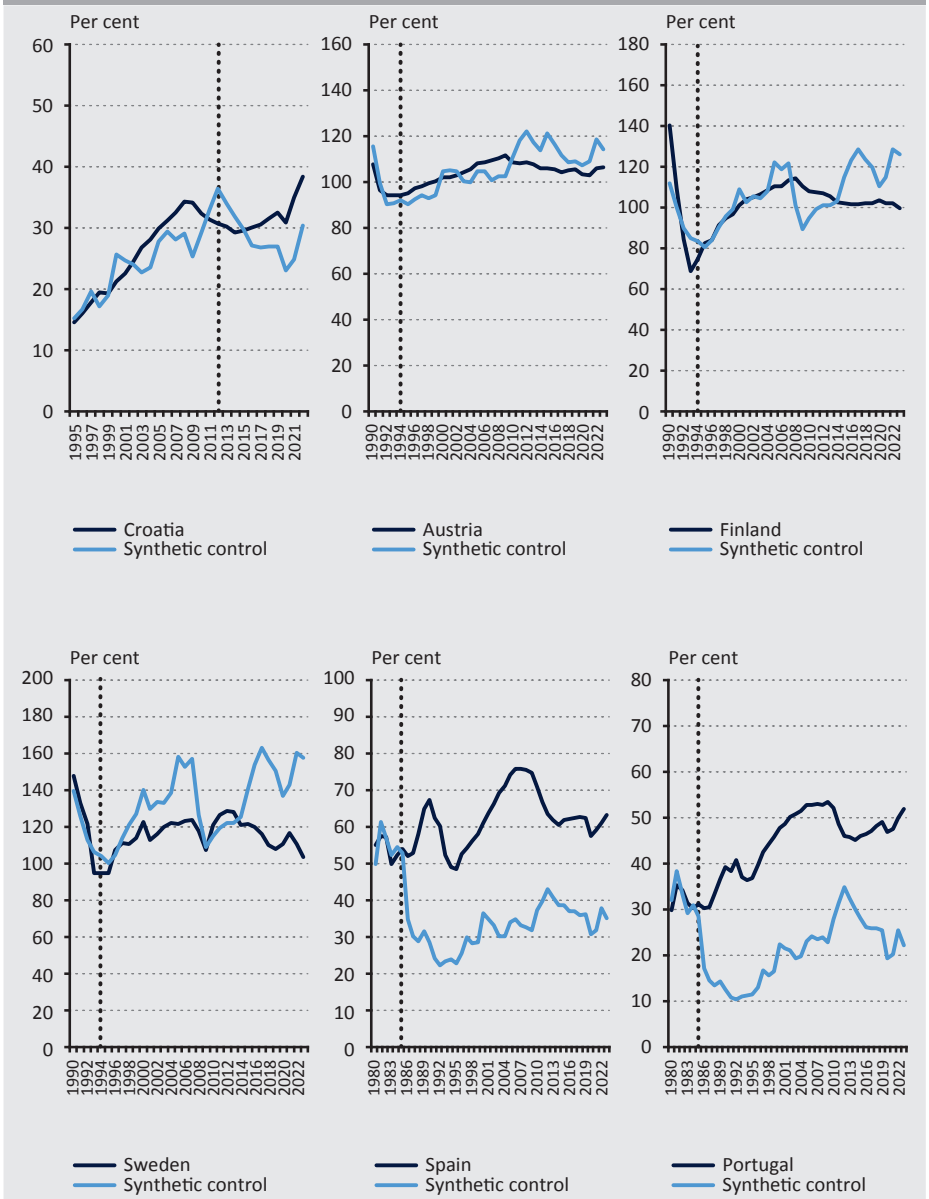
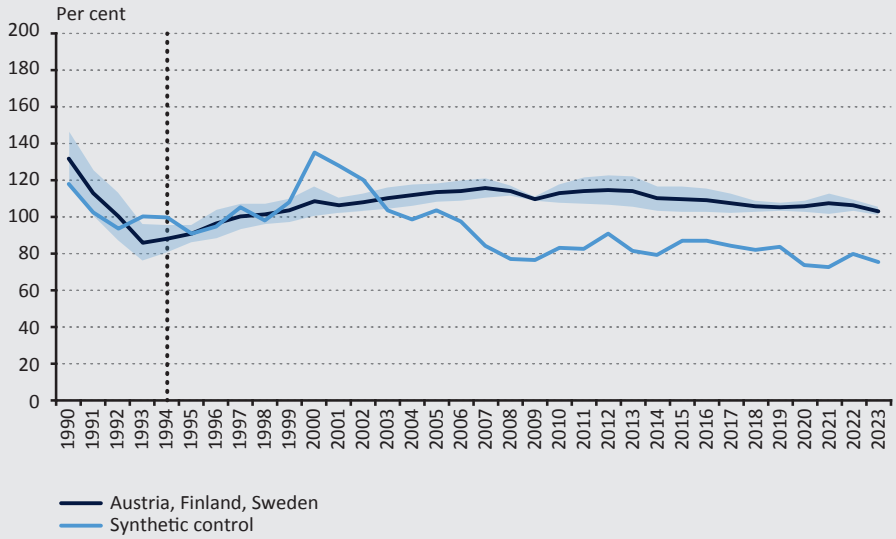


Note: Synthetic controls based on GDP and GDP per capita in nominal USD, GDP per capita in PPP USD, and real GDP per capita growth. Dashed lines denote the year before accession.

Source: IMF October 2024 World Economic Outlook database and authors' calculations

Figure 10
GDP per capita of Austria, Finland and Sweden as a percentage of Germany's, excluding Iceland, Liechtenstein, Norway and Switzerland from the synthetic control pool



Note: 95-per cent confidence interval shown. Synthetic controls based on GDP and GDP per capita in nominal USD, GDP per capita in PPP USD, and real GDP per capita growth. Simple averages across countries. Dashed lines denote the year before accession.

Source: IMF October 2024 World Economic Outlook database and authors' calculations

Endogenous Money Supply Theories and Their Main Implications*

Péter Aradványi – Zoltán Szalai

Contrary to earlier exogenous approaches, it is now accepted, particularly among monetary experts, that the creation and the putting into circulation of money in modern financial systems is an endogenous process. However, there is still a significant delay in drawing a number of conclusions. This article presents what we consider to be the most important implications for the monetary policy toolbox, the implementation of monetary policy and international capital flows. An endogenous money creation approach can help to provide a more solid foundation for analyses and avoid possible economic policy mistakes.

Journal of Economic Literature (JEL) codes: E41, E51, E52, E58, F32, F36

Keywords: interbank market, monetary policy toolkit, endogenous monetary theory, current account, net and gross international capital flows, sterilisation

1. Introduction

The 2007–2008 global financial crisis caught the economists who applied the traditional macroeconomic frameworks presented in the best-known textbooks by surprise. Equally unexpected was the response of central banks, which increased their balance sheets to an extent previously only seen in times of war and other disasters. Analysts applying the traditional framework feared runaway inflation and a complete loss of credibility for central banks.[1] For the central banks, this situation created a communication trap that was difficult to avoid, because, while they considered their extraordinary measures justified, officially, they adhered –

* 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] Tensions between central bank leaders are well illustrated by the resignation of Bundesbank President Axel Weber in February 2011 and Jürgen Stark from the European Central Bank (ECB) Executive Board in September 2011. In 2021, they were followed by Bundesbank President Jens Weidmann, who also resigned. Some German economics professors' fear of inflation was widely shared in other Member States, which went to court on a number of occasions (*Treeck 2021*). They requested the court to declare that the ECB's purchases of securities were contrary to the German constitution and the EU's founding treaty. The case came before the European Court of Justice, which found the action unfounded.

either explicitly or implicitly – to the traditional analytical framework used in normal circumstances. This is probably the reason why leading central banks published a series of articles[2] pointing out the limitations and even the misleading nature of the traditional approach, the importance of which suddenly grew with regard to the effectiveness and credibility of crisis management.

The central bank communication of the past is no longer sufficient to properly interpret the functioning of the financial system and monetary policy on a broader basis. This is best reflected in the fact that the price shocks that followed re-opening after the Covid epidemic and that were amplified by the disruption of supply chains and the Russo-Ukrainian war, give the impression that the period of low inflation prior to the pandemic was only temporary, and that the increase in central banks' balance sheets was bound to be reflected in runaway prices sooner or later. In what follows, we briefly summarise the main findings of the endogenous monetary theory. Without going into detail,[3] we aim to illustrate its broader implications for macroeconomic theory and economic policy, i.e. the aspects that have not received sufficient attention so far.

2. Differences between the endogenous and the exogenous monetary theory

The most important finding of endogenous monetary theory is that in modern financial systems money is created in response to the demand of non-monetary agents in the economy as a result of the lending activities of authorised institutions, hereafter referred to as banks. Endogenous money creation happens when, in response to actors' demand for credit, banks lend not only pre-existing money and savings, but also new money, which they create. This is where banks differ from other financial intermediaries; the latter can collect and invest only existing money and pre-existing savings. According to the 'financial intermediary' approach of the exogenous money theory, banks cannot create money either collectively or individually, they can only lend and borrow money. Modern banks do not feature in the 'loanable funds' theory.

If, however, pre-existing savings do not limit the lending activity of banks, i.e. they can 'create money out of nothing', is there any other limit to this activity? In what is termed as the multiplier model of the traditional exogenous monetary approach, banks are required to maintain a certain deposits-to-reserves ratio called the reserve requirement ratio set by central banks. This means that, in addition to the effective reserve requirement ratio, the amount of central bank reserves held by individual banks also limits lending. Monetary policy can also influence banks' lending by changing reserve requirements and the supply of reserves for banks.

[2] See, for example, *Carpenter and Demiralp* (*2010*); *McLeay et al.* (*2014*); *Deutsche Bundesbank* (*2017*); *Banque de France* (*2016*); *Ábel et al.* (*2016*).
[3] For details, see the central banks' documents referenced in the previous footnote.

Thus, according to the traditional approach, the banking system can create more credit at the level of the system as a whole through the multiplier than the savings represented by existing reserves. However, it was assumed that this option was not available to individual banks. Literature in English-speaking countries calls it 'fractional reserve banking', referring to the role that reserves were assigned to play in money creation.

According to the endogenous monetary theory, the above textbook approach is misleading. The first conspicuous problem is that some central banks (such as the Bank of England or the Bank of Canada) never set reserve requirements, while other central banks reduced them from earlier double-digit levels to 1–2 per cent, which does not seem to be an actual constraint on money creation.[4] A more serious problem is also the ability of individual banks to generate more credit than savings. As *Werner* (*2014*)'s case study demonstrated, when loan applications are considered, the bank administrators do not know whether the bank happens to have offsetting funds on the deposit side at that very moment. It is the organisationally independent liability management department (treasury) that must have such knowledge. At this point, the nature and circulation of central bank reserves are worth discussing.

2.1. The interbank market

Private commercial banking, which evolved as a result of the institutional development of modern financial systems spanning centuries, needed a non-profit-maximising institution that could ensure a smooth flow of payments (*Goodhart 1988: 45–46*). The circulation of central bank reserve money between banks is a special type of circulation in which, in addition to the central bank only banks and a few institutions can participate. The central budget also keeps its account with the central bank.[5] This closed payment system works on a clearing basis, which means that offsetting items within and between institutions are netted, and only remaining balances have to be achieved exclusively with central bank reserves. Central bank reserves, which can only be issued by central banks, may 'circulate' exclusively in this market, purely in the form of bank account money.

Commercial banks must close their positions at the end of a trading day. In addition, if applicable, they must also comply with the mandatory reserve requirements. Finally, whether or not there is a reserve requirement, they aim to maintain the level of reserves that they set for themselves in order to meet their interbank obligations. Therefore, demand for reserves by banks short of reserves is not interest-sensitive,

[4] Responding to the severe financial crisis, the Magyar Nemzeti Bank (MNB) increased the reserve requirement ratio for deposits with a maturity of less than two years from 1 per cent to 10 per cent in several steps. As we will see later, subsequent to the Great Financial Crisis, central banks switched to a regime based on the abundance of interbank liquidity, i.e. requirements impose even fewer external quantitative constraints on banks' ability to create money. Even before the crisis, the MNB operated with ample liquidity (on the liabilities side).

[5] In some countries, the government budget also has accounts with commercial banks. For example, the Bank of Canada also influences interbank liquidity conditions by absorbing or reinvesting these deposits.

i.e. they must borrow on the interbank market at whatever interest rate is charged to them. If other commercial banks are unwilling to lend, the central bank will lend against eligible securities as collateral. Because of demand-side insensitivity to interest rates, central banks put a cap on interbank interest rates. In the event of excess liquidity (excess supply) in the interbank market, interbank interest rates are stopped by the 'floor' set by central banks.

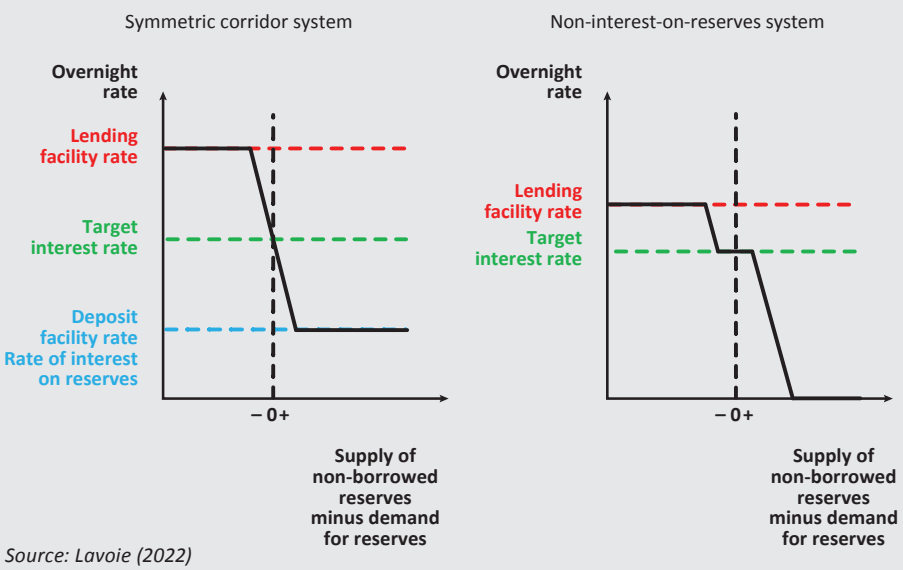
Today, the most important instrument ('operational target') for implementing monetary policy is the central bank base rate, which influences the interbank interest rates applied to reserves and banks' funding costs, and also reflects central banks' monetary policy stance. Central banks use securities operations (open market operations) and standing facilities (marginal lending facility and deposit facility) to ensure that interbank market interest rates are close to their interest rate target.

Taking recent unconventional practice into account, *Lavoie* (*2022*) argues that central banks have four systems at their disposal to achieve their interest rate target: a symmetric interest rate corridor, an asymmetric interest rate corridor (no interest is paid on reserves), an interest rate cap and an interest rate floor.

2.1.1. The symmetric interest rate corridor

In this system, central banks set a symmetric interest rate corridor around the central bank's interest rate target, with the upper bound being the interest rate on the marginal lending facility and the lower bound being the interest rate on the deposit facility or the interest rate paid on reserves (*Figure 1, left*).

Figure 1
Symmetric (left) and asymmetric interest rate corridor with no interest rate paid on reserves



Source: Lavoie (2022)

The interest rate charged on interbank market transactions is set within a range between the central bank's interest rate target and the interest rate on the lending facility, and may even reach the latter if the reserve deficit is large enough. If the banking system is faced with a surplus of reserves at the end of the day, the reserves not lent on the interbank market may be placed in the central bank's deposit facility. In the event of excess reserves, the interbank market interest rate is set between the central bank's interest rate target and the deposit rate/interest rate paid on reserves. The more excess reserves the banking system has, the more closely the interbank market rate approaches (or even reaches) the interest rate on the deposit facility.

In a symmetric interest rate corridor regime, central banks can shape their interest rate policy independently of reserve conditions, as the interbank market interest rate follows changes in the central bank's interest rate target closely with the help of the standing facilities.

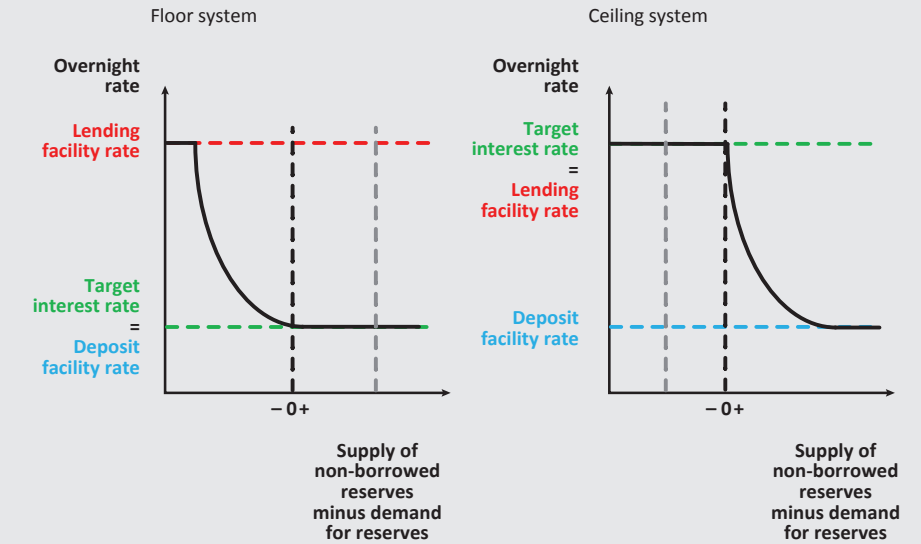
2.1.2. The no interest paid on reserves regime

In this regime commercial banks can lend an unlimited amount through the marginal lending facility, but the central bank does not pay interest on reserves and/or it does not have a deposit facility *(Figure 1, right*). The effective application of the regime may face difficulties because if the horizontal part of the curve close to the interest rate target is not sufficiently long, central banks have to adjust the supply of reserves continuously to reach the interest rate target, given the lack of a deposit facility.

2.1.3. The interest floor regime

In the floor regime, central banks' interest rate target is identical to the interest rate on the deposit facility, and the banking system has a structural reserve surplus; therefore, the interbank market interest rate is close to the deposit rate (central bank interest rate target) (*Figure 2, left*). The advantage of the floor regime is that central banks can increase their balance sheet, and hence the supply of reserves in an unlimited amount, without the interbank market interest rate falling below the target level.

Figure 2
Interest floor (left) and interest cap (right)



Source: Lavoie (2022)

2.1.4. The interest cap regime

In the interest rate cap regime, central banks keep the banking system in structural reserve deficit, forcing commercial banks to rely on the lending facility continuously. The central bank interest rate target is identical to the interest rate on the lending facility; as a result, if the reserve deficit is large enough, the interbank market interest rate will be close to the central bank interest rate target (*Figure 2, right*). In the cap regime, it is the marginal lending facility that ensures the independence of interest rate and balance sheet policy.

2.1.5. Reserve maintenance period

To smooth the interbank market interest rate over time, central banks gradually transitioned to a system of delayed (overlapping, ex-post) compliance, i.e. banks had to comply with their reserve requirements ex-post. The length of the delay is the number of the days that elapse between the last day of the calculation period and the first day of the compliance period. The advantage of these regimes is that banks can adjust their reserves with less uncertainty and thus with lower interest rate volatility over the reserve maintenance period. Delayed compliance also demonstrates that, contrary to what the multiplier theory claims, reserves cannot be a basis for lending.

2.2. Clearing money and endogenous money creation

Understanding the nature of payments between participating banks, i.e. the clearing mechanism (*Kregel 2019; Lavoie 2022*) is key to the endogenous monetary theory. In the textbook model, central banks could achieve their inflation target more easily by regulating the quantity of reserves than by setting interbank interest rates. However, this option is not available to central banks, as central banks cannot deny access to reserves to banks which are short of reserves because this would lead to a halt in payments and other disruptions to the functioning of the economy. Instead, they can influence demand for reserves ex post through their interest rate and other conditions.

Commercial banks operate as if they were also clearing institutions. Within their own organisation, each bank can match transactions between their customers; as a result, only transfers between customers of different banks appear in the interbank market. If transactions between banks cancel each other out, banks do not need central bank reserves even for transfers between themselves to expand their balance sheets to an even unlimited extent. Such expansion is limited only by micro- and macro-prudential requirements. The more concentrated a country's banking sector is, the lower the proportion of the interbank transfers that is actually needed. Some banks may be in a net deficit or surplus position in certain periods, and others in other periods, however, the amount of the resulting net interbank lending and, hence, increase in demand for reserves does not necessarily imply that excessive lending occurs at the macroeconomic level, which the central bank should curb. By contrast, there may be no significant demand for interbank reserves due to the increase in banks' balance sheets[6] at a roughly identical pace. Yet lending in the banking system is excessive. In a period of general optimism, this is a rather likely scenario.

The interbank market is segmented in some countries. There are banks whose customers usually or structurally hold net surplus (net savers, as is traditionally the case with banks with predominantly retail customers) and those whose customers are typically net borrowers, mainly firms, which transfer more into the accounts of others than they receive into their own. In such a case, banks with a structural surplus lend to banks with a deficit in the interbank market. These structural features may persist, but at the macroeconomic level this does not necessarily imply that deficit banks are overheating, as the amount of transfers between banks is not in itself a proxy for the risk of overheating at the aggregate level. Finally, if a bank's customers transfer more to another bank's customers, that is not necessarily because that bank has an excessively lax, even aggressive, lending policy. It is possible that the interbank market is in deficit only because of the distribution of customers.

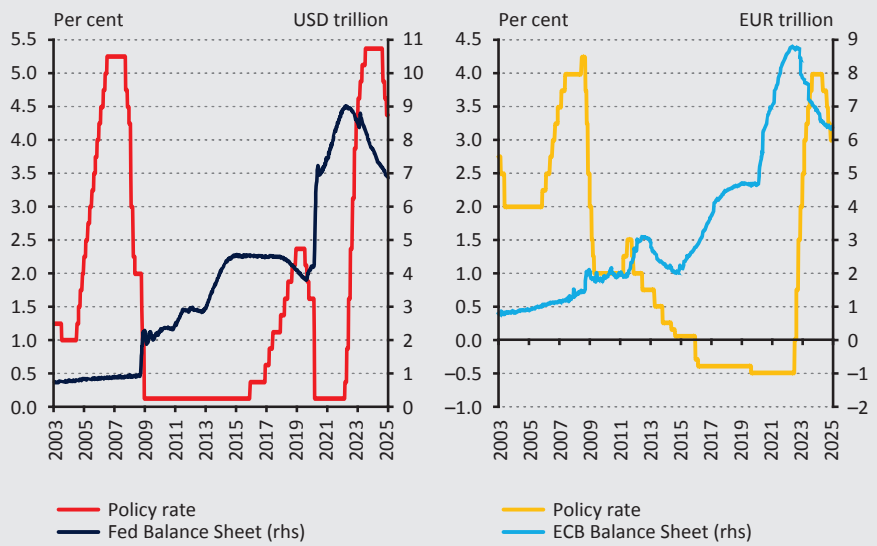
It can be seen, therefore, that there *is a multi-leveraged* relationship *between the aggregate level of lending and the level of reserves*. This is why it would be

[6] In Keynes' words, 'in step'. *Keynes* (*1930: 26*), *Lavoie* (*2022*: *204*).

unreasonable for central banks to deny banks' demand for central bank reserves in the context of a quantitative monetary aggregate targeting framework. Following experiments in the 1970s and 1980s, central banks abandoned strategies based on monetary aggregates and moved to direct inflation targeting.

Another consequence of clearing money is that there is no economically meaningful relationship between the size of central banks' balance sheets and the policy rate (*Figure 3*).[7] This is best illustrated by the central banks' actions following the Great Financial Crisis. The increase in central bank reserves resulting from 'quantitative easing', which led to a manifold increase in central banks' balance sheets, did not lead to a pick-up in bank lending, as many had expected on the basis of the multiplier theory, often fearing a surge in inflation. The reserves cannot be 'lent' by banks, as they cannot leave the interbank market. At the aggregate level, only central banks can decrease or increase the amount of money, and banks cannot collectively influence its amount. However, as we have seen, banks' lending activity is influenced by the amount of reserves only indirectly, which central banks provide endogenously in response to banks' demand.

Figure 3
Trends in the central bank balance sheet and policy rates in the US (left) and the euro area (right)



Note: For the Fed, the centre of the policy rate is shown before December 2008, and the centre of the policy target range is shown in the figure. For the ECB, before 2016 the interest rate on the main refinancing operations is used as the reference rate, while from 2016 onwards the interest rate on the deposit facility is used as the reference rate.

Source: Federal Reserve, ECB

[7] This separation between the policy rate and the central bank balance sheet is referred to in the literature as 'decoupling'. See *Borio – Disyatat* (*2009*).

The mechanism of endogenous money creation is now generally accepted, even if many have not yet updated what they learned from traditional textbooks.[8] Although ten years have passed since the Bank of England published its article in 2014, the old exogenous monetary analysis framework remains in place in respect of the following issues. This is not a purely theoretical problem; rather, it unnecessarily complicates central banks' communication with economic agents, erodes central bank credibility and may lead to economic policy mistakes.

3. Some consequences of endogenous money creation in a closed economy

In this section, assuming a closed economy, we present cases in which using the traditional exogenous money creation framework leads to erroneous empirical model specifications or misleading interpretations.

3.1. Crowding out effect

It follows from the above that what is termed as the 'crowding out effect' often mentioned in connection with budget deficits does not exist in the usual quantitative sense, since it assumes that the government borrows the extra money needed to meet its expenditure exceeding tax revenues from a fixed amount of savings already existing independently of it, similar to the case of loanable funds. Given that the government budget is less interest-sensitive than the private sector, it crowds it out of the savings market. This crowding out will then cause private investment to fall short of what would otherwise be possible. According to a more sophisticated argument, which acknowledges the endogenous nature of money creation, crowding out takes place through interest rates. This means that, even if the amount of 'savings' is not quantitatively limited, demand for credit in the interbank market will raise interbank interest rates. A third, even more sophisticated version suggests that central banks respond to increased demand for credit by raising interest rates. However, based on what we said earlier about the operation of interbank markets, central banks change interbank interest rates in line with their inflation target and the maintenance of such. In other words, the budget deficit affects interbank interest rates only through its possible impact on the central bank's inflation forecast (outlook), to which central banks adjust interbank market conditions. If, for example, there is still surplus capacity, and the budget deficit is not an inflationary factor in the central bank's forecast, the central bank will keep interbank interest rates at the previous level despite the budget deficit.

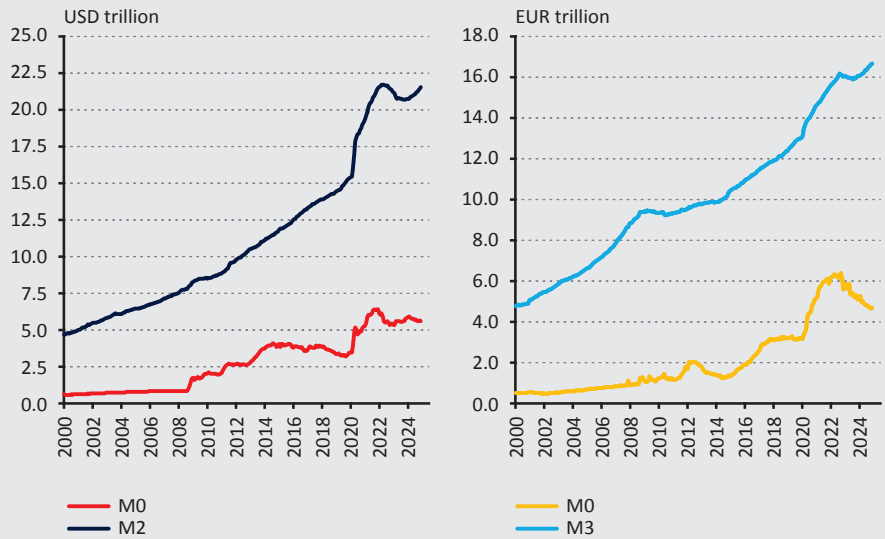
[8] Olivier Blanchard, former IMF chief economist and professor emeritus of economics, asked tweeters whether he should present the multiplier theory of money creation in the forthcoming new edition of his book (X (formerly twitter) 14 May 2023): https://x.com/ojblanchard1/status/1657779919613460482).

3.2. Quantitative easing

Central banks responding to the Great Financial Crisis used 'quantitative easing'. With QE, they purchased securities from banks and the non-bank private sector, in exchange for which central bank reserves were created. However, as has been discussed, banks cannot 'lend' reserves. The most that happens is that the reserves available to them increase; however, they would only need this if, despite clearing, there were a sudden increase in demand for reserves. The likelihood of such a scenario is only moderate even during a strong economic recovery; however, responding to the Great Financial Crisis, nearly all actors reduced their demand for credit, and, taking advantage of low interest rates, even made efforts to repay existing loans.

Benjamin Bernanke, then chairman of the US Fed, tried to change this misnomer repeatedly, recalling (*Bernanke 2009*) that it was not simple 'quantitative' easing that the Fed had introduced, but rather, following the decades-old practice of the Japanese central bank (*Ito 2006*) known as quantitative and qualitative easing, the Fed sought to directly ease credit conditions by buying securities ('credit easing'). In other words, the Fed wanted to reduce risk premia, i.e. to achieve an 'interest rate' or 'price' effect, and to make the terms of riskier and longer-term corporate loans more favourable. In other words, it is the composition of central banks' asset portfolio that is important, not only liabilities and the amount of central bank reserves. In Europe, where bank loans play a larger role in corporate lending than corporate bonds, the ECB eased the conditions of corporate financing mainly through long-term loans and favourable interest rates and other conditions for such (*ECB 2010*). Nevertheless, the terminology persists, and it is feared that it has contributed to the spread of perception among the wider public that central banks increased money supply, thus significantly increasing the risk of inflation.

Figure 4
Monetary base and M2–M3 monetary aggregates in the US (left) and the euro area (right)



Source: Federal Reserve, ECB

The traditional analytical framework made it difficult to understand central bank actions and eroded the credibility of central banks. Central banks cannot directly make commercial banks increase lending (*Figure 4*). Unlike the multiplier model, they can stimulate lending only indirectly by offering favourable interest rates. Due to the special dynamics of the financial system, the price of financial assets (such as shares) rose. Increasingly high asset prices were financed by credit. By contrast, investment in the real economy remained subdued. Lending remained demand-driven and demand for credit was depressed as previously indebted actors strove to strengthen their balance sheets by repaying their loans.

3.3. Helicopter money

In light of the hardly noticeable impact on aggregate demand and inflation, which was consistently below the target, the idea of using what is called 'helicopter money' emerged. Those in favour of the proposal argued that the measure would have the expected effect, because it would be 'financed' by money created by the central bank rather than by relying on pre-existing savings, for example through bond issuances. This means that domestic actors (e.g. households) would receive money from the central budget or directly from the central bank, i.e. of course not from a helicopter, but rather as an electronic signal sent to their bank accounts. The unspoken assumption is that it is the method of financing, i.e. central banks'

creating money 'out of nothing' or the government's issuance of bonds, that determines whether the operation, i.e. an injection of free money, will have an inflationary effect and/or any impact on aggregate demand. The idea underlying this is the assumption of 'loanable funds'. Accordingly, if money creation by the central bank ('printing' of excess money) increases the amount of money available to economic actors at unchanged interest rates, as in the helicopter metaphor, that has an inflationary effect. Conversely, it is assumed that in the case of bond financing, the budget competes for pre-existing savings; the only difference is that savings are borrowed and spent by either the private sector or the government, and therefore, bond financing does not lead to inflation.

However, as has been pointed out, the banking system and banks' clients can subscribe bonds to be issued on credit; thus, there are no amounts of savings fixed in advance for which the state has to compete. However, as a result of quantitative easing, the banking system had already plenty of central bank reserves when the proposals were made. Interest rates are influenced by central banks in order to achieve and maintain their inflation target, which bond issuance alone does not influence. In this respect, helicopter money alone does not bring about any change. Central bank interest rates and their impact on other interest rates are determined by the central bank's assessment of inflation in the wake of increased aggregate demand resulting from money creation, regardless of how helicopter money is 'financed'.[9] This is no different from deficit financing presented earlier. In this case, too, it is the impact on inflation via aggregate demand rather than the manner of financing that is crucial.

In recent decades, central banks have been banned from directly financing the budget; they must 'finance' a deficit by issuing bonds. However, this measure did not eliminate the financial system's ability to create money endogenously. All that has changed is that private sector operators, i.e. banks and/or the non-bank private sector, must subscribe government securities first. Central banks will continue to set interbank interest rates and the liquidity situation, and therefore the conditions for underwriting government bond issuance. Prior to the crisis, leading central banks operated under structural reserve constraints. Although commercial banks maintained minimum central bank reserves, they received the liquidity from central banks needed for subscription when government securities were issued.[10] If there is an abundance of reserves, providing the necessary liquidity for bond purchases is a matter-of-course issue; in fact, central bank had already provided it.

[9] *Borio et al.* (*2016*) arrived at the same conclusion as did post-Keynesians. This is not surprising, because the BIS staff also assume an endogenous money supply.

[10] In modern systems, government securities are bought by primary dealers for later 'distribution' or for their own account. They undertake to underwrite the issuances and support the secondary market liquidity of the bonds. Prior to issuance, central banks regularly consult primary dealers and ensure that the banking system has sufficient reserves for underwriting. See *Nersisyan – Wray* (*2020*), described in *Szalai* (*2020*).

3.4. Sterilisation

Sterilisation refers to the absorption of central bank reserves (for example, by selling government securities) that have increased in the interbank market as a result of central bank purchases of foreign exchange. When commercial banks convert increased amounts of foreign currency into domestic currency, the amount of domestic money increases in the interbank market. Central banks absorb such excess reserves, for example by selling government bonds to keep interbank interest rates at the desired level. This is a typical central bank operation in fast-growing, small, open economies, where capital flows in in response to the business cycle. By buying foreign currency, central banks often aim to prevent an excessive appreciation of their own currency in order to protect international competitiveness.

Looking at the extent of 'sterilisation', analysts monitor the impact that central banks' intervention in the foreign exchange market may have on domestic inflation, for example through domestic lending and the exchange rate of the domestic currency. Such analyses typically examine the quantitative relationship between the growth of interbank reserves and the change in central bank reserves. If the increase in reserves due to foreign exchange purchases is fully offset by sterilisation (with an identical decrease in interbank reserves), sterilisation was complete (*Filardo – Grenville 2012; Disyatat 2008*). The term implies that the conversion of capital inflows into domestic currency cannot be a means of additional lending.

Such quantitative analyses are potentially misleading. If, for example, the observer deems that the intervention has only partially been 'sterilised' by the central bank, they conclude that it may have undesirable effects on inflation or the exchange rate. However, as has been pointed out, this is misleading because there is no such a direct link between macroeconomic variables and central bank reserves. Central banks seek to influence the macroeconomy through their policy rates rather than through the amount of the reserves they maintain; there is also no meaningful link between interest rates and reserves (see *Figure 5*). Central banks 'sterilise' their intervention in the foreign exchange market when and to the extent that they consider it necessary to keep the central bank interest rate at a desirable level. This means that 100% 'sterilisation' is not necessarily desired; on the other hand, it may not be sufficient to keep the central bank interest rate at the intended level. It is even more important to realise that 'sterilisation' is not a matter of a separate decision, rather it is automatic: the level of intervention is influenced by capital inflows and banks' demand for reserves, which, in turn, is influenced by many other factors at any given time (*Disyatat 2010; Angrick 2017; Lavoie 2022*).

Adler et al. (*2021*) analysed data from 140 developed and less developed countries from the perspective of sterilisation. They found that, despite capital inflows, 84 per cent (90 per cent in developed countries) of central bank interest rates did not fall, and may even have risen, while interbank reserves were only 42 per cent 'sterilised' in quantitative terms.

What provides meaningful information for analysts is not the extent to which central banks offset excess liquidity quantitatively, but rather the way monetary conditions evolve as a result of capital inflows and exchange rate developments.

3.5. Impossible trinity

The economic policy options for small, open economies are usually described by a trilemma known as the 'impossible trinity'. According to the impossible trinity, from among the three 'freedoms', i.e. floating exchange rates, independent interest rate policy and free capital flows, economic policy can only pursue two at the same time, but not the third. A related dilemma is that there are only two extreme solutions in the exchange rate policy: either a floating or a fixed rate, with no managed floating in between the two.

The traditional theory plays a key role in explaining the trilemma and the dilemma; in fact, it is extended to cover open economies. Here again, the main problem is the assumption that central banks influence bank lending and inflation by regulating the level of reserves. Thus, if a central bank strives to curb further appreciation of the domestic currency driven by capital inflows into a strengthening economy by intervening in the foreign exchange market, it will increase the domestic currency-denominated reserves in the interbank market, which, according to the money multiplier theory, will lead to excessive lending, overheating and inflation, as well as to a current account deficit, and eventually to currency depreciation and economic slowdown and contraction. Furthermore, the conversion of inflows into domestic currency leads to an excessive build-up of international reserves, which over time leads to significant losses, as the returns on the investment of reserves are usually lower than the interest on domestic currency. For this reason, it is argued that an intermediate floating exchange rate regime is unstable and potentially unsustainable.

However, contrary to the traditional trilemma and dilemma approach, as was stated earlier, central banks do not aim to achieve their goal by focusing on the quantity of reserves. Key policy rates are the primary tool of central banks even in less developed and converging countries. Moreover, central banks have a number of tools at their disposal to absorb excess liquidity, which obviates the need for raising interest rates. In the past, they mainly resorted to increasing the mandatory reserve ratio, but after the liberalisation they switched to operations involving central bank bonds or the interest rate paid on excess reserves. Taking also into account what we presented in connection with sterilisation, central banks have more room for manoeuvre than what follows from the trilemma and the dilemma theories, to adjust domestic financial conditions in line with their inflation target, in an environment of free capital flows, and there is also room for the managed floating of the exchange rate (*Filardo – Grenville 2012*).

4. Some consequences of endogenous money creation in an open economy

In what follows, assuming an open economy, we show why it is important to revise the traditional analytical framework in the light of endogenous money creation.

4.1. International capital flows and the current account

Analyses of international capital flows and the balance of payments in most macroeconomic studies have yet not been modified in line with the analytical framework of endogenous money creation. Typically, developments in the balance of payments are presented as the (current) balance of exports and imports of goods and services and of income transfers, and capital flows are treated only as a passive item offsetting the current account balance thus defined. Domestic savings are implicitly equated with financial savings, as if part of the real wealth produced were set aside for future consumption or export. The extension of I=S (investment=savings) to an open economy (net exports=S-I) corresponds to this, where the part remaining over and above domestic consumption is exports. In a number of analyses, this relationship is interpreted as if exporting countries financed their own exports to importing countries, analogous to the 'loanable funds' model.[11] In reality, however, importers may take out bank loans (import credit) either in the exporting country, in their own country or from a third bank in a country not involved in the export-import transaction, and the currency of payment is also a matter of agreement. Just as domestically, internationally, too, all trade in goods must be financed, constrained by the ability of banks to finance it, and so it is independent of the savings recorded in national accounts. It is more accurate to say that the savings recorded in the national accounts unlock real funds for use (unconsumed income), but they do not constitute financing (*Borio – Disyatat 2011, 2015; Kumhof et al. 2020; Felipe et al. 2022*).

4.1.1. Intertemporal approach to the balance of payments

One major exception is a study by *Obstfeld* (*2012*), according to which capital inflows are not only a passive result of the flow of goods and services; they may also be active, for example in response to yield spreads, and play a dominant role in current account developments. For example, in a fast-growing economy, foreign capital may flow into the economy in the form of portfolio or direct fixed capital investment in anticipation of higher returns, and this excess investment may emerge as an import surplus in the trade of goods, contributing to the current account deficit.

The reversal of the causality is significant, because traditional analyses treat the current account deficit as an obvious indicator of competitiveness, identifying a deficit with poor competitiveness. Assuming intertemporal optimising behaviour, Obstfeld's analytical framework allowed to treat persistent deficits as future consumption brought forward, which does not necessarily have to be adjusted and is not a sign of poor competitiveness. This means that it is optimal for faster growing

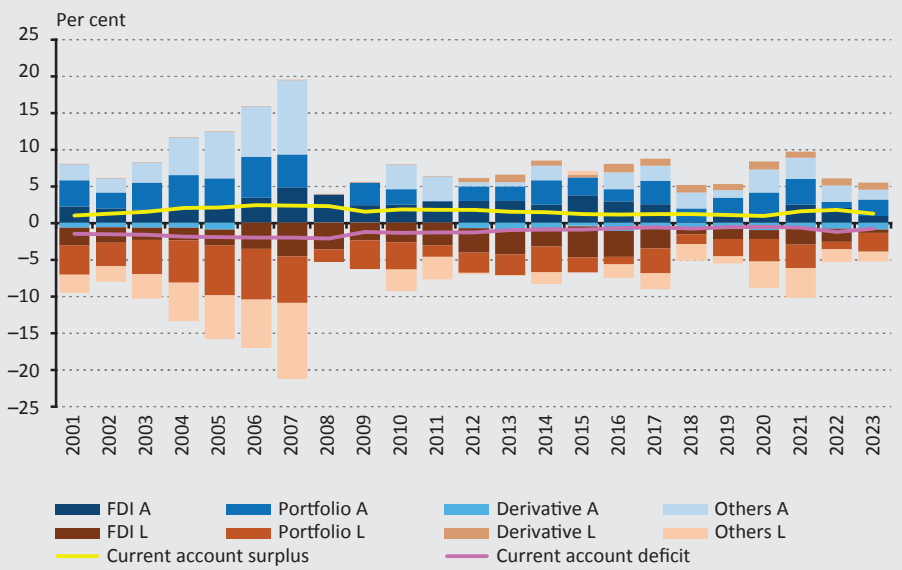
[11] For example *Bernanke* (*2005*) or *Gourinchas – Rey* (*2013*).

countries (or countries with younger populations) to incur indebtedness, while it is optimal for countries with a slower growth rate (or aging populations) to save and lend. This is an important step forward, but such an analysis of the international balance of payments does not break with the theory of 'loanable funds' in the domestic context and the treatment of banks as passive intermediaries (*Borio – Disyatat 2011, 2015*). Gross capital flows are still understood here as intertemporal barter in real terms.

4.1.2. Addressing global imbalances before the financial crisis

However, even this revised analytical framework proved spectacularly inadequate after the Great Financial Crisis. In a modern, liberalised international financial system, capital flows are only very indirectly linked to the flows of goods and services and income flows that make up current account items. It is true that after the Second World War, even the most developed countries tended to restrict international capital flows and link them to trade in goods. Over the decades, however, foreign direct investment (FDI), portfolio investment (minority purchases of securities), foreign exchange transactions and direct foreign currency lending by banks (other flows) underwent gradual liberalisation. As a result of external and internal financial liberalisation, compared to historical capital flows, current account balance items or even GDP growth rates, international capital flows increased by many times (see *Figure 5*, where global gross capital flows relative to GDP far exceed global current account balances as a proportion of GDP).

Figure 5
Global gross capital flows and current account balances as a percentage of global GDP



Note: Gross capital flow data indicate outflows with a positive sign and inflows with a negative sign
Source: IMF Balance of Payments Statistics

A large and growing proportion of capital flows is not linked to trade in goods and services or net income flows; rather it is directed, for example, at assets (stocks): minority shares (less than 10-per cent stake) and bond purchases (i.e. portfolio investment), majority-owned business investment (FDI) and other financial flows (e.g. bank loans). Such items are recorded as gross capital flows (gross inflow and gross outflow), which represent net acquisitions of debt (sales and purchases) and net changes in liabilities (increases and decreases in debt). The balance of gross flows results in net capital flows (and changes in international reserves), which often have little to do with the current account balance.[12]

In particular, the financing of foreign governments' deficits and the share of various investment vehicles, including real estate lending, increased. Like domestic lending, these international capital flows often reflect the creation of money by foreign banks, rather than a mere transmission of 'pre-existing foreign savings'. Therefore, it is misleading to analyse capital flows in the context of the international savings-investment framework, an extension of the loanable funds theory.

Prior to the Great Financial Crisis, the example of Japan in particular was a striking refutation of this approach: while Japan's internal indebtedness was blatantly high due to the bursting of the real estate bubble, the Japanese yen was nevertheless a popular foreign currency of financing (carry currency) due to its low interest rates (*Borio – Disyatat 2011; MNB 2014: Chapter 1*). Japanese banks were able to lend to foreign countries despite domestic debt. In the wake of the Great Financial Crisis, further patterns of capital flows emerged, revealing the misleading nature of the usual approaches. One of the most important patterns is the true nature of Chinese capital flows to the US. It is widely believed that Chinese capital flows to the US were due to excessive Chinese savings[13] which financed the US deficit. But the reality is that the capital flowing into the US significantly exceeded the current account deficit or even the budget deficit. That the bulk of the inflows came from the UK (London) and euro area banks was even more striking, as the former had had a current account deficit and the latter an overall current account balance of around zero before the crisis (*Johnson 2009*) (see *Table 1*).

[12] For more details, illustrated with examples, see *Kohler* (*2020*), and the studies by *Avdiyev et al.* (*2016*) and *Borio – Disyatat* (*2009*) (the latter reviewed by *Szalai 2019*).

[13] Fed chairman Bernanke's famous 'savings glut' explanation for globally too low interest rates (*Bernanke 2004*). To be fair, Bernanke himself later moved somewhat away from this current account thesis and began to emphasise the role of the capital account, insofar as he stressed the role foreign countries' demand for safe assets issued by the US. *Barsky – Easton* (*2021*) documents the evolution of Bernanke's view. Nevertheless, the thesis persists: see, for example, a recent article by Martin Wolf, a highly respected financial journalist for the Financial Times (*Wolf 2024*).

Table 1
Changes in holdings of US securities held abroad (billion USD)

	2016	2017	2018	2019	2020	2021	2022	2023
Europe	7,094	7,768	8,127	8,522	9,201	12,089	10,833	11,921
of which								
Euro area countries	4,037	4,497	4,819	4,950	5,339	6,853	6,146	6,720
United Kingdom	1,427	1,493	1,598	1,776	1,988	2,617	2,434	2,627
Asia	5,901	6,154	6,445	6,932	7,519	8,420	7,699	8,055
of which								
China	1,630	1,541	1,607	1,543	1,569	1,575	1,473	1,432
Japan	1,960	1,998	2,044	2,280	2,553	2,765	2,474	2,494
Latin America	565	565	625	645	589	642	614	678
Canada	951	1,061	1,210	1,262	1,335	1,977	1,844	2,055
Caribbean financial centres	2,100	2,290	2,338	2,496	2,559	3,181	2,916	3,092
Other	528	574	655	677	751	880	987	1,071
Total	**17,139**	**18,412**	**19,400**	**20,534**	**21,954**	**27,189**	**24,893**	**26,872**

Source: U.S. Department of the Treasury

As can be seen in *Figure 5* in general, capital flows (in gross terms) at the global level cannot be derived from or limited to, current account balances. This is why a country's financial vulnerability, the exchange rate of its currency and interest rates (*Borio – Disyatat 2011; Barsky – Easton 2021*) also moved away from what could be predicted on the basis of the current account alone.

The traditional approach has had unnecessarily serious consequences, most recently during the European financial crisis, when the credit crisis, which was the result of capital flows, was seen as a current account crisis or competitiveness crisis and austerity measures were adopted to resolve it. But, as Borio and Disyatat note, austerity measures-driven savings recorded in national accounts cannot finance financial obligations on their own, and often make matters worse.[14]

4.2. Gross capital flows and the 'puzzles' of the international financial system

In the examples below, the lack of distinction between net capital flows included in the current account balance and gross capital flows makes analyses misleading.

[14] *Borio – Disyatat* (*2015: p. 25*). See also *Febrero et al.* (*2019*) and *Virág* (*2020*: *pp. 99–105*) and the literature cited there.

4.2.1. The Feldstein-Horioka puzzle

The Feldstein-Horioka 'puzzle' refers to the close link between investment and savings in the national economy. This means that in a well-functioning international capital market, investment should not take place where savings are generated, but rather where the best investment conditions are (*Borio – Disyatat 2011*). In their estimated equation, they examined the investment ratio (I/Y) as a function of the savings ratio (S/Y), that is (I/Y = a + b S/Y + e, where b is the 'retention ratio'). The retention ratio for 16 OECD countries is estimated at 0.89 for the years 1960–1974 (*Feldstein – Horioka 1980*). The study launched an extensive research programme that continues to this day, with a variety of hypotheses for a high b ranging from financial market frictions to the imperfections of host country institutions.

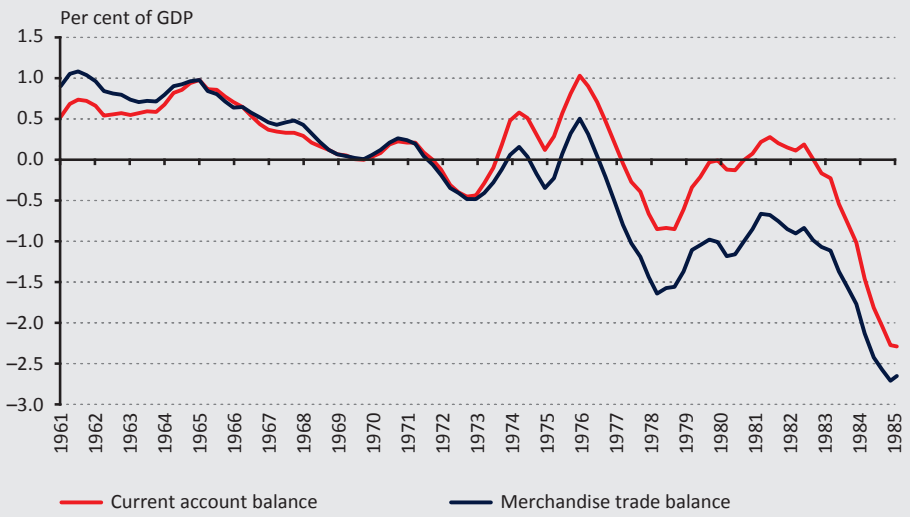
The Great Financial Crisis showed that European countries were rather integrated financially with the US economy, even though they were in balance in terms of national accounts savings and investment (foreign trade). Conversely, while for many years and decades China had a significant export surplus with the US, it was financially more closed under long-standing capital controls. In other words, savings and investments recorded in the current account and national accounts, respectively, do not reflect the degree of financial integration (*Borio – Disyatat 2015; Felipe et al. 2022*).

4.2.2. The Triffin dilemma

In the case of the *Triffin dilemma*, Triffin's original problem was placed in a framework with the current account at its centre, and it was assumed that the only way for a state issuing international money to supply the global economy with international money was to run a current account deficit – to become indebted – compared to countries that demand its money. That is, it was assumed that net exports (like closed real economic savings) would finance the import surplus of the country running the deficit.

Under endogenous money creation and liberalised international capital flows, the relationship between capital flows and net investment in the real economy or savings is so indirect that their magnitude and direction may be opposite. *Triffin's dilemma* is also explained if we agree that the banks of the state issuing international money are able to supply the world economy with the money it needs, regardless of current account developments. In the years following the establishment of the Bretton Woods system in 1944, when the US dollar became the official international currency and demand for it was huge, the US current account was positive, only to turn negative much later, after the break-up of the system in 1971–1973 (*Bordo – McCauley 2019:13*) (*Figure 6*).

Figure 6
US trade and current account balances as a percentage of GDP

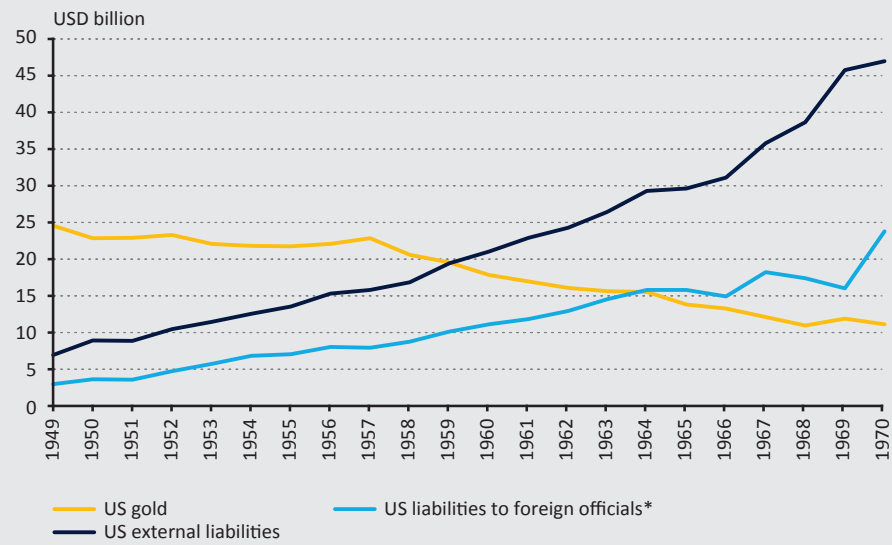


Source: Conversable economist blog, https://conversableeconomist.blogspot.com/2013/11/the-triffin-dilemma-and-us-trade.html, U.S. Bureau of Economic Analysis

It was not by assuming a current account deficit that Triffin formulated his dilemma either.[15] Originally, what he considered a threat was an increase in the claims by foreign central banks from the US to a level exceeding the US monetary gold reserves, which could be caused by, but not limited to, a current account deficit. (*Bordo – McCauley* (*2019*) also present a fiscal or 'risk-free instrument' version of the Triffin dilemma.) Even though the Bretton Woods system collapsed only years after this point was reached in the first half of the 1960s, the international financial system did not collapse (*Figure 7*).

[15] *Bordo – McCauley* (*2019*). In the 1950s, Triffin feared that the US would try to protect its gold reserves and limit the issuance of dollars, causing difficulties in global trade. To avoid this, Triffin proposed the separation of dollar and gold, advocating instead for the creation of a new international currency, such as the Bancor proposed by Keynes.

Figure 7
Development of US gold reserves and liabilities to the rest of the world



*Note: *Official liabilities to foreign central banks and finance ministries. These are the reserves that can easily be used for foreign exchange intervention.*

Source: Bordo – Maculay (2019:4)

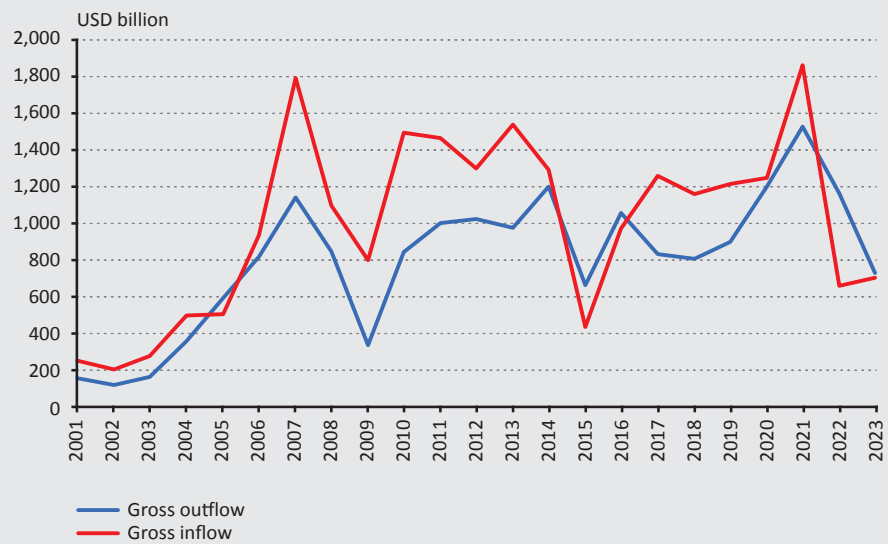
Bordo and his co-author attribute the growth of US dollar liquidity to global demand for it, in which claims on countries other than the US play a larger role than claims on the US. They point out that China's current account surplus does not prevent the Chinese currency from becoming an international reserve currency, just as it did not prevent the US dollar from doing so at the time. At the same time, contrary to expectations based on the fiscal 'Triffin dilemma', increased US public debt in the Great Financial Crisis strengthened the US dollar's role as a reserve currency and demand for it continued to rise, not fall, during the crisis.

4.2.3. Lucas' paradox

Similarly, the authors of *Lucas' paradox* (*Lucas 1990*) – according to which capital should flow from developed, capital-rich countries to less developed, capital-poor countries offering the possibility of higher returns – do not distinguish between 'real savings' and financially oriented 'finance'. The flow of capital from poorer countries to richer countries is deduced from developments in current account balances, as if the direction of capital flows could be determined by the current account balance. The most glaring examples are the Chinese export surplus and the US trade deficit that evolved years after Lucas' article.

However, the export-oriented strategy of less developed countries, i.e. the pursuit of a net current account surplus, may be reasonable, and it does not preclude the possibility of significant capital flows into the country (*Borio – Disyatat 2011: 19–20*). Less developed countries that have successfully converged (such as the countries of Southeast Asia) pursued an export-oriented strategy, accumulating foreign exchange earnings generated as a reserve to retard the appreciation of their currencies, which would undermine their competitiveness, and as 'self-insurance' against an unexpected reversal of capital flows. As was pointed out above, according to the 'impossible trinity', this strategy would sooner or later become unsustainable because of the difference between domestic and foreign interest rates. In reality, this difference does not always cause a loss which would make the convergence strategy unsustainable. According to *Kregel* (*2006*), alternative development strategies based on net capital inflows more frequently lead to unsustainable macro-financial situations and IMF-imposed stabilisation policies, which entail higher economic losses. Both 'anomalies' result from the asymmetric nature of the current international monetary system, where the correction of imbalances and indebtedness is unilaterally imposed on deficit/indebted countries.[16]

Figure 8
Gross capital flows to emerging and developing countries



Note: For comparability, capital inflows are shown with a positive sign
Source: IMF Balance of Payments Statistics, various years and online database

[16] For more details, see e.g. *Kregel* (*2019*, *2021*).

Despite all of these considerations, the paradox is unfounded if we examine gross capital flows rather than current account balances in emerging and developing countries. *Figure 8* shows that capital inflows exceed outflows. Accordingly, in both the Feldstein–Horioka and Lucas paradoxes, an erroneous analytical framework can lead to potentially incorrect economic policy conclusions, namely, to encourage external financing and capital investment, even at the expense of social and environmental sustainability.

5. Summary

Approximately a decade ago, following the example of the Bank of England, a number of leading central banks started to promote an endogenous money supply approach as opposed to the textbook monetary models. However, in many other areas, a change of mindset is still to come. For reasons of space, we have only briefly indicated that the change is also very important for practical economic policy. Thinking along conventional lines can easily lead to misguided or sub-optimal economic policy actions in areas such as monetary policy stance, financial vulnerability, correction of external imbalances, development policy and investment promotion, and the international monetary system.

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Innovation-driven Economic Growth – How Hungary Will Be Home to Innovative Entrepreneurs and Enterprises*

László Bódis – Ádám Kiss

Productivity is significantly higher in countries that consistently spend at least 3 per cent of GDP on R&D, irrespective of economic cycles. Increasing productivity is necessary to boost the competitiveness of the economy and accordingly, significant growth in domestic R&D expenditure is essential. The challenges of the Hungarian RDI ecosystem have been properly identified, and the policy actions of recent years have put in place a strategic, institutional and funding framework to achieve these goals. In the long term, the objective is to create an ecosystem that is self-sustaining on a market basis, but where the state assumes a key role in designing the regulatory environment and the funding and supporting instruments. By systematically implementing the strategy outlined in this article, Hungary may be able to boost its economic performance through innovative, Hungarian-owned firms capable of producing high value-added products.

Journal of Economic Literature (JEL) codes: O30, O38, O40

Keywords: RDI ecosystem, innovation by SMEs, economic competitiveness, value added, public incentives to promote innovation

1. Introduction

At the Olympics, Hungary's athletes have repeatedly shown that Hungarians are capable of achieving great results at the top international level despite the country's small size and limited opportunities: the number of recent summer Olympic gold medals won by Hungarian athletes is the 9th highest in the world in absolute terms. This same excellence can also be seen among Hungary's scientists and young talents: Hungary ranks 11th in the world in the number of Nobel Prize winners per capita, 5th in the absolute ranking of international mathematics student Olympiads and 9th

* 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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in the ranking of physics student Olympiads. The success of Hungary's champions and researchers can also serve as an example for Hungarian entrepreneurs and enterprises. Indeed, as in sports and science, exceptional perseverance and preparation are also required in the world of business to achieve success.

Why shouldn't it become a reality that by 2035 many innovative Hungarian firms will have joined the ranks of the most influential, fastest growing technology companies in Europe or even the world? While the 'Olympic champions' of business do not return home with gold medals, their billions of euros in enterprise value, their ability to create high value added and their international presence make a significant contribution to the economic success of their country, in our case Hungary.

Innovation plays a key role in shaping a nation's competitiveness and economic development by facilitating the creation of high value-added products and services, increasing productivity and opening up opportunities for new markets, as first described in the growth model of *Solow* (*1956*). His model explains economic growth using three basic factors: labour, capital and technical progress. According to the model, long-term economic growth is primarily driven by the latter, as investment in technical development and innovation directly affects economic productivity and competitiveness. This enables a developed country to achieve sustainable economic growth even without significant changes in employment rates or the capital stock.

However, as early as 1987 Solow pointed out that the rise of the digital economy does not necessarily confirm the universality of this thesis (*Cséfalvay 2024*). The Solow paradox points out that even though digital progress takes place at a rapid pace, in many cases, its impact is not immediately reflected in productivity indicators. This is particularly evident in the decelerating economic growth and declining labour productivity observed in developed countries (*Cséfalvay 2024*). Identifying the causes of the productivity paradox at the global level and at the level of the national economy is of key significance for RDI[1] policy, as there is a need for interventions that can transform technological progress and innovation activities into real economic growth.

According to *Schumpeter* (*1942*), innovation is driven first and foremost by firms, as they are constantly seeking new, more efficient solutions; therefore, old structures can be replaced by more competitive models through 'creative destruction'. However, the entrepreneurial sector is not homogeneous: Innovation-Driven Entrepreneurship (IDE) needs to be distinguished from various other forms of entrepreneurship (*Botelho et al. 2021*).

In Hungary, innovation potential is determined by several factors (*NRDI Office 2021*), including the low innovation capacity of SMEs, the significant dominance of large,

[1] Research, development and innovation.

export-oriented companies, the inadequacy of university–industry cooperation, underdeveloped knowledge transfer between sectors and the lack of skilled labour (*Pongrácz – Nick 2017*).

Innovative enterprises have significant growth potential in Hungary as well: they grow faster (*Szoboszlai et al. 2024*) and show higher productivity (*Halpern, 2020; Halpern – Muraközy 2010*). Accordingly, government intervention should aim to create an environment for innovation-driven businesses that facilitates their growth and strengthens their position. RDI policy needs to be transformed to respond effectively to bottlenecks in the spread of innovation in Hungary, while also being able to address the challenges posed by the Solow paradox. According to the *Draghi Report* (*2023*), the role of innovation and the increasing importance of innovative companies may be a determinant of the formulation of economic policy strategies not only in Hungary, but also at the level of the European Union.

However, more than just radical technological progress is needed in order to increase competitiveness: developments that improve continuous operational efficiency are also required (*Gelei – Kenesei 2017; Katona 2021*). Therefore, it makes sense to elaborate a comprehensive portfolio of measures to promote the complex strengthening of the innovation ecosystem, increase its resilience, improve knowledge transfer and support Hungarian innovative companies with their efforts to enter the global market.

This essay outlines the challenges faced by the innovation ecosystem and the relevant policy responses.

Reflecting on the above, the vision of innovation policy is to increase the number and share of innovative companies in the economy and to strengthen and increase the number of export-capable champions among innovative companies, with some of them growing into globally outstanding technology companies which, based on Hungarian creativity and scientific achievements, are among the most successful ones in their respective industrial/technical fields. In the past decade, the government achieved numerous successes in the field of R&D and innovation: Hungary was the only country to advance one category to moderate innovator in the European Innovation Scoreboard in 2023; R&D expenditure has tripled in nominal terms since 2010; the headcount of R&D personnel has more than doubled (rising by 114 per cent, which was the third largest increase in the EU); and the number of PhD students has increased by almost 50 per cent in the past 10 years. The number of university patent applications in 2024 was 143, twice as many as in 2022 and nearly seven times as many as in 2018. The change in the university model, the renewal of the Hungarian Research Network, the strengthening of the National Research, Development and Innovation Fund and the new foundations of the funding structure have also contributed to these results. With this vision in mind

and based on the achievements of recent years, this essay highlights the importance of domestic innovation and the innovative business sector in enhancing economic competitiveness. To achieve this objective, we provide a comprehensive overview of the characteristics of corporate innovation in Hungary, and then present the strategic goals of innovation policy and the path to achieving those goals. We argue that research and innovation need a long-term strategy, with long-term, predictable and gradually increasing funding, as well as consistent, rigorous implementation. As US venture capitalist John Doerr put it: *'Ideas are easy. Execution is everything.'*

2. Background – why is it essential to strengthen innovative Hungarian companies today?

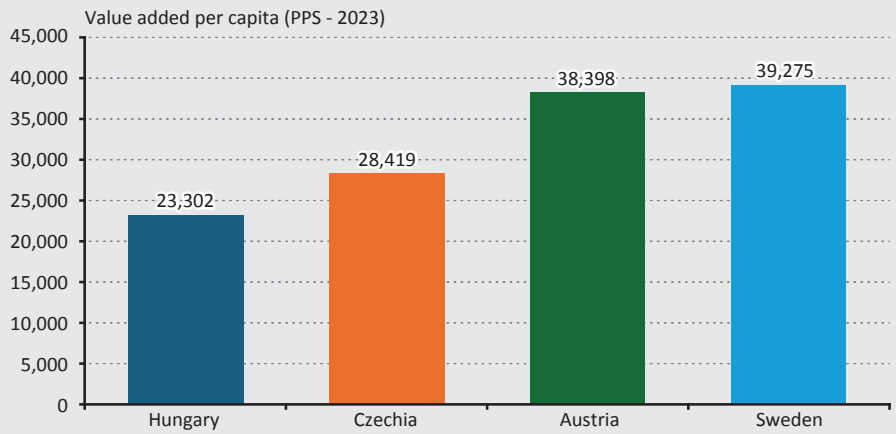
Based on an analysis by the global consulting firm *McKinsey* (*2020*), in the decade after 2010 economic growth was driven by an expansion in employment during the first five years, and by productivity growth during the second five years with continued growth observed, albeit at a slower pace, in employment.

In the period since 2010, nearly one million people have entered the Hungarian labour market, and according to the calculations of György et al. (*2024*)*, the Hungarian middle class has increased from 34.9 to 54.6 per cent.* Comparing Hungarian employment rates with those of Czechia, Austria and Sweden[2] – countries whose population size is similar to that of Hungary – we find that in most education categories Hungary has caught up with or even exceeded the employment rates of the benchmark countries.

Thus, while further accelerating employment growth continues to be an important economic policy objective, *over the medium to long term Hungary's economic growth may be based primarily on productivity growth*, in other words, growth in value added per employee (*McKinsey 2020*). International and domestic statistics on value added reveal that there is considerable scope for increasing value added per capita (*Figure 1*).

[2] For the purposes of this paper we used these three countries – which are similar in terms of population size to Hungary but with different levels of innovation – as benchmarks to set the target level for the development of innovation areas. Although these countries differ from Hungary in terms of their historical, economic and geopolitical situations, it is worth drawing inspiration from their examples.

Figure 1
Value added per capita (PPS, 2023)



Note: Added value at current prices calculated per one million inhabitants and divided by the GDP volume index per capita measured in purchasing power standard (PPS). Added value: https://ec.europa.eu/eurostat/databrowser/view/nama_10_a64/default/table?lang=en&category=na10.nama10.nama_10_ma; Population as of 1 January 2023: https://ec.europa.eu/eurostat/databrowser/view/tps00001/default/table; PPS adjustment: https://ec.europa.eu/eurostat/databrowser/view/tec00114__custom_11737615/default/table?lang=en

Source: Computations based on Eurostat data

Upon further analysis of the structure of Hungarian value added, we find that *foreign-owned companies play a significant role in the production of value added*. The same is true for all countries in the Central and Eastern European region. Over the past 15 years, economic policy has been able to significantly increase the domestic share of value added in Hungary (by about 10 percentage points), which is considered a major success. Nevertheless, it still stands at only 58 per cent, ranking Hungary 22nd among the EU Member States.

Partly as a result of this structure, an amount equal to 4 per cent of GDP – more than HUF 3,000 billion – exits Hungary each year on average in the form of capital income.

Research, development and innovation, including the use of new technologies, play a key role in boosting the value added generated by Hungarian-owned enterprises. The correlation can be also measured fairly well at the macro level: countries that spend more on R&D have significantly higher productivity. Companies relying on more advanced technologies and higher-level knowledge can be more competitive and produce more valuable products, not only domestically but also on international markets. This is particularly important for Hungary, as exports of high value-added products can stabilise and boost the economy's performance in the long term. This is also demonstrated by the 'smile curve,' which analyses the relationship between

value added and the individual activities of the production chain (see *Baldwin – Ito 2021*; *Boda 2020*). R&D and design are the highest value-added activities in the production chain.

Accordingly, *we can successfully increase value added per capita – i.e. productivity – in the Hungarian economy*, and thus ensure long-term economic growth, *if we increase the number of innovative companies and strengthen those that are already innovating.*

3. The role of innovative enterprises in the Hungarian economy

As innovation is the central theme of this essay, it is worth explaining what this term means. Innovation is defined in the Oslo Manual, an international standard for measuring innovation developed by the OECD and Eurostat. According to the Manual, an innovation is a new or improved product or process (or a combination thereof) that differs significantly from the company's previous products or processes and has been made available to potential users, in the case of a product, or brought into use by the company, in the case of a business process (*OECD/Eurostat 2018*). MIT provides a simple definition of what may at first seem a complex concept: *Innovation = Invention x Commercialisation* (*Aulet 2013*). This approach highlights that innovation is not merely the existence of an original idea or technological breakthrough, as its successful market introduction and utilisation are also fundamental prerequisites. If any of these are missing, we cannot talk about innovation.

To measure innovation performance, EU Member States conduct a survey every two years within the framework of the *Community Innovation Survey* (CIS), in which the self-reported innovation activity of the business sector in Member States is assessed using a comprehensive set of economic units with 100 or more employees, while a representative sample is used for units with 10–99 employees.[3] These results are aggregated by Eurostat and the latest survey data are available for the period 2020–2022.[4]

Taking the results of the CIS survey as a basis, the joint analysis of the Hungarian Central Statistical Office (HCSO) and the National Innovation Agency provides an accurate view of the role of innovative enterprises in the Hungarian economy (*Figure 2*).

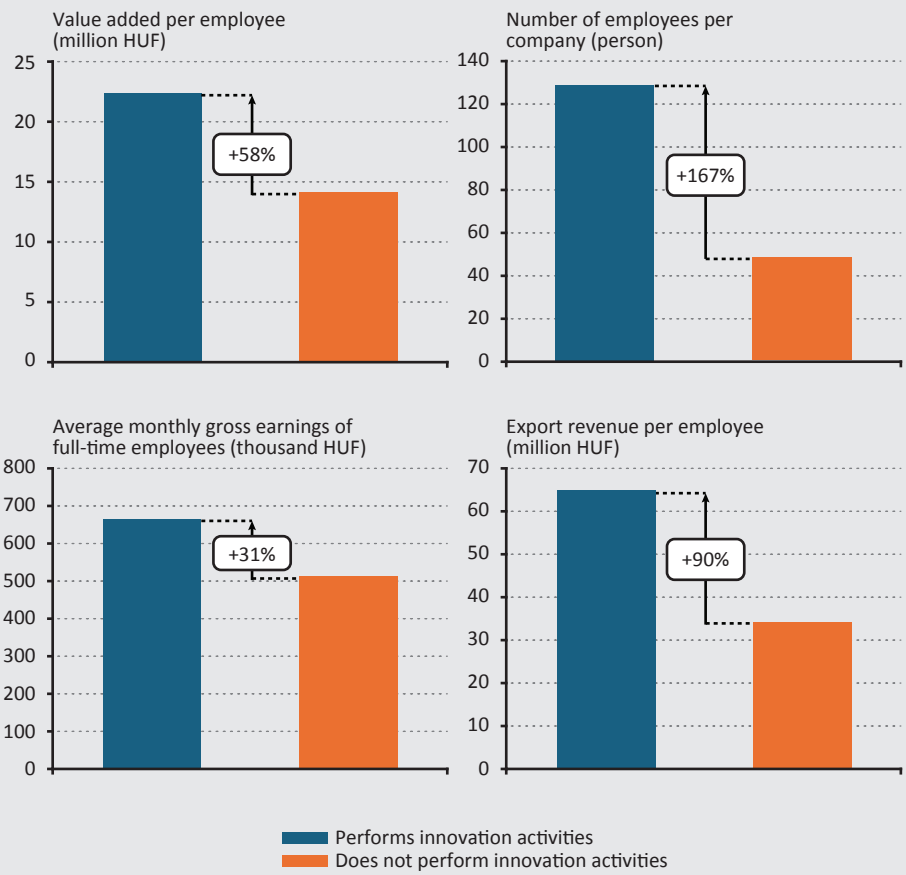
[3] The target population of the survey is enterprises with 10 or more employees operating in sectors B – C – D – E – G46 – H – J – K – M71–73.

[4] *Community Innovation Survey 2022*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Community_Innovation_Survey_2020_-_key_indicators&oldid=581743. (Last update: November 2024.) Downloaded: 21 January 2025.

Let us first examine the macro-level effects. Despite the fact that the share of innovative enterprises in Hungary is 30.2 per cent (in the period of 2020–2022), innovative enterprises account for:

- 64.7 per cent of the value added of enterprises (in other words, the GDP generated by this business sector);
- 68.7 per cent of the net sales revenue of export sales;
- 64.4 per cent of the net sales revenue; and
- 54 per cent of the number of employees.

Figure 2
Performance of innovative companies (2022)



Note: Data estimated using experimental methodology.

Source: HCSO

Breaking down these results by company, we find the following:

- *Innovative enterprises produce 58 per cent more value added per person on average, i.e. that much they are more productive than non-innovative enterprises.* Moreover, this is true for all size categories, i.e. not only for large – mainly foreign-owned – companies but also for – typically Hungarian-owned – small and medium-sized enterprises, where productivity is 25 per cent higher in the case of innovative firms.
- *Innovative enterprises have significantly higher employment* both in the case of SMEs and large *enterprises*.
- However, innovative companies are not only more productive and employ more people, but they also *pay significantly higher (31 per cent more) wages to their employees*. Moreover, *they export 90 per cent more* on average.

It is therefore reasonable to argue that strengthening the innovative business sector and increasing the number of innovative companies could make a significant contribution to the country's competitiveness – in terms of GDP, employment, wages and export capability – as innovation invariably has a positive impact on productivity (*Halpern 2020; Halpern – Muraközy 2010*)*.*

Now that we have explored the crucial role of innovative enterprises in Hungary's economic performance, we should examine how Hungary's business sector fares in terms of innovation activity.

4. Innovation activity in the Hungarian business sector

International innovation indices (such as the *Global Innovation Index* or the *European Innovation Scoreboard*) assess the innovation capabilities of countries in numerous dimensions (using around 80 and 32 indicators, respectively). While a detailed presentation of the indices falls beyond the scope of this paper, it should be noted that Hungary's innovation performance was ranked 36th in the world (*WIPO 2024:18*) and 21st in Europe in 2024 (*European Commission 2024a:3*) according to these indices.

The focus of our essay is on business innovation and its stimulation, and thus it is worth analysing the innovation willingness of the Hungarian business sector in more detail.

The individual segments of the Hungarian economy should be examined separately as an exporting medium-sized enterprise has completely different characteristics and needs a different type of support (as will be demonstrated later) than a micro-

enterprise or a startup. In the following, we analyse the main company segments as follows:

1) the MSME sector,[5] in particular Hungarian-owned (small-), medium-sized and large enterprises with or close to export potential,[6]

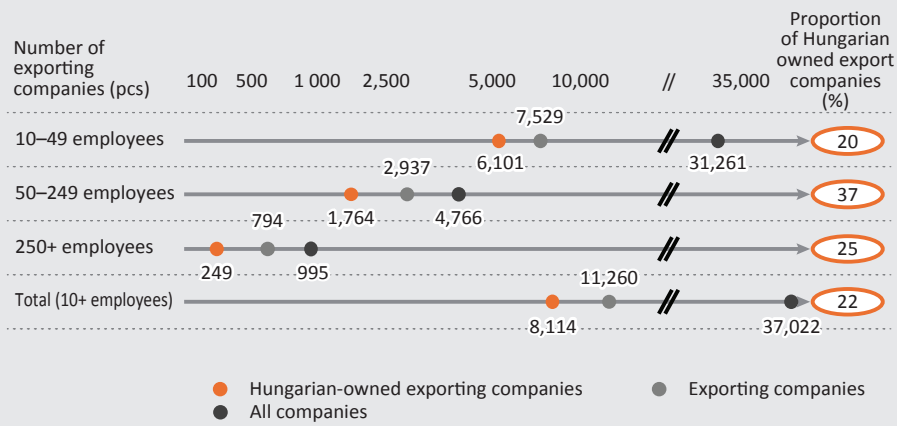
2) the innovative startup business sector.

4.1. Hungarian-owned companies with export potential and the MSME sector

How many companies are we talking about when we refer to the sector of Hungarian-owned small-, medium-sized and large companies with export potential?

Based on HCSO data for 2022, the total business sector[7] comprises around 37,000 companies with more than 10 employees (i.e. small, medium or large enterprises). Of these, just *over 11,000 (i.e. ~30 per cent) are engaged in exports, of which more than 8,000 enterprises are Hungarian-owned*. Of these, ~6,000 are small, ~1,800 are medium and ~250 are large enterprises (*Figure 3*).

Figure 3
Distribution of the number of exporting companies by size category and Hungarian ownership (2022)



Source: HCSO

[5] Micro-, small- and medium-sized enterprises.
[6] Based on their observations, *Halpern – Muraközy* (*2020*) suggested that innovation policy should treat Hungarian and foreign-owned firms differently.
[7] National economy sectors under review (TEÁOR'08): B-N, P-S, except S94.

An in-depth analysis of the data reveals that, while the share of Hungarian-owned companies is high among exporting small and medium-sized enterprises (80 and 60 per cent, respectively), *in terms of average sales revenue per company, foreign-owned companies have a significant advantage in these categories as well*: in the case of small enterprises, foreign-owned companies have a 6.1 times advantage and in the case of medium-sized enterprises they have a 4.8 times advantage on average in export sales revenue; consequently, the export sales revenue generating capability of Hungarian companies needs to be improved.

Looking at the data in an international comparison (*Table 1*), *at present Hungary has few exporting companies* proportional to its population: there are only 3,860 enterprises per million persons,[8] while the Austrian and Swedish corresponding examples indicate 4,700 – 5,200 enterprises, which means that considerably fewer companies enter the international markets from Hungary. There is also room for growth in terms of average export value, with Hungarian exporting firms earning around 30 per cent less from international sales as compared with companies of the benchmark countries. The lag is particularly noticeable in the case of SMEs (e.g. the average exports of medium-sized enterprises in Austria are nearly three times higher than in Hungary), but also the average export volume of Hungarian large companies is only about two-thirds of the same at Austrian and Swedish enterprises.

Table 1
Characteristics of exporting companies in 2022

	Average exports by enterprise category (EUR thousands)				Number of exporting companies per million persons
	Total	10–49 persons	50–249 persons	more than 250 persons	
HU	2,705	694	4,236	65,366	3,860
AT	4,052	1,493	11,343	100,275	5,192
SE	3,651	1,247	7,783	95,575	4,777

Note: Average exports: Export value/number of exporting companies (https://doi.org/10.2908/EXT_TEC01); calculated by population as at 1 January 2022 (https://ec.europa.eu/eurostat/web/interactive-publications/demography-2024#growing-population)

Source: Calculated based on Eurostat data

Not only the volume of sales, but also the value added of Hungarian exports lags behind the benchmark countries, especially compared to the performance of Austria and Sweden. In each country, the value added associated with the share of exports reflects the international competitiveness of the given economy and the innovation capacity linked to the quality of products. According to 2020 data, the value added

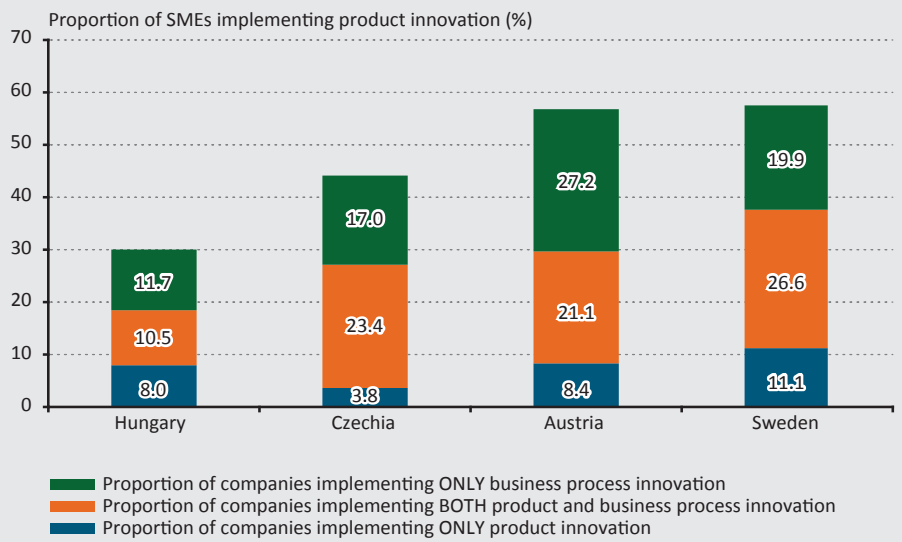
[8] It is important to note that all enterprises are included in these statistics, not the ones analysed earlier with more than 10 employees.

content of exports in Hungary is 55 per cent, while the corresponding figure is 62 per cent in Czechia, 70 per cent in Austria and 76 per cent in Sweden.[9]

Lower innovation activity is a key factor in the underperformance of Hungary's exporting business sector compared to the selected benchmark countries. Examining the Summary Innovation Index, *Halpern and Muraközy* (*2010*) found that Hungarian innovation activity, although similar to that of Slovakia and Poland between 2004 and 2008, was significantly lower than that of Czechia and the EU-27.

Nearly one-third of Hungarian enterprises (*30.2 per cent*) *are engaged in innovation activities*, far below the levels observed in Czechia (44.2 per cent) and Austria (56.7 per cent) (*Figure 4*). SMEs particularly lag behind in the area of business process innovation (discussed in more detail below): the Hungarian value is 21 per cent versus 39 per cent in Czechia and 50 per cent in Austria.

Figure 4
Proportion of active innovating enterprises in an international comparison (2022)



Source: Eurostat data (https://ec.europa.eu/eurostat/databrowser/view/inn_cis13_bas__custom_15555386/default/table?lang=en)

[9] Domestic value added in gross exports. https://data.oecd.org/trade/domestic-value-added-in-gross-exports.htm#indicator-chart. (Last update: 30 September 2020.) Downloaded: 21 January 2025.

Domestic companies are on par with the international benchmark countries in terms of product innovation: *Halpern and Muraközy* (*2010*) demonstrated for the period of 2004–2006 and *Katona* (*2021*) for the period of 2007–2017 that the innovation investments and developments of these companies are capable of becoming the engine of their own performance growth.

However, beyond product innovation alone, knowledge sharing, adaptation of modern technologies and process innovation are also of strategic importance for SMEs, which predominantly produce for the domestic market, as they play a key role in the productivity of companies and can reap additional benefits (*Gelei and Kenesei 2017; Katona 2021*).

Based on the country analysis of the European Commission's Report on the State of the Digital Decade 2024 (*European Commission 2024b, 2024c*):

- *52 per cent of* Hungarian *SMEs have basic digital skills* as opposed the EU average of 69 per cent;
- *only 7 per cent of SMEs use big data solutions* as opposed the EU average of 14 per cent;
- *only 21 per cent use cloud technologies* as opposed the EU average of 34 per cent; and
- *3 per cent of the enterprises use AI solutions* as opposed the EU average of 8 per cent.

These figures confirm that the SME sector's focus on adapting to the technological switch and therefore business process innovation is still limited.

Szoboszlai et al. (*2024*) demonstrated that the rapid growth observed among innovative firms was fuelled by improved technology, higher level of human resources, increased export intensity and access to venture capital. To increase competitiveness, it is therefore crucial to stimulate innovation and promote the international presence of domestic firms in order to enable Hungarian-owned enterprises to:

- increase the number of exporting companies;
- increase the sales revenues of exporting companies;
- achieve higher domestic value added in exports; and
- focus on the technological switch of micro and small enterprises through business process innovation.

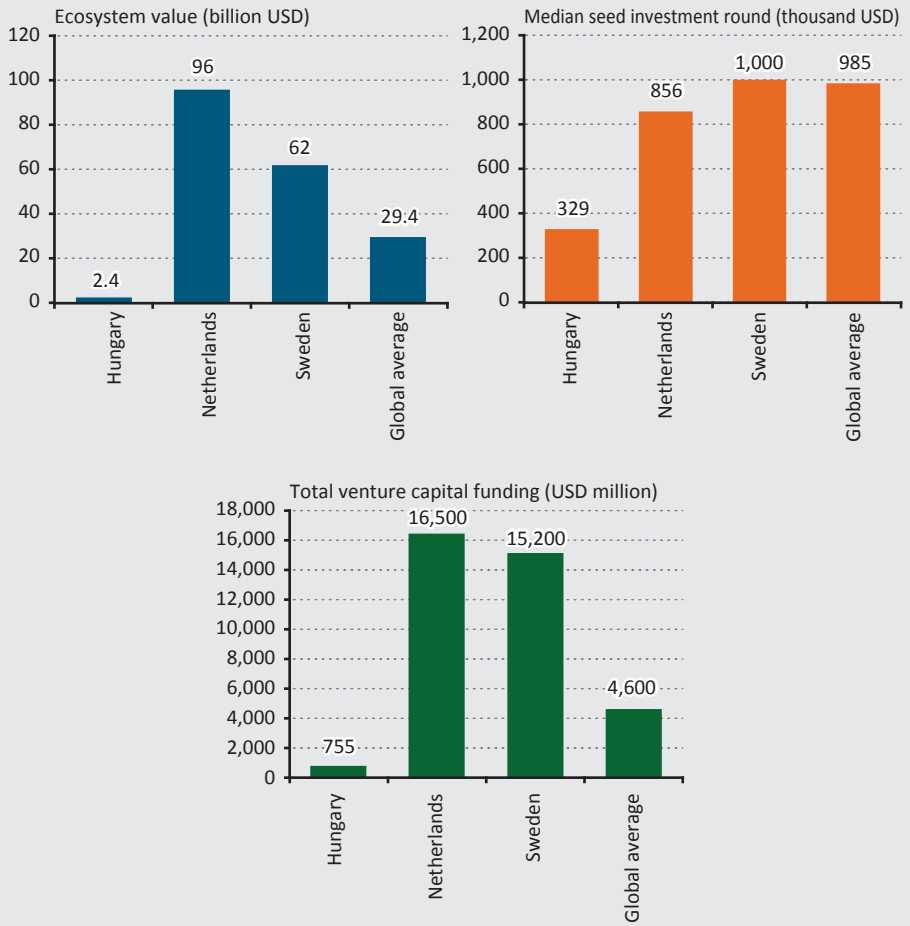
4.2. The innovative startup business sector

The Hungarian startup ecosystem is still significantly underdeveloped relative to the global average, as well as to the average of developed European countries of similar size. Based on data measured during the period 2021–2023, the *Startup Genome* (*2024*) report points out that:

- the *value of the ecosystem*, i.e. the consolidated value of the startups within the ecosystem, *is less than 10 per cent of the global average*, and compared to Sweden and the Netherlands the difference is 25 and 40 times, respectively;
- a threefold difference can be identified even for the median *seed investment rounds*;
- there *is also a significant gap in venture capital investment*: the Hungarian ecosystem lags behind the global average by a factor of six, and compared to the Swedish and Dutch ecosystems by a factor of 20 (*Figure 5*);
- the *number of business angels active in the ecosystem is low*: In Estonia it is around 165, in Austria around 250, while in Hungary barely a dozen angels are actively investing;
- *no new unicorns* (i.e. startups valued at more than USD 1 billion) were established in the period, compared to an average of 3 unicorns globally, 6 in the Netherlands and 7 in Sweden; and
- the *growth rate* (41 per cent) *of the ecosystem* has not reached the global average (48 per cent).

It follows from the above that, in the case of the startup ecosystem, policy needs to focus not only on increasing the number of startups, but also on their 'quality' improvement, including strengthening 'Deep Tech' startups that bring in-depth scientific results to the market, and on the available venture capital funding; in other words, comprehensive development is needed.

Figure 5
Selected indicators of the startup ecosystem in an international comparison (2023)



Source: Startup Genome (2024)

5. Financing innovation

It is difficult to measure innovation financing directly on its own; therefore, statistical offices apply international statistical standards, mainly R&D expenditure, as a proxy.

Based on the analysis of the structure of R&D funding in Hungary, the following conclusions can be drawn:

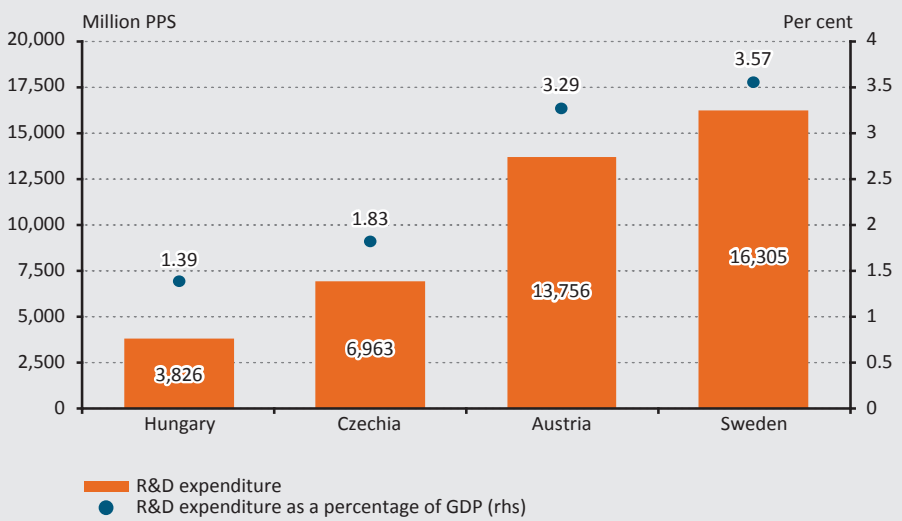
- The *ratio of Hungarian R&D expenditure to GDP* (1.39 per cent) remains below that of Czechia (1.83 per cent) and lags significantly behind Austria and Sweden (3.29 per cent and 3.57 per cent, respectively).

- The gap is even more significant in terms of *absolute expenditure* (in EUR millions), given the differences in GDP: *Hungary is more than 2 times behind Czechia and 5–7 times behind Austria and Sweden* (*Figure 6*). The costs incurred in research and innovation – such as research instruments, clinical trials (in life sciences) and labour costs – do not vary significantly between countries; consequently, the absolute figures are a better reflection of the differences in opportunities between the countries under review.

- The *share of public expenditure in total R&D is in line with international trends* (about one-third public and two-thirds market expenditure). It is important to note, however, that *foreign companies account for 62 per cent of corporate R&D expenditure*: in 2023, foreign R&D expenditure amounted to HUF 467.1 billion out of a total expenditure of HUF 757 billion.

- Although R&D expenditure *at universities* has increased significantly in recent years, *the proportion of resources devoted to applied research and experimental development is relatively low*: universities do not devote enough attention to the translation of research results into practical solutions, or to the valorisation and economic utilisation of applied research results.

Figure 6
Selected indicators of R&D expenditure in an international comparison (2023)



Note: provisional values.
Source: Eurostat (GERD by sector of performance. https://doi.org/10.2908/RD_E_GERDTOT)

Based on the above data, the following conclusions can be drawn:

- Hungary *needs to increase its R&D spending significantly,* both in absolute terms and as a share of GDP.
- *Today,* the *Hungarian-owned corporate sector spends little on research, development and innovation; there is a need to incentivise* both SMEs and large companies in this aspect.
- *Applied research expenditure at universities and research institutions needs to be increased further* in order to ensure that more research results are commercialised, e.g. through the establishment of spin-off companies.

6. The importance of state involvement in the market-driven development of innovation

6.1. Principles and intervention channels

In our view, *promoting innovation should be a market-driven process*. This means that the long-term goal is to create an ecosystem that is self-sustaining on a market basis; in other words, where a large number of adults are open to entrepreneurship, have market-viable, innovative ideas and can find the professional support and financial funding that is relevant to them at the time.

However, *international good practices* reveal that in all innovation ecosystems that are now considered advanced (such as Israel, Sweden, Singapore or South Korea), *the state played a significant role* in R&D and innovation expenditures, in setting up funding and supporting instruments and in formulating the regulatory environment. This primarily implies the following tasks:

1) education–training–knowledge provision,

2) organisational–structural,

3) regulatory and taxation, and

4) funding.

Channelling market perspectives into policy making is essential for successful innovation policy, which is why NIÜ has launched the *Startup Roundtable*, which brings together the key players in the startup and innovation ecosystem: startups, business angels and venture capital organisations, incubators and other stakeholders and opinion leaders in the ecosystem.

6.2. Target groups and strategic objectives of intervention by the state in the field of business innovation

In order to boost the innovation activity of the Hungarian corporate sector and the performance of the startup ecosystem above the European average, we have identified the following business segments to be developed and targets to be met by 2030:

1) On the one hand, it is necessary to focus on *developing and strengthening the export capacity of Hungarian-owned small, medium-sized and large enterprises operating in traditional, mature but innovation-driven industries* (e.g. food industry and production, health industry). Strengthening the innovation capacity of these companies will contribute to creating a stable, internationally competitive domestic industrial base and support them in adapting to global technology trends, thus improving the competitiveness and export capacity of the national economy. *Particular emphasis should be placed on 'champion' companies in this sector*, i.e. those which have demonstrated the fastest growth and innovation activity in recent years.

   Objective: The sector of exporting Hungarian-owned small, medium and large enterprises should be bolstered; the number and value added of exporting Hungarian-owned companies should be increased through new innovative products, technologies and services introduced to the market.

2) On the other hand, there is a need to focus *on innovative startups and technology startups, in particular, Deep Tech*[10] *companies* with high growth potential and innovative solutions. These firms are able to bring radical technological innovations that can compete not only on domestic market but also on international markets, contributing significantly to economic growth (*Botelho et al. 2021*).

   Objective: The performance of the Hungarian startup ecosystem should reach the global average, and 30–50 Deep Tech startups should be established every year.

3) Thirdly, there is also a need to focus on *micro and small enterprises addressing the issue of technical adaptation, i.e. implementing business process innovations*, e.g. by modernising their production technology, business model or logistics system.

   Objective: It should be achieved that one in two (50 per cent) Hungarian SMEs is engaged in innovation. In this context, the share of small businesses introducing

[10] Deep Tech companies, which are part of the startup ecosystem, are characterised by 5 key factors: (1) focus on new scientific and/or technical breakthroughs or on solving major societal challenges (academic background); (2) global scope; (3) high R&D intensity; (4) founders have high expertise in their field; and (5) significant funding needs.

innovation should rise from the current 26.6 per cent to 50 per cent, and the share of SMEs carrying out business process innovation should reach at least 40 per cent.

In the following, we present policy ideas and instruments aimed at the development of each business segment.

6.3. Bolstering the sector of Hungarian-owned small, medium-sized and large enterprises with export potential

As described above, the sector, which comprises around 8,000 companies, is characterised by low innovation activity (30.2 per cent) and relatively low value added and export revenue generation capacity. In terms of policy measures, special attention should be paid to the sector's outstanding 'champion' companies, the role of which is discussed in more detail below.

Ónodi and Répáczky (*2022*) found a significant correlation between managers' openness to innovation and successful corporate innovation. While this kind of openness of the leaders depends on personality traits, it can also be improved in a conscious, targeted manner through leadership training. In line with these findings, the most important reasons for the low innovation ambition and willingness of domestically-owned enterprises can be summarised below, based on our own experience:

- At many SMEs, management does not have a high level of English language skills and international market experience. This limits their ability to follow technical and managerial developments on the international stage and to compete at that level.
- The owners of firms in today's mature industries typically have a specialist background, and no or limited business skills, which limits their ability to organise their organisational processes and structure effectively beyond a certain point and size.
- Due to the distance between academia and industry, a large number of Hungarian-owned businesses do not have links with higher education institutions and research institutes, and are unable to effectively connect to the academic infrastructure, available services and collaboration opportunities. Today, only 11 per cent of innovative SMEs collaborate with universities and 3 per cent with research institutes.
- Innovation requires a great deal of managerial attention, as strategic management decisions and organisational culture have a significant impact on the effectiveness of innovation. However, this temporarily diverts resources from the main activity, while the results are perceivable only over the medium to long term. As a result,

innovation is often not a top priority for companies and encounters organisational resistance.

Based on the above analysis of the situation, in the case of these enterprises, policy should focus on the following tasks:

- education–training–knowledge:
  - disseminating and promoting innovation insights and highlighting the importance of innovation;
  - providing specialist assistance to businesses in terms of technology and market insights;
  - facilitating connections to universities and research institutes;
  - developing export capacity, strengthening international trade relations.

- regulation and taxation:
  - raising awareness among businesses about existing tax incentives.

- financing:
  - establishing connections with universities and research institutes for joint product and technology development.

The first step is to focus on *increasing the willingness and ambition to innovate* through various evangelisation[11] and education programmes. It is important for businesses to recognise that innovation is not an end in itself, but a strategic tool that gives them the opportunity to increase profits, boost revenues and operate more efficiently.[12] Intervention by the state may help these companies to become better equipped to identify and implement innovation opportunities. *This is the goal of the Hungarian Innovation Agency's (NIÜ) education and knowledge transfer programmes*: it is deemed a success that in 2024, nearly 1,000 companies participated in the NIÜ's business process innovation training, the majority of which had not previously been engaged in innovation.

In addition to the knowledge transfer programmes, *in 2024 the NIÜ launched its free innovation project development service*, whereby external experts (market and science/technology) are available to companies to assess not only their innovation development ideas but also the innovation readiness of the whole company, and to formulate proposals for their further development. This type of support can help companies to successfully identify areas where innovation can bring real value added, thereby laying the foundations for their long-term competitiveness.

[11] For the purposes of this paper the term 'evangelisation' refers to a set of active programmes and communication campaigns aimed at shaping attitudes.

[12] Analysing a sample of firms in the Central and Eastern European region, *Bistrova et al.* (*2017*) demonstrate that 1) the highest share of intangible assets is associated with the most profitable firms; and 2) regressions on return on equity, gross profitability and net profitability indicate that the increasing financial performance of the sample of firms is associated with the increase in the share of intangible assets.

Connecting with universities and research institutes takes place at two levels: education and training on the one hand, and research and innovation on the other. In education, cooperation can be implemented through internships, participation in dual training, cooperative doctoral training or the establishment of a corporate department. In research and innovation, cooperation can start by identifying topics for a corporate thesis or research paper, using university research services or joint development.

In order to encourage cooperation between the business sector and the sector of universities–research institutes, the *National Research, Development and Innovation Office (NRDI Office) has implemented the University-Business Ecosystem Platform (EVOP)* and its first module, Kooper. EVOP is intended to provide a single, transparent platform for companies, opening a window for them on the entire higher education and research sector.

Foreign market entry and embeddedness is facilitated by *the NIÜ's XPAND programme*, which involves a three-step process whereby NIÜ experts not only prepare companies to export and enter the relevant foreign market, but also support the best prepared companies to participate in the most important technology and innovation fairs in the selected target markets, with a number of relevant partner meetings organised on site. In 2024, the programme assisted more than 50 Hungarian SMEs with entering foreign markets.

The Hungarian *tax regime* provides *opportunities to* encourage research and innovation, but *only a small proportion of companies take advantage of them* (typically only 300–500 companies per year, while the number of companies involved in R&D has ranged between 1,700 and 2,100 in recent years).

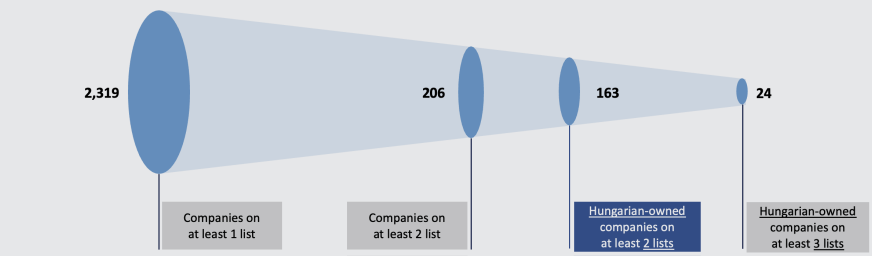
Product and technology development in cooperation with universities and research institutes is a key focus of policy and the NRDI Office, which is why the *SME Focus Area Innovation Programme* and the *Large Company Focus Area Innovation Programme*, announced for the first time in 2024, aim to encourage cooperation through non-refundable grants, typically with a 50–70-per cent funding intensity. In return for the grant, the funder expects three things: 1) a new product, technology or service should be created; 2) the company should protect the result of the development – primarily by means of a patent; 3) the developed product should generate sales revenue already in the short term, primarily on foreign markets. Co-financed projects enable companies to carry out major development projects with less risk, while stabilising their market position and maintaining their growth and profitability in the long term. For this purpose, in 2024 HUF 110 billion was allocated to SMEs and HUF 15 billion to large companies, and the funding schemes are also available in 2025.

As indicated above, particular attention should be paid to the targeted development of champions in the exporting Hungarian business sector. Based on the corporate analyses prepared by various Hungarian analyst firms (*Figure 7 and 8*), in recent years *163 Hungarian companies* have been identified with the greatest development potential*: they are the outstanding small and medium-sized exporting companies that may emerge as the national champions of the future.*

Figure 7
Hungarian-owned companies with the greatest potential

We compared 4 corporate ranking to determine which Hungarian owned companies have the biggest market potential

No.	Company list	Creator (source)	Number of companies	Criteria for selection
1	MNB IDE	Magyar Nemzeti Bank (based on Opten)	1,134	▪ Innovative (IP, R&D) + fast growing (20+%/year) (2016–2019)
2	Macronomic Winners of the decade	Macronomic Institute (based on Opten)	829	▪ Featured industry + rapid growth + export (2017–2021)
3	BSE 50	Budapest Stock Exchange (own data)	246	▪ Medium-sized companies with a stable market position (2018–2023)
4	Horizon winners	Horizon (CORDIS database)	278	▪ Companies receiving innovation funding in the Horizon 2020 program
+1	NRDI Office supported	NRDI Office (NRDI Fund grants)	-	▪ Companies receiving grant from the NRDI Office in the last 6 years
+2	EDIOP RDI supported	EDIOP Managing Authority (EUPR)	-	▪ Companies receiving grant from EDIOP RDI funds in the last 6 years

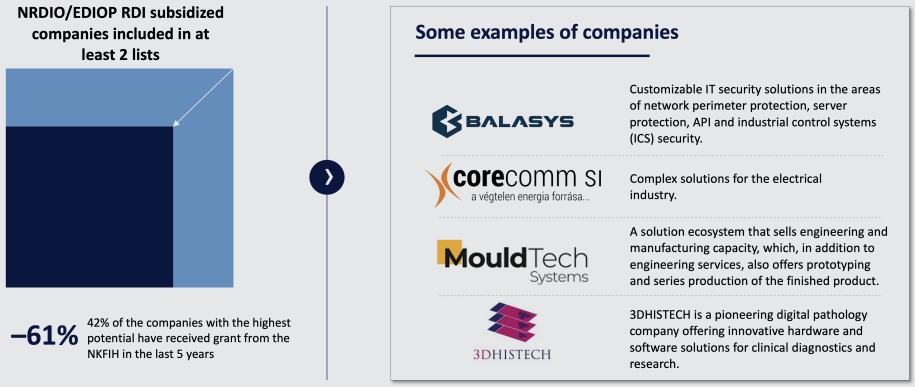


	Companies on at least 1 list	Companies on at least 2 list	Hungarian-owned companies on at least 2 lists	Hungarian-owned companies on at least 3 lists
Number of employees (2023) (persons)		12,813	8,246	1,256
Revenue (2023) (HUF billion)		14,503	6,133	176.5
CAGR (2019–2023) (%) (average)		15.0	12.8	12.2

Source: KIM–NRDI Office–NIÜ

Of the 163 enterprises, *61 per cent have received R&D funding in* the last six years, indicating that the policy was successful in identifying enterprises with the greatest potential in the application process. The objective is to address these companies with proactive means to help them move forward and gain international prominence.

Figure 8
Funding rate and exemplary Hungarian-owned companies



Source: KIM–NRDI Office–NIÜ

6.4. Building up the startup and Deep Tech sector

In the case of the startup innovative enterprise sector, we believe that stronger state involvement is advisable compared to the previously described Hungarian-owned exporting companies. Indeed, as we have shown, Hungary has not yet developed and reinforced a startup and Deep Tech ecosystem by international standards. Thus, interventions by the state are intended to increase the number of startups and facilitate their rapid growth so that they become competitive (large) companies even in the international markets, in line with the approaches suggested by *Havas et al.* (*2023*), namely, ensuring a skilled workforce, appropriate entrepreneurial culture and knowledge sharing.

6.4.1. Education–training–knowledge provision

The *first phase of support is 'evangelisation' and education*: this ensures that the founders of innovative technology companies acquire the skills they need to grow fast and develop a healthy ambition.

Young people open to founding a startup face the following challenges:

- At present, most Hungarian founders lack ambition and thinking on an international scale. Risk aversion is high (which is not specific to Hungary: it is a challenge at the European level), exacerbated by several factors. Firstly, the acceptance level of failure is low: failure is often not seen as part of progress and learning, which discourages risk-taking.

- This is exaggerated further by the low level of savings, which results in a shorter 'personal runway.' Founders typically do not have sufficient financial reserves to sustain a risky business for years while also providing for their own livelihood. The same is true for the group known in the literature as *'friends, family and fools (FFF),'* whose members play an important funding role in the pre-seed stage of startups in developed ecosystems.

- The relatively young age of the Hungarian market economy, with a market environment that has existed for only 35 years, also contributes to the lack of entrepreneurial skills, which are typically not part of a multi-generational tradition. *Csákné Filep et al.* (*2020*) pointed out that Hungarian and international research ascribed an important role to the entrepreneurial skills acquired during the years of education in the success of startups.

The development of evangelisation and education is critical for stable, long-term results, but it is an activity that takes far too long to yield a market profit if any at all; therefore, the state has a key role to play at this stage. Consistency and continuity in these programmes are very important, as supporting a change in culture and the acquisition of basic skills requires continuous presence and communication.

With this in mind, the *Hungarian Startup University Programme* (HSUP), the flagship programme of the NIÜ, was launched almost 5 years ago and is constantly enhanced and relaunched year after year. The two-semester higher education programme has so far reached nearly 20,000 university students and has already resulted in numerous market-tested startups. The NIÜ's goal is to extend the programme to secondary school students in the coming years.

In addition to higher education students and secondary school students, the education of researchers is also of strategic importance, as they can become the founders, co-founders and technology leaders of internationally significant Deep Tech companies. This is why the NIÜ is launching the *Pathway to Business* programme this year, which in the first pilot year will give 20–25 doctoral and postdoctoral researchers from six higher education institutions the opportunity to work on bringing their research results to market in the framework of a one-year *sabbatical*, with subsistence and material costs covered.

6.4.2. Organisational–structural tasks

In addition to training programmes, it is the duty of the state to develop and bolster technology transfer processes in universities and research institutions. Experience shows that over the last 15–20 years, there have been many initiatives to build up these capabilities in universities, but none of them have been able to provide a long-term solution. It has been seen that, after the phase-out of a targeted funding

programme, the technology transfer offices reduce human resource capacities or do not focus on these activities as they should.

To address this issue, the *Technology Transfer Company (TTC)* project was launched at the end of 2023 to analyse the most successful university and research institute technology transfer models in the world, and to outline a model for Hungarian universities and research institutes that, based on experience, can most effectively and efficiently support the commercialisation of research results. In the first year, these companies were set up in the 100-per cent ownership of five higher education institutions, and this year's objective is to support the establishment of additional new TTCs. The TTCs are established by the institutions themselves, while state involvement is limited to the provision of continuous professional support from a dedicated directorate of the NIÜ.

6.4.3. Regulatory and taxation tasks

One of the key policy challenges is to create a regulatory environment for innovative startups that does not restrict, but rather supports them in successfully bringing their innovations to the (external) market. However, these regulatory challenges typically manifest themselves in everyday life. This is why NIÜ organised the Startup Roundtable in conjunction with participants of the startup and investor ecosystem to discuss and analyse these regulatory issues among others. Several achievements have been registered in this field in the last year and a half. Firstly, by creating the possibility of *Convertible Note*[13] financing in the summer of 2023, based on international (mainly US) examples, and subsequently, in the autumn of 2023, by addressing the tax challenges encountered in the application of the *Employee Stock Ownership Plan* (*ESOP*)[14] through regulation. In the autumn of 2024, another important step was *the introduction of a tax exemption for the in-kind transfer of intellectual property rights,* in conjunction with the stakeholders of the ecosystem. While these issues do not promote the startup ecosystem in and of themselves, they may act as a barrier to the development of the ecosystem, and their elimination is a common interest.

In addition to regulatory issues, it is a key objective that *tax measures* should also support – primarily – *the financing of early-stage startups*: based on international best practices, it would be reasonable to introduce in Hungary, as well, *a tax credit for business angels*, and focus should also be placed on *encouraging venture capital investments* in early-stage financing.

[13] A loan that can be converted to equity: an internationally widespread early-stage funding framework that enables startups to raise investment funds from incubators and individuals quickly and easily.

[14] A regulatory framework where key employees can share in the success of the company through stock options to maintain long-term motivation, whereby the tax on the increase in wealth from the shares is only payable after the liquidation event.

6.4.4. Funding tasks

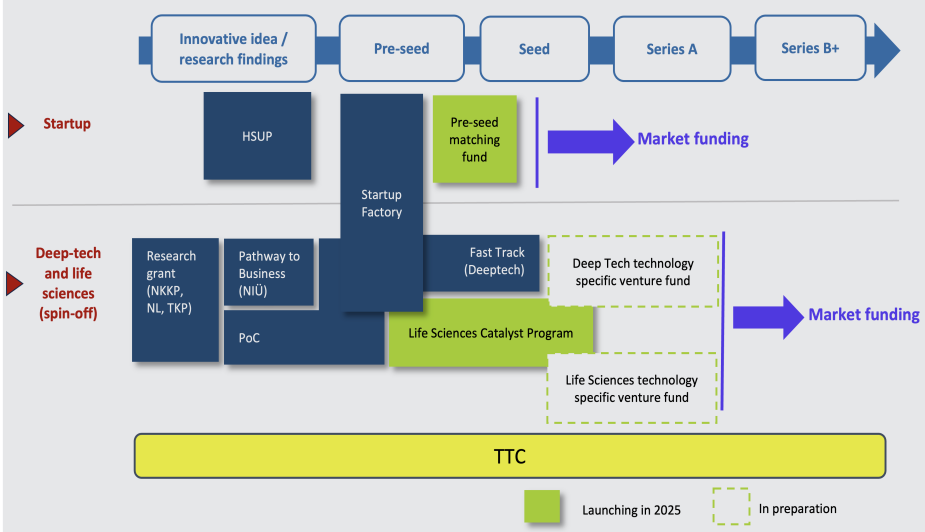
At present, the availability of early-stage funding in Hungary is limited, especially for pre-revenue enterprises. The reasons for this are the following:

- low savings and limited availability of FFF funding;
- scarcity of local angel investors;
- conservative institutional venture capital, which is also typical at the European level; and
- limited availability of tender schemes for early-stage firms.

State involvement in activating early financing is important, but it is not always ideal as direct financing. *Karsai* (*2022*) also stresses that public funds are unable to fully observe market considerations, and available funding is often allocated in a sub-optimal way, which is not sustainable in the long run.

Over the past two years, a funding structure for research and innovation has been established under the leadership of the NRDI Office (*Figure 9*), which supports the development of startups and Deep Tech companies from the birth of an innovative idea or research result through the various startup stages. *In all cases, it does so with the logic of market financing in mind, enforcing this as much as possible within the public framework.*

Figure 9
Research and innovation funding structure



Source: KIM–NRDI Office–NIÜ

The startup ecosystem

Beyond market initiatives, the development of the startup ecosystem will start with the HSUP programme, which is expected to generate a range of innovative ideas and startups. In order to strengthen Hungarian *incubators*, which play a key role in the early stage of startups even in developed ecosystems, the *Startup Factory programme* was launched for the fourth time in 2023, with the NRDI Office providing non-refundable grants to ten market incubators to incubate Hungarian startups.

To address pre-seed financing challenges, in consultation with market actors, the NRDIO is to launch a *pre-seed matching fund* (a venture capital fund), co-investing with market investors at 50 per cent, funded from the 2025 Programme Strategy. The fund does not make investment decisions on its own; its role is to invest in startups when there is a market lead, thus reducing the risk for the market investor (business angel, VC). In view of the problems of public funds, as mentioned by *Karsai* (*2022*), the fund will be managed by a market capital fund manager, selected through a public procurement process, so that the fund will be able to invest strictly on a market basis (not in the form of a state aid), which is significantly simpler and more manageable for startups than the funds provided under previous capital schemes funded by the state.

According to the professional view formulated on the basis of academic analyses (e.g. *Karsai 2022*), the Seed funding rounds should already be provided by market (domestic and international) investors for the startups, which means that the state's role in financing should end at this point, as a general rule.

The Deep Tech ecosystem

As a technical clarification, we wish to add that for the purposes of this essay, Deep Tech companies also include technology companies operating in the Life Sciences area (*pharma, biotech, medtech, healthtech*), because they share many of the characteristics of Deep Tech companies. However, the literature and some analyst firms typically separate these two areas, due to the different characteristics of their market entry, and we do the same in this chapter.

Deep Tech companies are typically based on a research insight resulting from a research project and take this scientific breakthrough to market in the form of products and technologies. In recent years – for the lack of space we will not go into detail – the NRDI Office has significantly reformed the system of excellence-based research funding under the supervision of the Research Council of Hungary, resulting in the establishment of the *National Research Excellence Programme* (*NKKP*) to replace the former Hungarian Scientific Research Fund (OTKA). *The budget for the NKKP has increased significantly* (from HUF 13 billion in 2023 to HUF 40

billion)*, and further increase is targeted.* Under the programme, around 250–300 high quality science research projects are launched every year, some of which can be subsequently nudged towards innovation. In addition to the research excellence programmes, numerous thematic research programmes (*National Laboratories, Thematic Excellence Programmes*) have been launched at the institutional level in recent years, which are also producing research results that can be consistently driven towards innovation.

The primary task of the TTCs is to identify these innovative research results in universities and research institutes and to finance their technological and market validation from their *Proof of Concept* funds, established in the framework of a programme launched in 2023.

One relatively new element in the funding system is the *Fast Track* Programme, which is intended to facilitate the market uptake of research results. The programme provides HUF 100–300 million in non-refundable pre-seed funding to existing Deep Tech companies. From 2025, life sciences will be separated from the Fast Track Programme and replaced by dedicated calls under the *Life Sciences Catalyst* Programme, tailored to the specificities of the field. It is important to note that *translational activities require significantly higher (public) investments* (especially in deep technology areas) than other (fundamental) research activities: in the field of medical biotechnology, for example, bringing a laboratory-validated medicinal product candidate to the end of Phase 1 of the clinical trials can take around HUF 1.5–2 billion. *Due to the high costs involved, many of the promising research projects do not have the opportunity to be utilised*.

The next step in the financing process needs to be provided by venture capital (VC) funds. As already mentioned, resources available in the domestic VC market are scarce; this is why the Ministry of Culture and Innovation intends to launch, with the planned use of EDIOP[15] Plus funds, *technology-specific venture capital funds*, which will make investments along the lines of market principles, under the guidance of market capital fund managers. This is where *Series A* investment rounds come into play, which are investments that venture capital funds are meant to provide, strictly on a market basis.

6.5. Strengthening the innovation activity of micro and small enterprises

As already discussed, the innovation activity of micro and small enterprises is low, due to two factors: 1) the lack of information available (why innovation is worthwhile); and 2) funding challenges that are even more acute in this particular sector.

[15] Economic Development and Innovation Operational Programme

Without repeating the contents of *Section 6.3*, let us only refer to the NIÜ's innovation training service, which concerns the tasks of education–training–knowledge provision.

In addition, for the first time in 2024 a dedicated *business process innovation call* (GINOP Plus 2.1.3-2024) was launched with a budget of HUF 75 billion for micro and small enterprises. Under this programme, the enterprises concerned can apply for a grant of HUF 20–50 million with a funding intensity of 70 per cent to switch technology and modernise their production, business model, logistics or marketing processes. The programme will reach more than 2,000 enterprises/entrepreneurs that have not previously been involved in innovation, which may in itself significantly increase the share of innovative SMEs. One important objective is to maintain these types of support programmes over the long-term in a predictable manner.

7. Summary

While the government has made numerous achievements in strengthening the R&D and innovation ecosystem over the past decade, there is still considerable room for further improvement, as we have seen in comparison with benchmark countries of a similar size. In the next decade, boosting productivity will be one of the key pillars of sustainable growth for the Hungarian economy, and R&D and innovation will play a major role in achieving this goal. Based on CIS data, our paper demonstrates that innovating companies outperform non-innovators in terms of productivity, size, value added and exports, and that it is essential further to increase the number of such companies to achieve the objectives of the national economy.

Based on international experience, in successful innovation ecosystems such as Israel, Sweden, Singapore and South Korea, the state has taken an active role in increasing R&D spending, developing financing instruments to stimulate innovation and improving the regulatory environment. In the long term, however, the objective is to create a market-driven system that stimulates innovation in a self-sustaining way.

The innovation policy objective for the coming years is to make significant progress along the lines of the above principle in three priority segments:

1. *Increasing the number and value added of exporting Hungarian companies* by bringing new innovative products, technologies and services to the market.
2. *Supporting innovative startups and tech firms,* especially Deep Tech companies with high growth potential and innovative solutions. The goal is to grow these enterprises both in terms of their number and market value.

3. Encouraging the technological development of domestic small and medium-sized enterprises and increasing the share of innovative SMEs to 50 per cent.

By focusing resources invested in innovation with these three objectives in mind, we can build a solid foundation not only for the competitiveness of the companies, but also for the long-term growth of the Hungarian economy.

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The Connection between Institutions and Economic Development – the Work of the 2024 Nobel Laureates in Economics*

István Kónya

In 2024, the Nobel Prize in Economic Sciences was shared between Daron Acemoglu, Simon Johnson and James Robinson for their research on 'the formation of institutions and their impact on development'. One fundamental question in economics is why different countries have reached radically different levels of development. It is now generally accepted that the role of the institutions that regulate the functioning of the economic and political system is pivotal in this issue. The laureates made a huge step forward in exploring the causal link between institutions and economic development. They convincingly demonstrated that the adequate protection of property rights had a substantial positive impact on long-term economic development. Another key scientific achievement of the researchers was the endogenisation of the formation and evolution of institutions. The research programme of Acemoglu and Robinson shed light on why and under what circumstances policymakers choose institutions that help (or hinder) economic development.

Journal of Economic Literature (JEL) codes: O11, O47, P14, P16

Keywords: Nobel Prize, development economics, institutions

1. Introduction

In 2024, the Nobel Prize in Economics was shared between Daron Acemoglu, Simon Johnson and James Robinson for their research on 'the formation of institutions and their impact on development'.[1] This was not the first time that the role of institutions in the inequalities between countries had been emphasised, and the 2024 laureates were not the first to be associated with this idea. At the same time,

* 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] This paper relies heavily on the official publication detailing the scientific work of the laureates, which was published when the prize was awarded (*Nobel 2024*).

they played a major role in two important issues that were previously difficult to examine using economic methods.

The ultimate subject of economic analysis is the individual. The study of income and social inequalities also focuses on the individual. However, as the Nobel Prize committee's factsheet also notes, differences in development between countries account for about two-thirds of global income inequality between individuals:

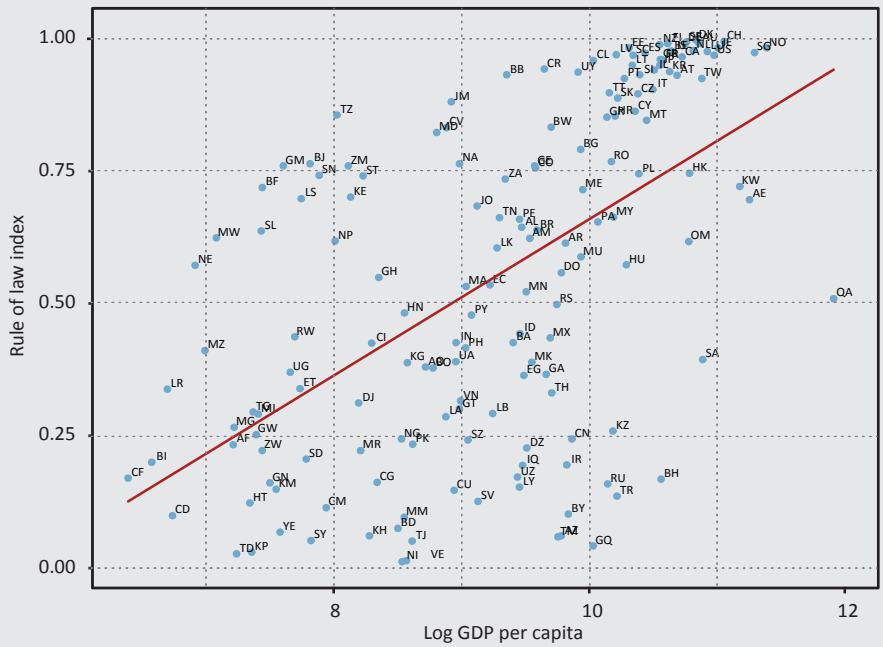
The poorest 50 percent of the global population earns less than a tenth of total income and owns just 2 percent of total net wealth. This inequality is primarily driven by disparities between countries, which contribute to approximately two-thirds of global income inequality. (Nobel 2024: 1)

The scarcity of macroeconomic data and the ubiquitous interdependencies (endogeneity) make it particularly difficult to identify the causal relationship between institutions and development. Using innovative data and econometric methodology, Acemoglu, Johnson and Robinson convincingly demonstrated that one fundamental feature of market economies – the effective protection of property rights – had a positive impact on long-term economic development. Although certain details of the methodology are disputable, the main conclusion is soundly argued and the research programme can be considered groundbreaking.

Another fundamental question is why, if there are better and worse institutions in terms of development, certain countries choose the latter, why bad institutions can persist, and under what circumstances they may change for the better. Two of the laureates, Acemoglu and Robinson, provided substantive answers to these dilemmas in joint articles and in articles co-authored with others. To do this, they used dynamic games, a methodological tool of game theory. Their theoretical work and related empirical articles established a new branch of literature that has now expanded significantly.

Why is it important to examine economic development? What are the 'institutions' that may help us understand differences in development? What recommendations can a researcher studying these issues offer to policymakers? These are perhaps the most fundamental questions in economics, to which there are no comprehensive and reassuring answers. However, the work of the laureates has provided important tools and methods to address the questions raised, in a meaningful way.

Figure 1
Rule of law and economic development



Note: The horizontal axis indicates the logarithm of GDP per capita at purchasing power parity in 2022, while the vertical axis indicates the rule of law index for 2022 of the V-Dem project 2024.

Source: Maddison database (https://www.rug.nl/ggdc/historicaldevelopment/maddison/releases/maddison-project-database-2023?lang=en)[2] and V-Dem database[3] (https://v-dem.net/data/the-v-dem-dataset/)

The outline of the problem is illustrated in *Figure 1.* In the figure, each observation represents an individual country. The horizontal axis shows the logarithm of the country's GDP per capita measured in purchasing power parity, while the vertical axis is the V-Dem 2024 rule of law index for 2022 (higher values indicate stronger rule of law). The index takes into account factors such as a government's respect for the law, the independence of the judiciary, the ease of access to justice, the level of corruption and the impartiality of the bureaucracy. The red line is a simple

[2] For the most recent estimates, see *Bolt and Van Zanden* (*2024*).
[3] *Pemstein et al.* (*2024*).

regression line applied to the scatter plot, which measures the strength of the cross-sectional relationship between the two indicators.[4]

Even though the correlation is not particularly strong, there is a clear positive relationship between the degree of the rule of law and the level of development. It is particularly interesting to note that the most developed nations have a consistently high rule of law index.[5,6] Clearly, the conclusion is that developed economies cannot exist without the rule of law. At the same time, unsurprisingly, the opposite is not true, since economic development may depend on many other factors.

Naturally, *Figure 1* shows correlation, not causation. It is possible that the establishment of the rule of law will, in time, lead to economic development, or at least be a precondition for it. On the other hand, reverse causality is also possible – sufficiently wealthy societies can afford the 'luxury' of the rule of law. The socio-political reasons for this latter effect may be manifold. The joint research programme of the recent Nobel Prize laureates focused on the former direction, i.e. the causal impact of institutions on growth. The latter possibility, i.e. bidirectional causality, was analysed by Acemoglu and Robinson in several studies. We will discuss these possibilities in detail later, but first we briefly outline the careers of the 2024 laureates.

Daron Acemoglu is a professor at the Massachusetts Institute of Technology (MIT), where he has been researching and teaching since 1993. He grew up in Turkey and received his PhD from the London School of Economics in 1992. His main research interests include economic growth, political economy, income inequality and technological change. He is a leading exponent of the 'new institutional economics' school. In addition to his Nobel Prize-winning work, he has made seminal contributions to the fields of economic growth, the labour market implications of robotisation, business cycles and inter-industry linkages, technological progress and income inequality research.

Simon Johnson is a professor at the MIT Sloan School of Management. He was born and educated in the UK and holds a PhD from MIT. His main areas of research are political economy and development economics, and his experience in these fields was put to practical use as Chief Economist at the International Monetary Fund between 2007 and 2008. He is also active in the research areas of economic development, public health and the transition to a market economy.

[4] The rule of law indicator shown is one – not necessarily the best one – of the metrics that can be used for measuring the most important institutions in terms of development. I have opted to include it here as an illustration because of its easy availability.
[5] The only partial exceptions are the countries of the Persian Gulf, rich in oil and gas.
[6] Because of the logarithmic scale of GDP per capita, advanced economies are horizontally concentrated relative to low-income countries.

James Robinson is a professor at the University of Chicago, where he has been teaching and researching since 2015. He grew up in the UK and holds a PhD from Yale University. His main research interests are political economy and development economics. In addition to his academic articles, he is the co-author with Acemoglu of the internationally acclaimed and influential book 'Why Nations Fail' (*Acemoglu* and *Robinson 2012*). In addition to his Nobel Prize-winning work, he has carried out detailed studies of the economies of Africa and Latin America, both through economic history and field research.

Table 1
Science metrics for the winners of the 2024 Nobel Prize in Economics

	Daron Acemoglu	Simon Johnson	James Robinson
Publications	291	77	112
References	63,596	25,932	27,723
H-Index	112	35	50

Note: Data accessed on 21 February 2025.
Source: scopus.com

Judging from their impressive careers and scientific impact, it cannot be disputed that the laureates truly deserved winning the Nobel Prize. Their seminal work has had enormous impact on academia, on wider economic policy and on public discourse (*Table 1*).

2. Scientific work

Among the wide-ranging research activities of the three laureates, the Nobel Prize committee highlighted two areas. The first was the empirical evidence for the causal impact of institutions on development, and the second was the drivers of institutional choice and change among political elites. In the following, I briefly describe these two areas.

Before going into the details, however, it is worth touching on what the laureates mean by 'institutions'. While it is difficult to provide a precise definition, Douglas North defined the term in his survey article as follows:

Institutions are the humanly devised constraints that structure political, economic, and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, laws, property rights). [North 1991: 1 (Abstract)]

In their actual research, Acemoglu, Johnson and Robinson use the concept of institutions much more narrowly. In their theoretical work, they focus primarily on the political system, with the redistribution of income (and its limits) by political

elites at the centre of their analysis. In their empirical studies, they use a practical metric of redistribution, which is the probability of unilateral expropriation of private property. Therefore, by 'institutions' they mean the legal security of private property. Additional important issues to consider are the degree of narrowness of this definition and the other elements of a country's institutional system that may be necessary for economic development, such as criminal law and its enforcement. As our aim is to give a brief overview of the work of the laureates, we will not go into this broader context.[7]

As discussed earlier, perhaps the most fundamental question in economics is economic development. The most influential work of Adam Smith, considered the founder of this branch of science, also addressed this issue (*Smith 2012*). To date, modern research has not been able to provide a clear 'recipe' for what makes a country achieve sustained, significant growth over decades.[8]

A useful framework for the neoclassical approach is growth and development accounting (*Solow 1957*; *Caselli 2005*). The latter may be used to decompose differences in development into contributions of factors of production (capital, labour) and productivity as a residual. There is a strong consensus in the literature (*Caselli 2005*) that large and persistent long-run differences in development are explained primarily by the efficiency of the factors of production, rather than their quantity.

However, this result raises a couple of fundamental questions. On the one hand, the exogeneity of productivity assumed by the neoclassical approach is highly questionable.[9] Technological progress is, at least to a large extent, the result of conscious research and development (*Romer 1990*). Moreover, in most countries, technological progress is mainly about adaptation. Why do many countries in the world use outdated, inefficient production methods when much better options are available? The second issue is that the quantity of factors of production is also endogenous and depends on the level of productivity. Therefore, the causes of underdevelopment must lie deeper than those suggested by a simple decomposition.

Economic (and social) development should be seen as an investment in the future. Such activities include not only investment in fixed capital, but also learning (human capital), sports and lifestyle (health capital), technology and business organisation methods (intangible capital), and the institutional system that supports

[7] See the handbook on the relationship between institutions and economic development edited by Baland et *al.* (*Baland et al. 2020*).
[8] While this paper only reflects on research outcomes from the post-World War II period, many other important antecedents can be listed in the discussion of economic development.
[9] Even with this limitation, the neoclassical model is useful for the study of growth. It still provides a reliable methodology for the empirical study of convergence, for example, and was an important step towards later models that treat productivity in an endogenous way.

the functioning of the market economy. Economic agents, such as companies, households and even the state, invest in the future if the expected return exceeds the costs of the investment. As the latter typically occur early and the former much later in time, the perception of the future and its predictability are key to investment decisions in the broad sense. It is also essential that the investor is able to keep the expected return, without fear of expropriation.

To sum up, stable, predictable protection of property rights is a prerequisite for long-term, sustainable development. The work of the laureates has provided empirical evidence for this claim. On the other hand, it has shed light on the conditions in which the political and social environment enabling this is created. Let us start with the first issue, which is the impact of institutions on development.

2.1. The impact of institutions on long-term development

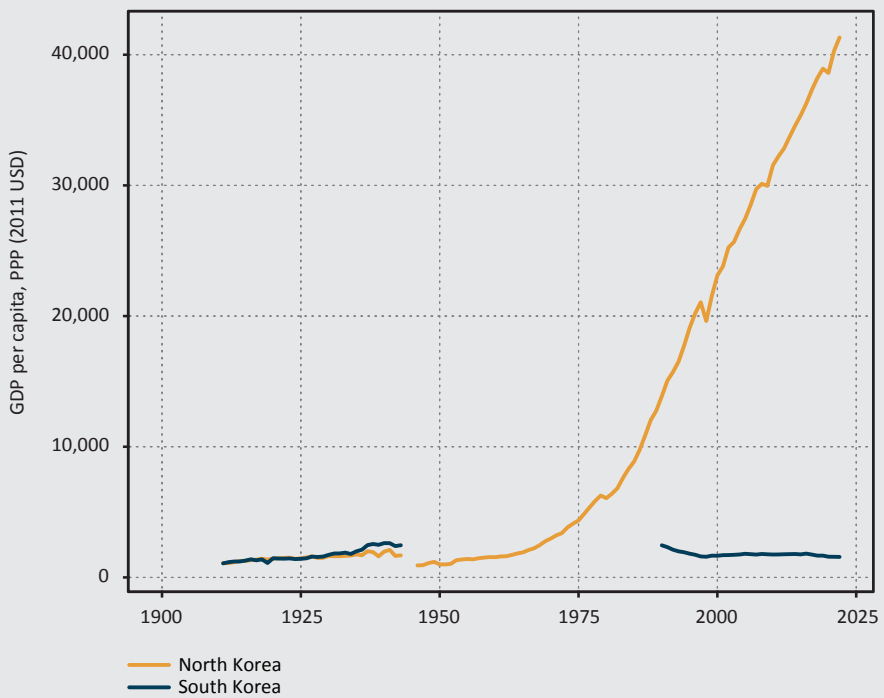
Acemoglu – Johnson – Robinson (*2001*) sought to answer the question of whether institutions can be shown to have a causal effect on economic development. The fundamental difficulty in exploring such causal relationships is the problem of endogeneity. As discussed in the introduction, there is a strong correlation between the institutions that support a market economy and development. However, it is not obvious that the former is the cause of the latter. The reverse explanation is also possible, i.e. that economic development allows the establishment and adaptation of better institutions.

The experimental methodology available in the natural sciences is not applicable in macroeconomics. First, we cannot experiment with entire economies, for both practical and moral reasons. On the other hand, even if we are able to perform *one* experiment, we cannot go back in time and perform another intervention from the same starting point. Third, the amount of macroeconomic data (such as countries) is very low. It is almost impossible to find two countries that are sufficiently similar to each other where we might simultaneously implement different economic policy interventions and examine their effects, controlling for everything else.

How can we establish causal relationships in the context of the macroeconomy and, in this case, economic development? The only viable option is to find *natural experiments*. One way to do this is to identify historical episodes where an external, exogenous shock caused parts of an economic unit to evolve in a different direction, temporarily or permanently. Such events are extremely rare and do not, *in themselves*, allow systematic investigation. However, they are extremely useful because they are the closest thing we have to an ideal controlled experiment. [10]

[10] In the context of natural experiments, it is worth mentioning the work of 2021 award winners David Card, Joshua Angrist and Guido Imbens (*Hermann et al. 2022*).

Figure 2
Development path of the two Koreas



Note: For North Korea, data are missing between the end of World War II and 1990.
Source: Maddison database

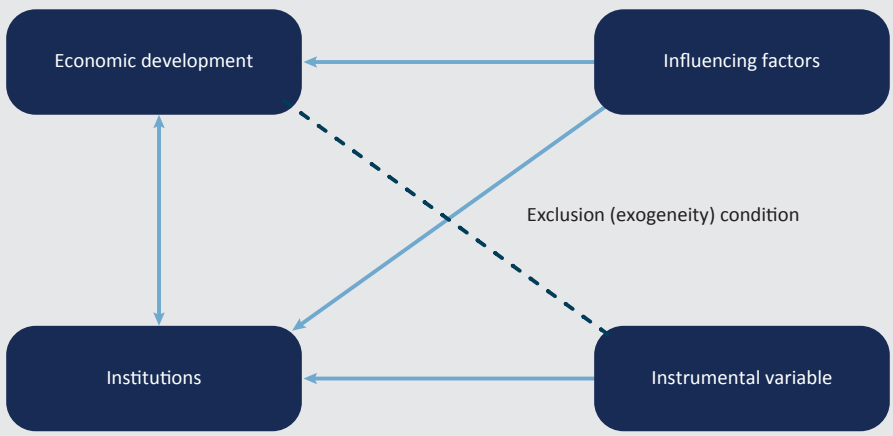
Figure 2 shows the different economic development of the two Koreas (North and South) since the early 20th century. Until the end of World War II, the Korean peninsula was unified both economically and socio-culturally, and its history after that point can be regarded as a natural experiment. The partition along the lines of great power interests was an exogenous event. In its wake, a dictatorship and planned economy were established in the north under the control of the Soviet Union (and later China), and an autocratic market economy in the south under the control of the US. The difference in performance between the two systems is dramatic, to the benefit of the South Korean market economy. To a somewhat lesser extent, but a similar picture emerges when comparing West and East Germany between 1945 and 1990.

While this example is very convincing, it remains to be seen how well its lessons can be generally applied to other countries. To get a broader picture, it is useful to look at a larger group of countries. An innovative, systematic way of doing this

was proposed by *Acemoglu – Johnson – Robinson* (*2001*). The authors use the *instrumental variables* method known in econometrics to show that, in the case of former colonies, colonisation was an appropriate exogenous difference that might be used for examining the impact of institutions on development.

The instrumental variables method uses the logic of natural experiments in a regression setting. In this case, we are looking for an exogenous event that influenced the development of institutions in the countries concerned, but did not directly affect economic development. Provided that we can control for all other differences in the regression, we may isolate the causal effect of institutions, using the appropriate instrument. *Figure 3* describes the logic of this method. The dashed line indicates the exclusion restriction, i.e. the assumption that the instrumental variable has no *direct* effect on economic development.

Figure 3
The instrumental variables method



Acemoglu – Johnson – Robinson (*2001*) examine the current economic development of ex-colonial countries in the light of the institutional system they inherited from the former colonial powers. The *mortality of European settlers* is used as an instrumental variable, using the following argument. During colonialism, the European conquerors introduced new institutions to serve their own interests. If colonialism was followed by significant immigration from the mother country, the settlers established institutions they brought with them, which were more conducive to a market economy. However, if settlement was not attractive due to high mortality (mainly from unknown tropical diseases), the European population was limited to those required for administration. In this case, the main objective was the exploitation of colonial resources, for which the institutions were set up to

facilitate this ('extracting'). In other words, *Acemoglu – Johnson – Robinson* (*2001*) argue that the local epidemic situation experienced by the colonisers had a decisive influence on the development of institutions.

In order to turn settler mortality into a good instrument, two additional conditions must be met. On the one hand, there must be a meaningful link between the epidemic environment of centuries ago and today's institutions. The authors justify this empirically, explaining that institutions are highly persistent.[11] On the other hand, the instrument cannot have a direct impact on the current level of development. Empirically, this exclusion criterion can neither be proven, nor disproven. *Acemoglu – Johnson – Robinson* (*2001*) argue, however, that – partly because of advances in medicine and hygiene, and partly because of the stronger immunity of the original population – it is highly unlikely that the epidemic situation during the colonial era might have a significant impact on the current state of development.

To put the identification strategy into practice, *Acemoglu – Johnson – Robinson* (*2001*) collected data on settler mortality using historical sources. Today's institutions are measured by the probability of expropriation, i.e. the strength of property rights. The target variable is GDP per capita at purchasing power parity. The influencing factors include a number of indicators used in the literature, such as distance from the equator, the continent of the colonised country (mainly Africa), or the type of legal system (Anglo-Saxon or French).

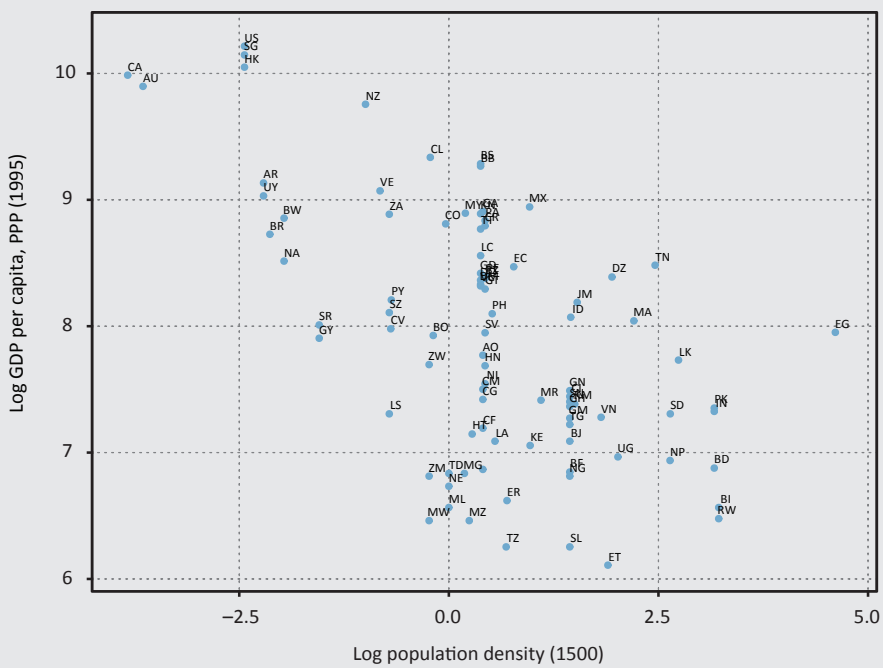
The results provide clear and robust evidence that stronger property rights lead to higher economic development. The impact of institutions, i.e. the estimated coefficient, is significant. According to the authors' calculations,[12] if we compare the two former colonies of Nigeria and Chile as an example, the difference in institutions implies a 700-per cent difference in development. Although the authors suggest that this may be the upper bound on the actual effect due to measurement errors, the order of magnitude is meaningful and plausible. Interestingly, the results hold even if we exclude from the sample the most obvious settler colonies, where the original population has been almost completely replaced.[13] It should also be noted that the estimate can explain lower levels of development in some countries even when the authors control for different continents. Their findings suggest that underdevelopment in Africa, for example, is caused by poor institutions, and not by some sort of 'African curse'.

[11] Evidently, the study of the long-lasting impact of institutions is not limited to the laureates in the literature; see for example *Dell* (*2010*); *Guiso et al.* (*2016*); or *Juhász* (*2018*).
[12] *Acemoglu – Johnson – Robinson* (*2001*): 1387.
[13] USA, Canada, Australia and New Zealand.

Acemoglu – Johnson – Robinson (*2002*) provide further evidence on the importance of institutions. In their view, the number of European settlers in the colonial population was a key factor in the choice of institutions. This was determined not only by the presence of diseases that were fatal to Europeans, but presumably by other factors as well. Such a factor may have been the population density at the time of colonisation, where settlement was motivated by the availability of 'empty' land.

If European settlement at the time of colonisation was hindered or made more difficult by the higher population densities already present, Acemoglu, Johnson and Robinson argue that a '*reversal of fortune*' should be observed in the data. Previously less populated areas were more likely to have better institutions introduced, leading to stronger subsequent economic development. In other words, areas (colonies) with previously higher population density must now be less developed.

Figure 4
Early population density and current development



Note: The countries considered are those that Acemoglu – Johnson – Robinson (2002) classified as colonies.

Source: The author's own calculations based on original data provided by Acemoglu – Johnson – Robinson (2002) (https://economics.mit.edu/people/faculty/daron-acemoglu/data-archive)

The main results of *Acemoglu – Johnson – Robinson* (*2002*) are illustrated in *Figure 4*, based on original data shared by the authors. The figure shows a strong negative relationship between the pre-colonial population (measured in 1500) and the level of development in 1995. In other words, fortunes can really be reversed – earlier success (measured in terms of population density) was followed by relative decline during and after colonialism.

2.1.1. Criticism

Although the results of the two articles are convincing, the analyses have been the subject of important criticism from several quarters. *Albouy* (*2012*) criticises the instrumental variable, i.e. the creation of settler mortality rate as used by *Acemoglu – Johnson – Robinson* (*2001*). Since the historical data are rather incomplete and imprecise, the original results are not necessarily robust enough for critical reconsideration of the instrument. However, in their response, *Acemoglu – Johnson – Robinson* (*2012*) are of the opinion that *Albouy's* (*2012*) procedure, which excludes observations that are considered less accurate in most of the countries at issue, is excessive. In their interpretation, the original results remain robust if the quality of the settler mortality data is evaluated in the real historical context.

Another substantive criticism questions the interpretation of the results and not their robustness. *Acemoglu – Johnson – Robinson* (*2001*) and (*2002*) hypothesise that colonies where Europeans were able to settle developed more strongly. They attribute this effect to the established institutions. *Glaeser et al.* (*2004*) identify an alternative mechanism based on the human capital of settlers. They draw attention to several problems (e.g. the choice of variables to measure the institutional system), but perhaps their most important insight is the relationship between human capital and institutions. While institutions are external constraints for economic actors, human capital – by definition – is embodied in the decision-makers. Therefore, not only did the European settlers take with them the institutions that embodied the rules of the game, they also brought along the human capital intrinsic in themselves. It is conceivable that the results found by *Acemoglu – Johnson – Robinson* (*2001*) and (*2002*) are due to the latter, i.e. human capital. In this view, better institutions were not necessarily a cause of economic development, but probably a consequence of it.

Acemoglu – Johnson – Robinson (*2014*) attempted to respond to this criticism. First, they document that the Europeans who moved to the exploited colonies were generally better educated (albeit in much smaller numbers) than those who moved to the settler colonies. Second, when both institutions and human capital are considered as explanatory variables in the empirical analysis, the role of institutions is much stronger. Thirdly, very similar results are obtained when using regional

data as well as national data. The use of regional data allows controlling for several factors (through country-fixed effects) that make comparisons between countries difficult.

To summarise, while the research of the laureates on the causal relationship between institutions and economic development is convincing, certain details are still disputed. The protection of private property, as a central institution of market economy, was likely to play an important role in later economic development. Looking back at *Figure 1*, we can see that no meaningful economic development is possible without the rule of law. However, other factors are also necessary for growth, as there are many countries in the figure where, despite the rule of law, there is no developed economy.

However pioneering the empirical strategy of the laureates, the mutual endogeneity of macroeconomic variables and the persistence of processes make it extremely difficult to separate alternative explanations. The work of Acemoglu, Johnson and Robinson is important not only for their actual results, but also for their seminal methodology and original questions.

2.2. Choosing the institutions

The second major research programme included in the justification for the Nobel Prize was carried out by Acemoglu and Robinson and examined the issues of the selection of institutions and their development over time. Although institutions are empirically very persistent, they are not immutable on a historical scale. In a number of studies and in their famous book mentioned above, Acemoglu and Robinson explore the circumstances under which ruling elites choose institutions that are either beneficial or harmful to economic development.

It is worth noting that the research programme is not about the general institutional system, mainly because it is extremely difficult to define. As in the previous chapter, they are mainly concerned about the security of property rights. This is defined as protection from unilateral redistribution by the elite. The details of the different studies differ, but the main conflict is between the elite in power and the rest of society (‘the common people’). The elite design and operate political institutions in such a way as to maximise the income they can expect, both from their own resources and through redistribution. However, they cannot achieve this goal without constraints, and are faced with various trade-offs.

One important trade-off – crucial in development economics – is the conversion between current and future income. Investment in the broad sense is the source of economic growth. This means that an investor gives up current consumption in order to obtain higher income and consumption in the future. In this context, the elite's choice is between a larger share of the existing total income in the short term ('a bigger slice of a smaller pie') or a smaller share in order to generate higher total income in the medium and long term ('a smaller slice of a bigger pie'). Institutions that foster growth are created when the latter strategy is more profitable for the elite.

Another factor limiting elite behaviour is the potential resistance of society. Although the institutions are shaped by the elite, it is possible for the common people to replace the elite (through 'revolution'). Like all conflicts, revolution leads to short-term losses for society as a whole. However, if the degree of redistribution between the elite and the common people can be sufficiently altered in favour of the latter, it may be in the interests of the latter to start a revolution. To prevent this, it is preferable for the elite to redistribute only to the extent that the loss to the common people from the revolution's outbreak is greater than the gain to the common people from the changed institutions.

One final, important aspect of dynamic relationships is the issue of *commitment*. A different equilibrium can be achieved if the actors – the elite or the common people – can make enforceable promises about their future behaviour. The commitment problem is also prominent in the operation of monetary policy (*Kydland and Prescott 1977*). As we will see, it also plays a major role in the survival of institutions.

It is obvious that, contrary to the description above, neither the elite nor the rest of the common people are unitary actors. However, simplification is an essential part of the economic approach. Therefore, I will continue to use this binary split to present the work of the Noble prize winners. Evidently, a more detailed division is possible (see briefly below), but assuming only two social groups is enough to understand the main takeaways.

To model the questions asked, Acemoglu and Robinson use game theory tools. Games that assume a dynamic, infinite time horizon may rationalise an extremely wide spectrum of social phenomena as equilibrium behaviour. According to the 'Folk Theorem' (*Friedman 1971*), the set of equilibrium outcomes is typically too large. For the literature, the challenge is rather to answer how to select the most empirically relevant solutions among the possible equilibria. For example, the study by *Acemoglu and Robinson* (*2000a*) uses the concept of Markov perfect equilibrium

for this purpose. For the sake of clarity, I will therefore not present the full model assuming an infinite time horizon, but a more tractable static version with an unambiguous equilibrium behaviour. The presentation of the simplified model draws on the *Nobel* (*2024*) paper, but omits the mathematical details.[14]

The model explains how a country chooses and maintains its institutions. The population consists of two main groups: the smaller *elite* and the larger *common people*. Initially, political power is in the hands of the former, but the common people have the power to change this situation (democratisation). Since the common people have larger numbers, in a democratic transition, institutions are shaped by their preferences (*median voter*).

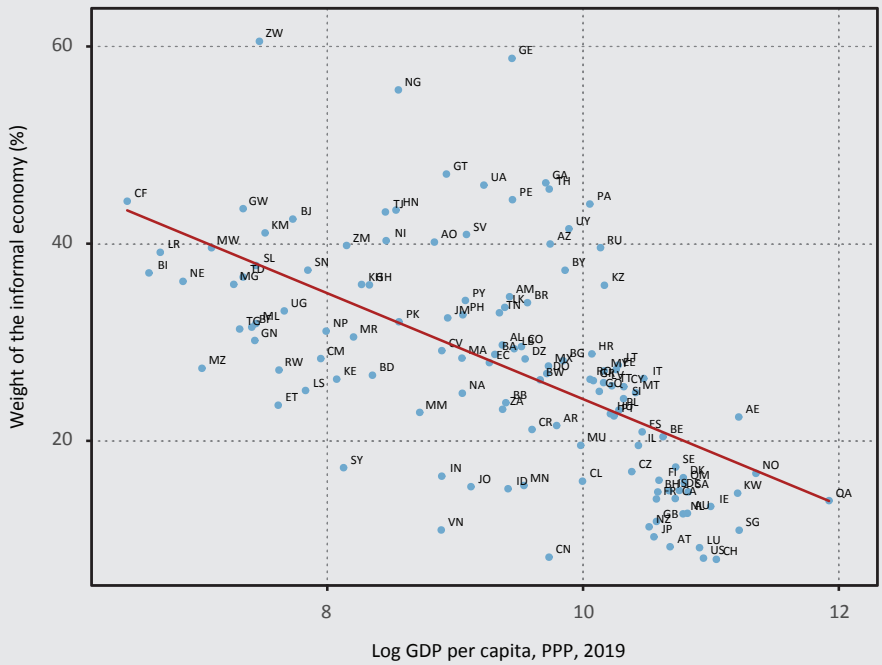
The economic system consists of two productive sectors – the formal and the informal sectors. The former has higher productivity, but is easier for the state (the elite) to control. In the informal sector, productivity is lower, but the income generated is more difficult to expropriate by the elite.[15] As *Figure 5* shows, the informal economy plays a significant role in most countries. However, we also see a strong negative relationship between economic development and the share of the grey economy. Acemoglu and Robinson's research programme interprets this phenomenon as a rational outcome of the interaction between institutions and economic agents.

In the initial situation, the elite have the possibility to extract resources from the public through taxation. Since the elite do not pay taxes, they operate entirely in the formal economy. All income earned by the public in the formal sector is taxable. In the informal sector, however, part of the income may be hidden from taxation. That is, the public chooses between the more productive but more heavily taxed formal sector and the less productive but less taxed informal sector.

If the common people cannot accept the framework set by the elite, they have the potential to start a revolution. In the *Acemoglu and Robinson* (*2000a*) model, the probability of success is one, but political crisis leads to lower output (income) in both sectors. After a successful revolution, the elite loses power and, as described above, loses control over redistribution. For the sake of simplicity, we assume that the common people will still not have access to the income of the former elite, meaning that there will be no complete role reversal between the two social groups.

[14] For those interested in further reading, we recommend the detailed analysis in *Nobel* (*2024*), pp. 23–28.
[15] See, for example *La Porta and Shleifer* (*2008*) or *Medina and Schneider* (*2018*).

Figure 5
Economic development and the informal economy



Note: The measure of the informal economy is the indicator developed by Kose et al. (2021) using general equilibrium modelling (as a percentage of GDP).

Source: World Bank and Maddison database

The timing of the model is as follows. The first step is for the elite to decide whether or not to introduce democracy. In the second step, the common people decide whether or not to start a revolution. In the third step, the members of the two groups choose which sector they will work in. Finally, the group in power sets the tax rates.[16] Since the model is static, or consists of finite steps, it can be easily solved by the well-known *backward* induction method of game theory. In other words, we first determine the tax rate as a function of the power relations, then we derive the distribution between sectors taking this into account, and finally we derive the political choices of the elite and the common people as a function of the expected payoffs.

It is easy to see that, in the last step, the elite – should they stay in power – is going to opt for maximum tax rate, i.e. total expropriation. Rationally anticipating this,

[16] Anticipating later results, *Nobel* (*2024*) also allows for unilateral transfers between the two groups beyond the tax system. For the sake of simplicity, we are going to disregard these transfers.

the common people will be active only in the informal sector, thus minimising the expected reduction of income. The elite will stay in the formal sector, as they do not pay taxes. In a democratic transition, however, the median voter, i.e. the common people, will prefer the minimum (zero) tax rate, which will attract everyone into the formal sector.

For the common people, democratisation is clearly a better long-term outcome. Social welfare is also higher because everyone is in the more productive formal sector. At the same time, a violent takeover (revolution) has transition costs. The public will choose revolution if the long-term benefits outweigh the short-term costs. Formally, the 'revolutionary condition' can be quantified with the following formula:

$$\mu > \frac{1-\theta}{A/B}, \tag{1}$$

where $1 - \mu$ is the GDP loss due to the revolution, $1 - \theta$ is the potential tax evasion rate in the informal sector, and A/B is the productivity advantage of the formal sector over the informal sector. The probability of revolution is higher, if (i) the revolution is expected to be less 'bloody'; (ii) the informal sector is inefficient; and (iii) the elite is able to extract substantial 'grey' income.

The final step is to analyse the elite's decision to democratise. If condition (1) is not met, there will be no revolution. In this case, the elites are clearly better off without ushering in democratisation. But if revolution is inevitable, it can be shown that the elites are better off preventing it by democratisation. In other words, condition (1) also determines the occurrence of the democratic transition.

An important assumption in the above derivation was that the elite cannot credibly commit to a sufficiently low tax rate because their interest is maximum expropriation at the last step (*dynamic inconsistency*). To what extent does it change the outcome if there is a '*commitment technology*' that obliges the elite to keep their prior promises? It is obvious that, in this case, the elite never democratises, because it can 'buy' social peace. It can also be shown that, in this case, the social optimum may be achieved without revolutionary loss, when everyone is in the formal sector. Finally, it can be shown that both the elite and the common people are better off than in a situation with no commitment.

Although democratisation may be prevented if there is credible commitment, Acemoglu and Robinson argue that such commitment is unlikely in the exercise of political power (see also *Acemoglu, Johnson and Robinson 2004*). The reason is that, in the case of political conflict, there is no external actor or technology that can enforce compliance with the prior agreement at the expense of the incumbents. An interesting question is whether an external actor such as the European Union can play this kind of role for the Member States.

In summary, the simple model can explain many interesting phenomena. First, it shows why and under what conditions an inefficient, autocratic economic system may survive. The main reason for this is the lack of commitment, which prevents the elite from compromising with the public in order to retain power. The model also explains the circumstances under which democratisation can occur. This might be, for example, technological progress that raises the relative productivity of the formal sector. Finally, it explains why democracy is not a necessary condition for economic development. If the elite can enter into a 'social contract' with the common people where a sufficient degree of self-restraint is credible, economic efficiency can be achieved in an autocratic system.

The empirical relationship between democracy and economic development is illustrated in *Figure 6.* As usual, the measure of development is GDP per capita at purchasing power parity. As an indicator of the democratic system, I used the 2022 V-Dem 'Liberal Democracy' index (*Pemstein et al. 2024*). It goes without saying that the figure is for illustrative purposes only and does not represent a causal relationship in any direction.

Figure 6
Democracy and economic development

Source: V-Dem and Maddison databases

The figure shows that the empirical link between democracy and economic development is weak. This is particularly true for middle-income countries, where there are examples for both strong democracies (Costa Rica) and autocracies (Thailand). However, it is interesting to observe the economically developed nations. Among these, the traditionally prosperous, early industrialised countries are all strong democracies. Countries that have high GDP per capita but are not democracies are almost exclusively represented by the monarchies of the Persian Gulf, rich in oil and gas. According to Acemoglu and Robinson, in these economies, the autocratic political system works because the surplus resources held by the elites allow for redistribution to a degree that is acceptable to the common people. An interesting exception is the case of Singapore, which does not have this type of natural wealth, but has managed to create a 'social contract' between the elite and the common people anyway. We cannot discuss the reasons for this, but in any case, the figure shows that the Singapore example is typically not easy to replicate.

2.2.1. Extensions

Many extensions and modifications of the basic model described above have been made by the award winners, both in their joint work and those with additional co-authors. *Acemoglu* (*2003*) examines why socially inefficient outcomes can persist. The study confirms that commitment is key to understanding this. *Acemoglu – Johnson – Robinson* (*2005*) synthesise the two research projects that led to the Nobel Prize and provide a number of empirical examples. These include the role of the English Glorious Revolution in bringing about the Industrial Revolution, the different socio-economic development of the two Koreas after World War II, or the differences in colonialism between the 'settler' and 'non-settler' colonies, which have already been discussed in detail. *Acemoglu* (*2006*) assumes three groups instead of the two used in the baseline model, and can thus also investigate the way redistribution through factor prices is achieved. *Acemoglu* and *Robinson* (*2000b*) and (*2006*) argue that the interest groups that successfully block technological progress are not economic losers (e.g. the machine breaking Luddites), but political losers.

Another interesting direction is the possibility of political instability. In the basic model described, democratisation is a one-way process. In reality, however, there are countless examples where the process can be reversed (see, for example, the countries of Latin America). *Acemoglu and Robinson* (2001) analyse the likelihood of this and identify the conditions leading to political instability. *Acemoglu and Robinson* (*2008*) examine a similar mechanism whereby former elites 'occupy' and empty democratic institutions and make them work in their own interests.

It is worth briefly mentioning the award-winning bestseller authored by the two laureates, 'Why Nations Fail' (*Acemoglu and Robinson 2012*). The book synthesises

Acemoglu and Robinson's research programme and makes it available to a wider audience. The key message is that the main determinants of economic development are not geographical or cultural factors, but rather socio-political institutions. In addition to the theoretical considerations outlined above, the book provides numerous case studies and historical examples to support the main arguments.

Empirical studies related to theoretical models examine testable claims. As mentioned above, in several of their works, the laureates cite historical examples to illustrate and prove the existence of the mechanisms. Among many others, *Acemoglu and Robinson* (*2012*) discuss in detail the problems of Mayan civilisation, the socio-economic system of Sierra Leone during and after colonisation, the development of the Australian institutional system and the impact of the Napoleonic Wars on the development of Western European countries.

Acemoglu et al. (*2019*) analyse the causal effect of democracy on economic development. Their results show that democratisation increases GDP per capita by 20 per cent in the long term. Note that, while this is not an insignificant order of magnitude, it is dwarfed by the cumulative long-term growth of up to 1,000 per cent in successful countries. This also confirms the theoretical result that democracy is one way of economic development, but not necessarily the only one. In addition, the effect is delayed over time, taking about 20 years, according to the authors' results.

3. Summary and impact

Acemoglu, Johnson and Robinson, winners of the 2024 Nobel Prize in Economics, have pioneered a new way of examining the role of key institutions in economic development, notably the protection of property rights. It has been conclusively demonstrated that good institutions are causally linked to subsequent growth. They have also made a very important contribution in explaining the choice of institutions and the role of elites in the survival, or rather the change of bad institutions.

Their findings have been validated and developed not only by their own research, but also by the vast literature that their work has inspired. We do not have the space to list these works in detail; instead, we recommend the reader to consult the detailed English summary of the prize (*Nobel 2024*). In it, the authors list a number of important additional examples for both the historical application of natural experiments and instrumental variables in economic history and for the theoretical and empirical study of the relationship between political institutions and economic development.

To conclude, here is a somewhat subjective view put forward by the author of this paper. The highly complex nature of economic phenomena has pushed economic

methodology towards strong simplification and towards studying different phenomena in isolation from each other. In many cases, this strategy has been effective and has led to key scientific contributions. At the same time, analysing different social systems in isolation from each other inevitably leads to a certain degree of neglect of their interactions.

It is a great achievement of Acemoglu, Johnson and Robinson to have brought the 'political' element, which had been very much emphasised in early economics, into focus. In particular, the main issues of economic development and, more broadly, macroeconomics are difficult to understand without the broader socio-political context. To avoid repeated bad economic policy decisions in the future, we also need to understand the political motivations behind them. This is what the 2024 laureates have provided guidance and scientific tools for, undoubtedly deserving of the Nobel Prize in Economics.

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The Impact of Artificial Intelligence on the Labour Market*

Máté Zsinkó

Technological progress and economic growth have gone hand in hand in past centuries, necessitating the continuous adaptation of labour markets. Historically, labour markets have demonstrated considerable adaptability to changes in the economic structure, leading to significant productivity gains. Today, however, most analyses agree that by the end of the decade, around 20 per cent of jobs in developed countries are projected to be affected by the spread of artificial intelligence and automation, and in Hungary this could affect nearly 1 million jobs. The use of new technologies may eliminate some jobs, create new ones and contribute to productivity gains mainly by complementing existing work processes.

1. Introduction

In recent times, we have witnessed the rapid development of artificial intelligence (AI). In the future, technology is expected to develop even faster and with an even greater impact, which could radically reshape labour market dynamics (*Acemoglu – Restrepo 2018*). In parallel with the development of AI, demographic trends in the developed world may also exert a significant impact on the labour market. In countries with ageing populations, demographic changes increase global labour shortages and labour market tightness, posing further challenges to companies and governments alike. In this context, the spread of artificial intelligence offers new opportunities in the labour market; on the other hand, it also poses challenges. Automation and robotisation through AI may make work processes more efficient and alleviate labour shortages, but may also lead to job losses, labour market restructuring and increased frictions. In this context of ageing societies and global labour shortages, it is worth examining how companies and individuals adapt to the changes brought about by AI. Grasping the opportunities offered by AI is essential for competitiveness and sustainable development. This article aims to provide an overview of the impact of artificial intelligence on the labour market, in particular, with regard to fears about labour shortages and possible job losses.

* 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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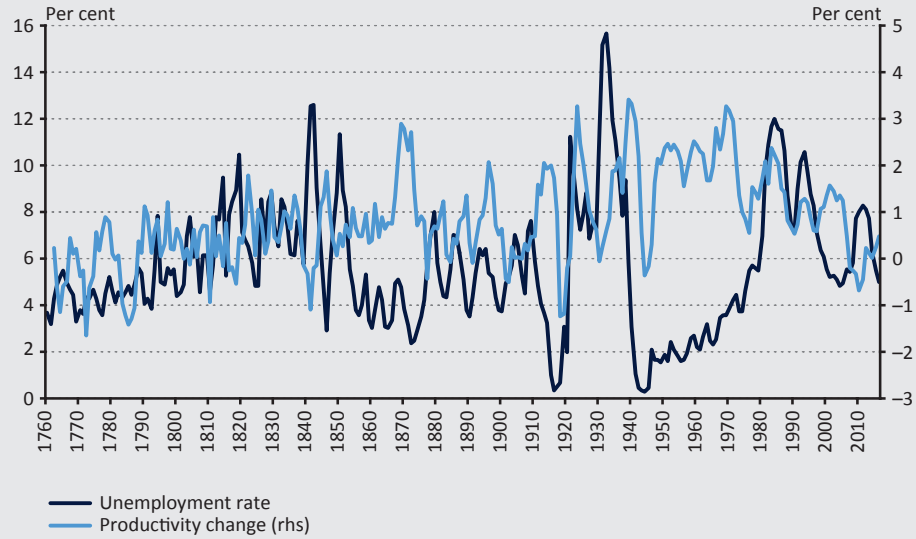
2. Historical experiences

Technological and economic development go hand in hand, with the former playing a vital role in driving innovation, productivity and prosperity. However, the question arises as to what impact this has on labour market dynamics and balances. Thanks to continuous progress in science, our environment is also constantly changing, with countless innovative inventions appearing in our lives, creating new markets and jobs, while displacing and transforming existing ones. The first industrial revolution dates back to the second half of the 18th century. Its main achievement was that steam power replaced human power for the first time in history. The late 19th and early 20th centuries saw the second industrial revolution, driven by mass production and electricity. The third industrial revolution has been linked to electronics and information and communication technologies (ICT) since the 1970s. We now live in the age of the fourth industrial revolution, driven by digitalisation. This will be followed by the fifth industrial revolution, with artificial intelligence playing a central role (*MNB 2018*).

Historical experience suggests that industrial revolutions did not lead to mass job losses, but rather transformed the way in which work is done and tasks are performed (*Acemoglu – Restrepo 2020a*) (*Figure 1*). New technologies can often create entirely new industries and jobs, while making existing processes more efficient and thus improving productivity. However, in transitional periods at the beginning of industrial revolutions, workers were likely to experience increased uncertainty and fear of losing their jobs. In addition, the access to and benefits from the results of technological progress are not evenly distributed across different sections of the society and different sectors of the economy. While productivity typically starts to increase immediately after the adoption of a new technology, real wage growth tends to lag behind, and thus initially it is mainly the owners of the technology who feel the improvement (*Allen 2009*). This leads to a temporary imbalance in the capital-labour income distribution in favour of the capitalists. This section focuses on providing an overview of the impact of major technological shocks on the labour market by observing the historical experience of previous industrial revolutions.

Figure 1
Annual change in productivity and unemployment rates in the UK



Note: 5-year moving averages for productivity.

Source: FRED (https://fred.stlouisfed.org/series/UNRTUKA and https://fred.stlouisfed.org/series/TFPGUKA, accessed 12 March 2024)

In the first and second industrial revolutions, innovation initially led to a rise in capital returns, while it was only later that productivity growth resulted in an increase in real wages. The wave of automation that started in the 1970s also reduced the share of wages in GDP, the wage share, and changed the distribution of labour income (*Acemoglu 1998*). Labour market demand for highly skilled workers rose significantly, while the relative position of mid-skilled workers deteriorated.

Since the start of the third industrial revolution, the labour market structure in developed countries has also undergone significant changes (*Acemoglu – Autor 2011*). Losers in the process have been mid-skilled workers, while the share of jobs requiring high- and low-skilled labour has risen. The mid-skilled labour replaced by automation can either be retrained so that they can take higher-skilled jobs or agree to take lower-skilled jobs. This phenomenon is called the U-curve by skill levels by *Autor and Dorn* (*2013*), which plots the increase in income inequality through changes in the skills structure.

Automation has been achieved largely through robotisation, which refers to technological processes that aim to automate human work processes using physical robots and software. When robotisation is coupled with artificial intelligence,

automated systems become much more intelligent and flexible, and thus capable of performing more complex tasks (*Perez et al. 2018*). The practical applications of robots so far show a mixed picture of their impact on the labour market. *Bonfiglioli et al.* (*2020*) summarised the experience of robotisation so far, based on French companies: the use of robots increases labour demand in the short term, but reduces it in the longer term. The reduction in labour demand observed in the longer term is due mainly to indirect effects, as firms that successfully implement robotisation increase their efficiency, which allows them to crowd out their less efficient rivals. Looking at the US labour market, *Acemoglu – Restrepo* (*2020b*) find that robotisation reduces employment and wages to a small extent. The robotisation of the US labour market is relatively low, and thus the impact on jobs is considered to be relatively low for the time being, but this could change rapidly in the future. *Kawaguchi et al.* (*2021*) show that in Japan, a 1-per cent increase in robotisation raises employment by 0.28 per cent, due to a competitive advantage following a price decline. It is important to highlight that the Japanese experience may differ significantly from what has been observed in other countries, because the Japanese labour market is in a unique situation: it was the first country to have a high uptake of industrial robots, a rapid fall in population makes labour shortages a particularly sensitive issue and the highly export-oriented nature of the Japanese economy may also help to accelerate the spread of robots.

3. The impact of artificial intelligence on the labour market

The rapid development and innovation in artificial intelligence has generated new research and societal debates around understanding the social, economic and ethical implications of the technology. Researchers differ on how AI will evolve, especially compared to human intelligence.

3.1. The international impact of artificial intelligence and automation

According to one assessment, the human brain's ability to solve increasingly complex tasks is limitless: just as every technological change since the industrial revolution has shifted human labour from automated tasks to more complex ones, so too will the evolution of AI. The other side views the human brain as a computer-like entity that sees even the most complex human manifestations (such as emotions, creativity, intuition) as some kind of computational result. If this is true, then the complexity of the tasks that the human brain can perform is finite. *Korinek* (*2023*) outlined three scenarios for the future impact of AI. The first is that the development of AI will boost productivity and create new jobs. In the second scenario, Artificial General Intelligence (AGI), which can perform all of the cognitive tasks that humans can, may emerge within 20 years, fundamentally changing the world of work and significantly reducing the role of the traditional labour force.

In the third, most radical scenario, AGI may emerge in up to five years, causing drastic economic and social restructuring. Given the wide divergence of the three pathways, Korinek proposes an adaptive policy framework that can accommodate and respond appropriately to future developments, which are still uncertain. The Fed expects the spread of artificial intelligence to result in a permanent decline in the wage share (*Drozd – Tavares 2024*). Their research suggests that the share of labour in national income production will fall, which could lead to increased inequalities and social tensions.

The impact of the widespread adoption of AI in the workplace may depend on three factors. Firstly, the elasticity of capital and labour supply, which is significantly affected by the heterogeneity of these two factors. According to *Ernst et al.* (*2019*), the more homogeneous an input is, the more elastic its supply will be, and thus the less able it will be to achieve high returns. In terms of the labour market, skilled workers are less flexible than unskilled ones, which is why they also have a wage premium. The second important factor is the substitution elasticity between capital and labour: the higher the elasticity is, the more it can reduce labour market demand when new technologies are introduced. Past technological innovations typically served as a complement to skilled labour, further increasing job polarisation and wage premiums. In the case of AI, however, the complementarity between capital and skilled labour is likely to be smaller, as AI can increase the productivity of low-skilled labour. At the same time, some AI-based applications may replace tasks performed by mid- and high-skilled workers, which, in turn, may lead to reduction in the wage premium for skilled workers. The third factor is whether investment in AI will raise the productivity of capital without a substantial change in output, which would imply a reduction in the labour share, or whether it will raise overall output to a higher level without crowding out labour force. In the latter case, productivity gains could create more jobs with higher wages, but the impact on the wage premium would still be uncertain. The impact of labour-saving technological changes on labour demand also depends on the price elasticity of the goods and services to be automated: if automation takes place in sectors with high unmet demand (mainly services), price elasticity may be high, and prices reduced by automation lead to a strong increase in demand, which compensates for the substitution effect. Taken together, these three factors paint a rather positive picture of the impact of AI on jobs and wages, but the specific effects are very difficult to predict (*Ernst et al. 2019*; *Acemoglu – Restrepo 2018*).

Autor (*2024*) anticipates the spread of artificial intelligence to rectify the unequal income distribution resulting from the aforementioned third industrial revolution. He argues that the spread of AI can reduce social inequalities and help to make mid-skill occupations more efficient and rebuild the middle classes. Artificial intelligence can help by making it much easier to access important information

and filter out unnecessary information, something that until now only professionals have been able to do. Autor shares the view of *Varian* (*2020*) that labour will run out earlier than jobs will and that the primary challenge is to alleviate the growing labour shortages expected to emerge in the developed world, which the spread of artificial intelligence can help to address. *Brynjolfsson et al.* (*2018*) expect similar positive effects from AI, stressing that there are very few professions that can be fully replaced by AI, which can perform complementary functions, thus improving productivity. However, productivity can increase differentially, with less experienced and less skilled workers growing more dynamically than more experienced and skilled workers (*Brynjolfsson et al. 2023*). This could lead to both an upward mobility of groups disadvantaged by past technological changes and diminishing the wage premium of those with higher skills.

When analysing the impact of robotisation and AI on the labour market, it is worth pointing out that (to varying degrees) nearly all jobs include easily replaceable routine tasks and specialised tasks that are more difficult to replace. *Autor et al.* (*2003*) define cognitive and manual tasks that can be performed in a limited and strongly simplified context as routine tasks. By contrast, they define situations where machines are used to supplement problem solving and complex communication sessions as non-routine tasks. Jobs exposed to higher risks cannot be grouped along the physical-mental axis, as in both cases there are both routine and non-routine tasks. According to *Deloitte* (*2023*), routine physical jobs include, for example, factory work or transport, where a significant part of the activities can be replaced by non-human labour; as a result, there is likely to be lower demand for such workers in the future, but their productivity can be significantly positively affected by AI as an additional tool. Unlike these jobs, manual workers who perform more complex tasks, such as plumbers, chefs or electricians, are much harder to replace. Regarding white collar jobs, administrative, customer service and simple programming jobs, among others, have a higher share of routine tasks and are expected to suffer the largest employment losses. For jobs with humans as their focus (e.g. psychologists, social workers) and those requiring strategic thinking (e.g. consultants), the risk of automation is much lower, while for creative and analytical jobs, AI is both a threat and a new tool that significantly increases possibilities.

3.2. Where are we in the transformation of labour markets?

The rapid spread of artificial intelligence has had a significant impact on labour markets in recent years, and been the subject of in-depth analyses by a number of institutions. The *OECD* (*2023*) has found that administrative and highly skilled white-collar jobs are most exposed to the effects of AI, while blue-collar jobs are more susceptible to automation. Analyses reveal that employers prefer training to redundancies, as the use of AI contributes to increased productivity. Workers reported that the use of AI tools had improved performance significantly, especially

when tasks were performed under algorithmic management. Generative artificial intelligence has transformed the structure of automation potential and has an increasingly large impact on knowledge-based jobs with low risk of automation. Historically, it was the simple physical and routine administrative tasks that were most affected; recently, however, automation potential of management, decision-making and creative tasks has grown significantly. According to *McKinsey* (*2023*), the highest increase in automation potential has been observed for high-skilled workers, while increase has been smaller for low-skilled workers, which narrows the educational gap.

According to the *World Economic Forum* (*WEF 2023*), 83 million jobs could be displaced between 2023 and 2027, while 69 million new ones could be created. Declines are mainly expected in personal services and administration, while the IT and technology sectors are expected to expand significantly. Generative AI technologies have a particular impact on office jobs, where there are typically more women than men. The analysis also found that labour markets in higher-income countries were the most affected, where the biggest technological gains were also expected. The IMF estimates that AI may affect nearly 40 per cent of the global workforce (*Cazzaniga et al. 2024*). Developed countries, where the transformation brought about by automation and AI is more pronounced, are hit particularly heavily. Conversely, in low-income countries, the lack of digital infrastructure and skilled labour limits the use of AI, which may further widen inequalities between countries. Developed economies need to establish regulatory frameworks to ensure the safe and responsible use of AI, while less developed countries need to focus on developing digital infrastructure and education.

4. The impact of artificial intelligence on the Hungarian labour market

Naturally, artificial intelligence will also affect the Hungarian labour market. For these effects to be analysed, it is necessary to understand the current structure and the future evolution of the labour market.

4.1. The impact of demography

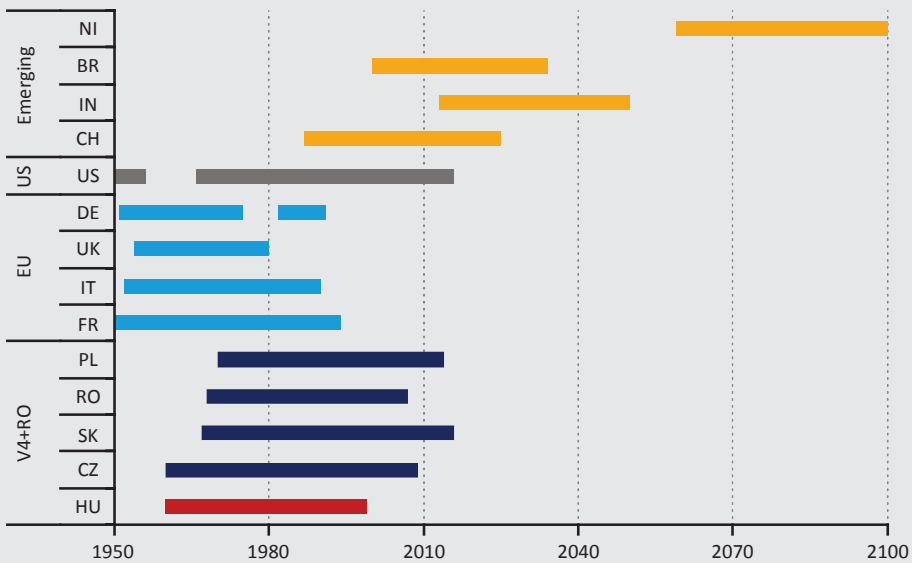
Like most countries in the developed world, Hungary is also affected by an ageing population and a decline in working age population. According to Eurostat's population projections, the natural decrease in the 15–74 age group in Hungary could be close to 300,000 by the end of the decade. The challenge is further exacerbated by the fact that the largest population decline is expected in the prime working age group (25–54 years of age) (*MNB 2024*). The OECD also predicts that[1] demographic constraints will be increasingly present and felt, which may limit future

[1] Old-age dependency ratio. https://data.oecd.org/pop/old-age-dependency-ratio.htm. Downloaded on 24 January 2024

employment growth. As society ages, the number of people leaving working age exceeds the number of those entering it. In developed and emerging societies, old-age dependency ratios are projected to climb at an accelerating pace until 2050.

Economic history has shown that the evolution of population size can have a profound impact on a country's economic prospects. When the proportion of people under 15 in a country's population falls to below 30 per cent and the proportion of people aged 65 and over is below 15 per cent, it is called a 'Demographic window of opportunity' or 'window of opportunity' (*UN 2004*) (*Figure 2*). In such a period, a country's economy can grow very dynamically thanks to the high proportion of the working age population. This window closed for most developed countries and for Hungary around the turn of the millennium; however, it may be an advantage for African countries and some Asian countries with a younger population (e.g. India) (*MNB 2018*). With the 'window' closed, most countries are now facing the problems of an ageing society, most notably, labour shortages.

Figure 2
Demographic window of opportunity in some countries



Note: V4: Czechia, Hungary, Poland and Slovakia

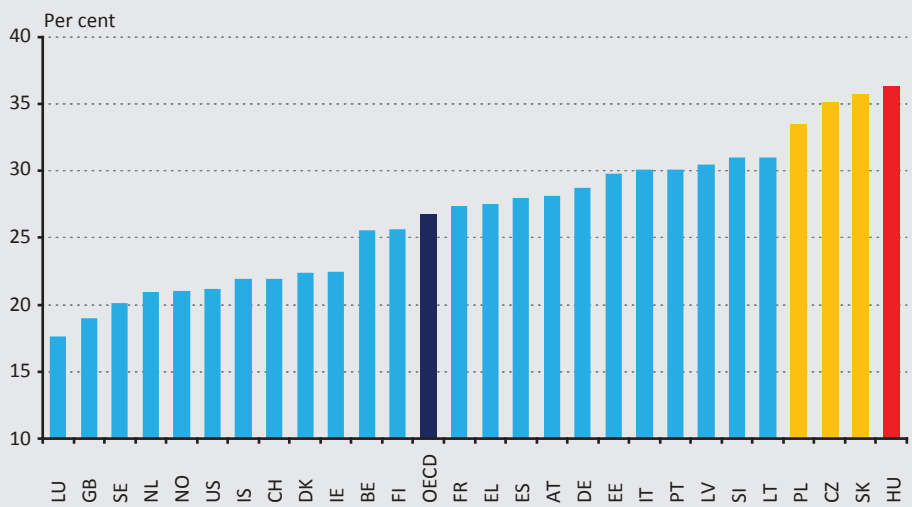
Source: based on UN World Population Prospects 2024 (https://population.un.org/wpp/, downloaded 5 April 2024)

Given the shrinking working-age population, AI and robotisation may even alleviate increasing labour market tightness and ease labour shortages. In Hungary, it has become increasingly difficult for companies to fill vacancies since the mid-2010s (*MNB 2023*).

4.2. The structure of the Hungarian labour market and the skills of workers

The *OECD* (*2023*) estimates that 36.4 per cent of those employed in Hungary's manufacturing sector have a job with a high risk of automation, the highest among the OECD countries (*Figure 3*). Such large-scale transformation requires changes at the highest level, without which AI will not increase productivity. It is also important to underline that updating definitions and revising jobs should not be a one-off occurrence, but rather a continuous one. This process is also time-consuming for employees, and it is unlikely that all employees will be able to adapt; as a result, the likelihood of displacement will be high for many. According to the *OECD* (*2023*), elderly and low-skilled workers may face the greatest difficulties in adapting, while opportunities for workers with disabilities could improve significantly. According to *Szalavetz* (*2019*), the impact of AI on productivity has not been significant so far, because we are still in the early stages of the megatrend when it is often only inputs that increase; outputs are expected to catch up later. *Szalavetz – Somosi* (*2019*) point out that robotisation and artificial intelligence can significantly reduce production costs, thus impairing the competitiveness of low-cost labour.

Figure 3
Share of employment in occupations at high risk of automation by country



Source: OECD (2023)

According to a study by *PwC* (*2019*), up to 900,000 jobs in Hungary may be affected by changes related to artificial intelligence by the mid-2030s. The analysis highlights the high number of jobs affected due to the structure of the Hungarian economy. The wave of automation affects mainly routine tasks, which account for a large part of the work performed in factories in Hungary. Most of the potential job losses (more than 380,000 jobs) are in manufacturing, while another 100,000 jobs could be affected in both transport and construction. These three sectors are responsible for almost one-third of domestic employment, but they account for nearly two-thirds of the jobs that could potentially be replaced. The study assumes that automation may come in three different waves, with a gradual increase in impact:

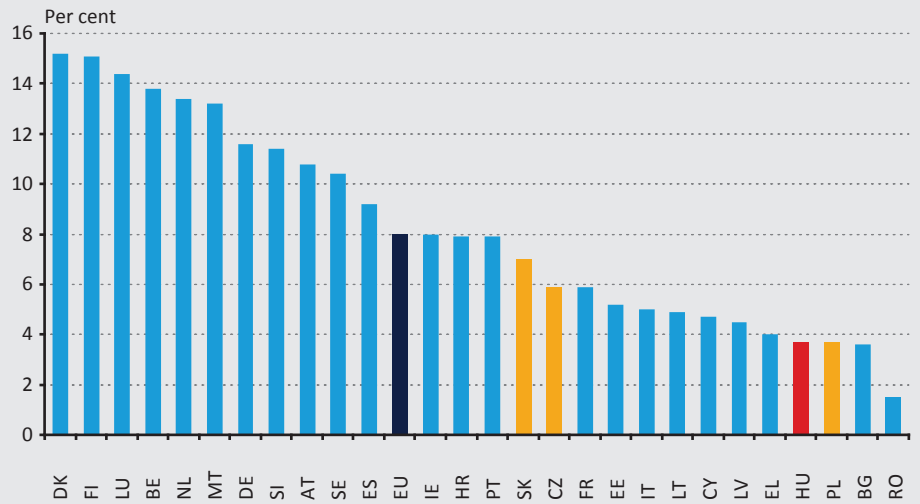
- The first (algorithmic) wave was expected to arrive in the early 2020s, threatening 45,000 jobs, mostly in education and healthcare.
- The second (additional) wave is expected in the mid-2020s, affecting more than 230,000 jobs, mainly in retail and community services.
- The third and most significant (autonomous) wave is expected in the 2030s, potentially threatening more than 640,000 jobs, mostly in manufacturing, transport and construction.

McKinsey's (*2018*) analysis predicts an even greater impact, with up to 1 million Hungarian jobs exposed to AI by 2030. However, it is labour shortages that cause problems in the Hungarian economy, which automation can help solve. This process can accelerate productivity by up to 0.8–1.4 per cent a year, depending on the extent and effectiveness of adaptation. The role of education and reskilling is stressed as essential to adapt to new technologies and to dispel fears.

Advanced IT skills are essential for both workers and companies to harness the potential of modern technologies to unlock AI-driven productivity gains. According to the *European Commission's* (*2023*) analysis on digitalisation, less than half of the Hungarian population has at least basic digital skills. Domestic companies also lag far behind in the use of AI, Big Data and cloud services. Only 4 per cent of Hungarian firms use AI, which is less than half the EU average (8 per cent) (*Figure 4*). The upskilling of workers is essential to catch up with the rest of the EU, but Hungary has a low participation rate in such activities (*OECD 2023*). The National Digitalisation Strategy 2022–2030[2] aims to improve this situation, with the key objective of placing Hungary among the top 10 best performing countries in the EU in the field of digitalisation by the end of the decade. To achieve this, progress is to be made in four priority categories: digital infrastructure, digital skills, the digital economy and the digital state. The targets set include raising the share of people with tertiary-level IT qualifications to over 10 per cent by 2030, thus improving the country's competitiveness.

[2] https://kormany.hu/dokumentumtar/nemzeti-digitalizacios-strategia-2022-2030

Figure 4
Share of companies using AI in the European Union (2023)



Source: European Commission (DESI) (https://digital-decade-desi.digital-strategy.ec.europa.eu/datasets/desi/charts, accessed 28 March 2024)

The strategy notes that, according to Artificial Intelligence Coalition estimates, up to 900,000 Hungarian jobs could be affected by the spread of AI-based technologies by 2030, meaning nearly one in four Hungarian workers. At the same time, the strategy emphasises that ideally AI can complement rather than replace human labour; however, to that end the continuous retraining and upskilling of the labour force is essential. AI education is therefore a priority of the strategy. Preparation should start at the level of public education, through awareness-raising materials and competitions, and with the widest possible involvement of teachers, who have a key role to play. In higher education, it is particularly important to integrate AI into courses and to adopt models that already work abroad. The strategy aims to reach out to 1 million people by the end of the decade. With properly skilled labour, labour productivity gains from AI adaptation could reach up to 40 per cent by 2030. As regards high-skilled labour, it is of particular importance to increase the share of data and AI specialists, while preventing low-skilled workers from sliding down the social ladder. For the latter, it is also particularly important to acquire basic competences, which can be facilitated significantly if manuals accompanying the tools are translated into Hungarian.

5. Conclusions

Artificial intelligence is expected to reshape the way we think about work and influence the development of labour markets. Experience so far shows that the labour market has always been able to adapt to technological changes, but training and retraining to meet the challenges of the new era is always key. In my paper, I have pointed out that as Hungary is a small, export-oriented economy with a high proportion of workers in the manufacturing sector, it is likely to be affected by the changes, and these challenges are particularly significant in terms of both the risk of job losses and the preservation of competitiveness. In order for labour markets to adapt successfully to the changes already caused by artificial intelligence and automation and to those expected to materialise in the future, training programmes are essential to equip workers and future generations with the skills and competences that a new economic environment requires. Equally important is the creation of a regulatory framework that helps to ensure that the risks from the changes brought about by technological progress do not lead to the increased vulnerability of workers and excessive social inequalities. Taking the right measures and preparing for the changes may enable the labour market and society to remain a winner of the technological progress, and artificial intelligence to increase productivity and overall contribute to job creation, while transforming the labour market.

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Relevant Economic Dimensions of Brexit*

Levente Nánási

Péter Halmai (ed.):
A Brexit forgatókönyvei és hatásai
('Brexit Scenarios and Impacts')
Dialóg Campus, Budapest, 2020, p. 302
ISBN: 9786156020116

The subject of this book is of fundamental importance for, among other things, the development of European integration. Brexit provides an empirical example of possible European disintegration, and this work offers a key to a comprehensive understanding of the process and the conclusions to be drawn.

Generally prepared before the British exit was finalised, the studies included in the book, analysing Brexit and its possible directions, were updated several times before publication. (This is why the book includes not one, but two forewords by the editor, *Péter Halmai*.) The main discourse presents Brexit in a comprehensive manner, while the individual units review all of Brexit's relevant economic dimensions. The first three essays provide a detailed 'natural history' of the political and economic discussions that framed the pros and cons of membership, leading up to the decisive national referendum in which the British people ultimately voted to leave. The remaining studies present the main themes of the book, providing a detailed analysis of the broad economic, financial and trade issues related to Brexit.

The book is part of a broad academic discourse on the economic and wider implications of Brexit. Its chapters reflect on the processes of Brexit in a highly objective way, drawing on independent research or comparing and analysing secondary sources. With a style that is clear, highly readable and easy to understand, the texts are easy to follow, even for the layman. The structure of the book follows a strict logic. The chapters build on each other, but are also easily understood individually.

* 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 backbone of the book is clearly the string of studies that review and assess the economic and trade situation in the aftermath of the UK's exit, providing both context and complexity. In the following, we review these studies.

Péter Halmai's thorough, multifaceted, monograph-like study begins the exploration of the economic implications[1] (*The Economics of Brexit*, pp. 83–208). He argues that the UK's membership in the EU had a number of very beneficial economic effects, particularly in terms of trade and attracting foreign direct investment. The aggressive propaganda during the pre-referendum campaign, which warned of disadvantages, did not cover the facts. The country's most dynamic economic growth since the Second World War coincided with the decades of UK membership. With regard to the contribution to the common budget, which was the cause of much controversy, the author's conclusion is that the UK's financial commitment represented a modest net burden compared to the size of the economy. In addition, the payment rules negotiated in 1984 improved the UK's net position. The cornerstone in the assessment of Brexit is an objective exploration of the economic issues. An analysis of the EU's financial relationship with the UK can provide an objective measure of the truth of the claims made during the campaign. It can also provide ammunition for a factual rebuttal of anti-globalisation and anti-integration voices. The second part of the chapter looks at the outlook for both a 'hard' and a 'soft' Brexit. In fact, the two terms suggest that the British have basically outlined two paths for redefining their relationship with the European Union. This issue in itself has proved almost as divisive as leaving the EU itself. According to pro-exit politicians, once Britain is no longer a member of the EU, it no longer wants to be part of the EU's single internal market or customs union. The other way would have been institutional cooperation (differentiated integration) that would have better reflected trade and economic integration. The chapter also looks at the restructuring of financial services, one of the most crucial consequences of Brexit. In this respect, Brexit is clearly a negative shift, as London used to be a dominant actor in the European financial sector. Deciding about the closeness of the future relationship, as well as about the boundaries, scope and reach in which the British will have access to the EU's internal market is a very sensitive issue. In addition, the UK also had to lay the foundations for its future trade relations. The paper concludes by discussing how the UK economy can recover from the shock of the sudden termination of a deeply embedded and stable partnership. According to the author, the negative consequences of the exit will be protracted and long-lasting. The UK economy faces a number of competitiveness, financial and structural challenges. Managing them outside the EU will be even more difficult.

Péter Halmai's study identifies and then elaborates on the possible directions of change in the complex and multifaceted system of economic and trade relations.

[1] On the topic of Brexit, in addition to this study, see also *Halmai* (*2018*), *Halmai* (*2020a, b, c*).

The author puts all of this in a broader perspective that also reflects the arguments presented by the prominent figures of 'deglobalisation'. With a high degree of objectivity, factuality and professionalism, he describes the financial and economic situation of the United Kingdom and the uncertainty and instability engendered by its departure, which are the paradoxical opposite of the expectations.

The essay by *Andrea Elekes* looks at the changing landscape of financial services. These processes have a major impact on the UK and London's financial market 'ecosystem' and could have a significant impact on British competitiveness. The author reviews the abrupt consequences for the British people of a 'hard' and a 'soft' Brexit, and then analyses in detail the effects on competitiveness. Elekes points out that there will be a number of transitions and systemic adjustments that will place an even greater burden on the financial system, in addition to the need to adapt to an ever-changing environment. This could hamper competitiveness, as well as the ability to adapt quickly to customer needs and the new regulatory environment, which will, consequently, lead to increasing costs and a temporary loss of competitiveness.

*Gábor Kutasi'*s study focuses on the effects of Brexit on the exchange rate, and, in particular, its consequences for Hungarian workers. The issue has great importance from a general British perspective as well, given that a significant proportion of EU nationals have provided the UK with skilled labour in occupations that require highly skilled workers or are plagued with labour shortage. Actually, British productivity has benefited from migration. The chapter uses the economic theory of labour migration as a starting point to point out the catalysts for economic emigration, the resulting changes in the host economy, the importance of integration and the reasons why the UK is a popular destination for workers. Kutasi uses empirical analysis to explore the relationship between the Hungarian labour market situation and the changes in the exchange rate of the British pound. The study may help to understand the motivating factors behind the emigration of 'Hungarians in England', often mentioned in public discourse. The author also looks at the financial incentives that may change their perceptions and affect the expectations related to their return. In the final chapter of the book, Kutasi and his co-author review the impact of Brexit on exports and on Hungarian foreign trade indicators.

The study by *Erik Szarvas* presents the implications of Brexit for the UK's WTO obligations. An overview of this topic can contribute to an understanding of the potential for an independent UK trade policy.

The volume of studies edited by *Péter Halmai* explores in great depth the root causes of Brexit and its economic implications for both the European Union and the United Kingdom. In my opinion, the aim of the work is fully achieved, since it succeeds in providing a comprehensive picture of the dynamics and expected

outcomes of events, taking into account all subsystems and aspects, without making any dubious predictions. The authors capture the essence of the problem – its 'core issue' – very well. They provide a picture of the problems that are unfolding and the difficulties that are likely to arise, in a series of studies that build on each other and expand on the subject.

Conversely, perhaps less attention than warranted is given to the economic dynamics that preceded Brexit.[2] From 2007 onwards, UK growth fizzled out and productivity growth stalled. Occurring in parallel with the effects of the global economic crisis, this led to a slowdown in real wage growth, income redistribution and rising inequality. These overlapping and reinforcing processes fuelled anti-elite and anti-globalisation sentiment, and were ultimately decisive in shifting the political arena towards populism.

The strength of the book is that the in-depth analysis is written in a language that is accessible even to readers with limited knowledge of economics, trade policy and finance. The well-illustrated, informative studies provide insights into the wider context and possible consequences of this highly complex international event. The authors have taken great care to provide an academic framework for a political and economic debate that is very heated and extreme, and which has severely constrained the discourse on the consequences of the British exit.

Nevertheless, I believe that further research in this area would be extremely interesting and useful. Economic and social processes in the post-exit period, together with the dynamics of EU-British relations, remain an area of research with great potential and many knowledge gaps. It goes without saying that such research is extremely time-consuming and, due to the complicated nature of the subject, requires very complex scientific activity, as well as meticulous, protracted coordination.

In summary, the book is a thorough, informative, coherent and well-argued account of the phenomenon of Brexit, together with its controversial and important consequences. An example of the disintegration of the complex processes of globalisation and the emergence of anti-globalisation, Brexit has a continuing impact on the economic and political life of the UK and the European Union. This in-depth analysis of Brexit helps us better understand the social, political and economic workings of our world.

[2] These issues are discussed in detail in *Halmai* (*2020a, b, c*).

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Report on the Lámfalussy Lectures Conference 2025*

Anita Németh – Ferenc Tóth

The 10th Lámfalussy Lectures, named after Alexandre Lamfalussy – 'father of the euro', prominent Hungarian-born economist and renowned expert on European finance – was held on 27 January 2025, organised by the Magyar Nemzeti Bank (the central bank of Hungary, MNB), with the title 'The Age of Geoeconomics: Evolution of Central Banking'. The event featured speeches and panel discussions with high-level decision-makers and global financial and economic experts. The conference ended with a celebratory roundtable discussion, at which former Lámfalussy Awardees discussed Lámfalussy's professional legacy and its relevance in the current economic environment. Two awards established by the MNB were also presented in connection with the conference: the Lámfalussy Award, named after the conference's eponym, was presented this year to ECB President Christine Lagarde, and the Popovics Award, named after the first Governor of the MNB, was presented to Csaba Kandrács, Deputy Governor of the MNB responsible for financial institutions supervision and consumer protection.

1. 100 years in the service of stability[1]

In his opening speech, MNB Governor *György Matolcsy* highlighted that the 10th edition of the Lámfalussy Lectures conference series was taking place 100 years after the establishment of the MNB. He praised the conference's eponym, Alexandre Lamfalussy, who – as a committed European and father of the euro – had done an exceptional job of stabilising the European economy and consolidating and integrating the continent. He noted that the creation of the European common currency served not only to promote economic stability, but also to build a peaceful and cooperative future. The euro could strengthen Western integration, guarantee peace and create opportunities for the single market. A single monetary policy could provide a more effective response to global economic crises. One of the leading topics of our time was geopolitics, and the birth of Europe was also the result of geopolitics. It determined our economy and our future. The question was how

* 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] The opening speeches can be viewed here: https://www.youtube.com/watch?v=t3s1D-2WNxM

the new waves of geopolitics would affect our economy and finances, and how the interaction between fiscal and monetary policy would develop. One of the key issues was the independence of central banks. Central banks must be independent of domestic and international financial markets, political parties, the media and the government, as the government also had an interest in ensuring that the central bank could work independently to combat inflation and maintain financial stability. We had to stand firm in preserving the independence of the central bank, because this was and could be the ultimate tool for fending off financial attacks from international financial markets.

2. Central Bank Independence in the 21st century

Christine Lagarde, President of the European Central Bank (ECB), delivered a pre-recorded speech as this year's Lámfalussy Award recipient. The central theme of her speech was the importance of preserving central bank independence in the current economic environment. Lagarde emphasised that central bank independence was crucial for maintaining stable and effective monetary policy, especially during periods of economic volatility. Independence ensured that central banks could focus on long-term objectives, such as price stability, without being exposed to short-term political pressure.

In her speech, she recalled that by the late 20th century central bank independence had become widespread around the world, partly due to the social consensus that emerged in response to the inflationary experiences of the 1970s. By the turn of the millennium, more than 80 per cent of the world's central banks enjoyed operational independence, and price stability had become the primary goal of monetary policy. Since then, the world had undergone significant transformations, and the factors underpinning central bank independence had come under increasing pressure. According to data cited by Lagarde, in the 2010s, 10 per cent of central banks faced political pressure every year, and between 2018 and 2020, central bank independence deteriorated significantly in countries covering 75 per cent of the world's GDP.

Political influence over independent central banks led to market volatility and increased the likelihood of various shocks and crises, while geopolitical tensions further amplified the frequency of such disruptions. However, Lagarde argued that the era of volatility was unlikely to undermine central bank independence. On the contrary, an unstable economic environment made independent central banks even more necessary. According to the President of the ECB, inflation expectations had remained stable even during recent inflationary shocks, demonstrating that the public continued to trust central banks' long-term commitment to price stability.

In her speech, Lagarde also paid tribute to Lámfalussy's work, highlighting his undisputed role in the formation of the Eurosystem and the ECB. His vision and foresight ensured that the Eurosystem was established with the proper structures and regulations, laying the foundation for the ECB's independence and effective functioning. Today, in an era of volatility, independent central banks were once again 'sailing in uncharted waters,' making it essential for them to safeguard their independence to effectively fulfil their price stability mandates.

3. The Decade of Geopolitics

Jeffrey D. Sachs, Professor of Economics at Columbia University, shared his thoughts on some key principles of the new global economy. He offered proposals for global adjustments to prevent further geopolitical crises. In his view, we were living in an apocalyptic era and were just 90 seconds away from a nuclear catastrophe.

Professor Sachs outlined the current challenges and his related proposals in several key points: the emergence of a multipolar world, the necessity of a new geopolitical approach and peace, the technological revolution, the environmental crisis and the so-called 'multicurrency' world. He emphasised that Europe needed a new, coherent geopolitical strategy and should reevaluate its relationships with China and Russia. He argued that instead of increasing military spending, diplomatic solutions should be prioritised. In his view, the ongoing technological revolution had two leading players, the USA and China, but for the sake of its international competitiveness, Europe should also strive to catch up in this field. He pointed out that Europe was still not unified and called for European cooperation, from space exploration to protecting the Arctic Circle. Sachs also addressed the risks posed by global warming. Citing climate scientist James Hansen, he warned that further increases in ocean temperatures could trigger a climate catastrophe, potentially pushing Europe back into an ice age. Regarding national currencies, he highlighted that the dominance of the US dollar was expected to decline within the next decade, and preparations should be made for the further internationalisation of the Chinese renminbi. In his closing remarks, Sachs praised Hungary for its contributions to global intellectual achievements, mentioning great minds such as John von Neumann, Leó Szilárd, the Polgár sisters, Ernő Rubik, Alexandre Lamfalussy, and Viktor Orbán.

4. The changing world economic order and the future of Hungary

Viktor Orbán, the Prime Minister of Hungary, expressed his appreciation of György Matolcsy's work. Thanking him for his efforts during his mandate as central banker, he called him an epoch-making economic politician. He praised Lámfalussy, who, as a Central European, played a key role in ensuring that the Central European

countries' accession to the European Union would be as smooth as possible. Lámfalussy assisted Orbán's work as an advisor and said that the introduction of the euro would bring with it a common fiscal policy for the eurozone members, but he did not say when; 25 years had passed since then and there was still no common fiscal policy. Lámfalussy also expressed criticism: without important steps, a situation would not be created where all members of the eurozone could benefit from the euro. Since the introduction of the euro, the productivity and competitiveness of the United States had been improving at a much faster rate than in the eurozone. In its current form, the euro favoured already strong and competitive economies, but it did not help the economies that were catching up to strengthen. It was precisely in response to Lámfalussy's admonitions that Hungary was not a member of the eurozone. The Prime Minister said about Jeffrey Sachs that he was the most prominent Western economist who had come to our region to help in the economic transition. They always agreed that Hungarians needed to connect with the whole world as soon as possible and as deeply as possible. Professor Sachs had always insisted that the world could be made a better and more peaceful place through free trade and cooperation and interconnection in the interest of all. Orbán used the term 'Hungarian consensus' instead of the previous 'Washington consensus', which meant that every nation had the right to consider itself as the centre of the world and the most important point of reference. Every nation, including the Hungarians, must seek the answer to the question of how it could ensure its survival and prosperity in this new world. In his opinion, the liberal era was being replaced by a sovereigntist era. Stability and security were of paramount importance, and the latter were becoming more valuable. Interestingly, the focus of this today was not the Ukrainian-Russian war, but rather migration. Nowadays, the security and stability of Western, primarily European, countries were determined by migration and its predictable consequences. Those who did not deal with this would not be able to find their place in the new world. The other important topic was the effective state: one of the great contests of the period ahead would be – or perhaps already was – the contest between state organisation models. The third key topic was connectivity-based foreign policy. The role of a country that could connect with everyone would increase. As a fourth key insight, he said that a strong middle class would be the key issue in the next 15–20 years. In the West, the European middle classes were shrinking, while in the East Asian world, huge social strata in the hundreds of millions were being brought into the middle class from below, creating not only stability but also economic prosperity for themselves. The Hungarian government had been working to create a strong middle class since 2010, with one million more people working today than in 2010. Micro-enterprises had doubled their revenues in ten years. Hungary was interested in peace. The success of the US administration's peace efforts was not ideological, nor even geostrategic, but was in Hungary's vital, everyday economic interest. Hopefully,

a grand US-Hungarian economic agreement would be concluded, which could give a boost to the Hungarian economy.

5. Panel discussion on the Geopolitical Tensions: The Decade of New Risks for Monetary Policy[2]

The first panel discussion that followed focused on new risks to monetary policy posed by vulnerabilities created by geopolitical tensions. The discussion was moderated by *Barnabás Virág*, Deputy Governor of the MNB. The participants were *Sylvester Eijffinger*, Professor of Financial Economics at Tilburg University and Visiting Professor of Economics at Harvard University; *Marcello Estevão*, Chief Economist at the Institute of International Finance; *Jacob A. Frenkel*, Chairman Emeritus of the G30, former Governor of the Bank of Israel; and *John Lipsky*, Senior Fellow at the Johns Hopkins School of Advanced International Studies, former Managing Director of the International Monetary Fund (IMF).

Barnabás Virág said that nowadays we were facing an extraordinary environment, with new types of crises and geopolitical tensions. We were living in an age of crises, which he called the age of transitions, as we could see transitions in many areas: the green transition, the digital transition and changes in demographic trends. In connection with all this, we faced great risks, but we also had many opportunities. His first question was *how the current environment was similar to the 1970s and early 1980s, and what were the most important differences and what were the most important conclusions for the world economy resulting from this extraordinary environment*. According to *Eijffinger*, financial markets had become more complex, digital currencies had appeared, and government debts had increased. As a solution, he mentioned adherence to the principles of central bank independence, which was the ability of central banks to enforce their objective function in policymaking, highlighting the importance of credibility. According to *Estevão*, we had learned from past experience that inflation expectations were important, the reputation of central banks mattered a lot, and transparency could be very useful, but fragmentation made the international coordination of monetary policy difficult. *Frenkel* asked not to throw away the old textbooks, because they would still be useful. We had learned in the past that supply shocks were extremely important and that they posed a great challenge to monetary policy, because it could not prevent or resolve them on its own. Many supply shocks were transmitted through the external sector, which was why geopolitics was of great importance. Budget deficits did not promote growth, but the debt problem was not only a problem of governments, as there was also private debt, and in many cases the differences were blurred because the public sector was trying to save the private sector. *Lipsky* highlighted that the

[2] It can be viewed here: https://www.youtube.com/watch?v=g7BMbVdWeSw

collapse of the Bretton Woods system not only triggered greater independence, but also posed greater challenges for central banks and gave impetus to the broader development of the world trading system and international capital markets, greater integration of the world economy in terms of trade, goods and services, and finance. In addition, technology had created an opportunity for financial integration that had not previously existed. For the first time since the 1970s, we thought that markets were closing in rather than opening up, and at the same time, technology indicated the opposite. This was a different challenge than before, but it was very real, full of opportunities and risks.

The next topic was *the future of globalisation*. The question was whether globalisation would continue to strengthen in the near future due to new technologies, digitalisation, or whether we needed to prepare again for a multipolar world, as we had experienced in trade before the 1990s. According to *Estevão*, people were much more focused on national problems these days, but international cooperation on issues such as climate policy, which was perhaps the greatest challenge of generations, was essential. It was much better to cooperate than to confront, but there would be less coordination in the future. *Frenkel* believed that the only thing a smaller country could do was to be flexible. To make sure that it was protected from shocks from the rest of the world. Although there was some movement towards fragmentation and deglobalisation, this did not mean that there was less interdependence. *Lipsky* noted that sanctions had resulted in a very inefficient, much more fragile and much more costly energy distribution, and there would be no winners in the end. *Eijffinger* raised the topic of the 3Ds: dis-savings, decarbonisation and deglobalisation. These processes, in his opinion, led to higher real interest rates, higher labour costs and inflation expectations, a greater degree of unpredictability and uncertainty, and thus a higher risk premium.

The next question was *what the future of the global monetary system could be in this geopolitical environment*. *Frenkel* considered the euro to be a success because it was able to survive its crisis 10 years ago, highlighting that supervision and regulation remained extremely important. *Lipsky* drew attention to the fact that the Draghi report showed a direct link between innovation, productivity growth, the financial system and the need to develop a deeper market. Europe needed to complete the banking and capital markets union. *Eijffinger* agreed with this, as this was a real key issue for the completion of the economic and monetary union. He highlighted that the most important message of the Draghi report was that it was necessary to discuss and decide how to finance innovation in the EU. *Estevão* underlined the importance of institutions.

Finally, *Barnabás Virág* asked the panellists for a short key message for today's central bankers. According to *Lipsky*, the trend in financial markets was moving away from traditional banking towards capital markets. In the past, central banks

had had less understanding of the facts and figures that were happening in the non-bank financial sector, which was likely to be important in creating financial stability in the future. According to *Eijffinger*, communication was of paramount importance in gaining public support for the independence of the central bank and its appreciation of its position. *Estevão*'s message was that central banks should stick to fundamentals, pay attention to supply shocks, and be transparent and professional. In his closing message, *Frenkel* highlighted the importance and fragility of capital and financial markets and that we should not ignore models, because even if they sometimes led us astray, this only meant that the past was very different from the future.

6. Panel Discussion on the Interaction between Fiscal and Monetary Policy[3]

The second panel discussion examined the ever-relevant question of central banking activities: the interaction between fiscal and monetary policy. The participants collectively emphasised the necessity of close cooperation between fiscal and monetary policy to ensure economic stability and growth. There was a consensus that the boundaries between fiscal and monetary policy had always been blurred, representing two sides of the same coin. The discussion also highlighted that central banks must address the financial risks of climate change, although tackling climate change itself fell outside their objectives and should remain within the jurisdiction of fiscal authorities.

The moderator, *Dániel Palotai*, Alternate Executive Director of the IMF, firstly pointed out that central bank independence was closely linked to the interaction between fiscal and monetary policy. He noted that excessive independence without cooperation with the government could harm a country's economy. Agreeing with this, *Alan J. Auerbach*, Professor at the University of California (Berkeley), stated that the boundary between fiscal and monetary policy had further faded in recent decades due to responses to global crises and challenges. He pointed out that high public debt posed a challenge for monetary policy in many countries, as monetary tightening increased debt servicing burdens and slowed GDP growth.

Jean Boivin, Managing Director of the BlackRock Investment Institute, emphasised that fiscal and monetary policies must collaborate to ensure economic stability. He highlighted that fiscal policy could play a greater role in stimulating the economy, particularly when monetary policy had limited room for maneuver, such as in the case of near-zero interest rates. However, he also warned that fiscal expansion must be sustainable to avoid jeopardising long-term financial stability.

[3] It can be viewed here: https://www.youtube.com/watch?v=4uwdl1EFRMw

Harold James, Professor at Princeton University, provided a historical perspective on the interactions between fiscal and monetary policy. He pointed out that poor coordination between the two policies in the past had led to economic instability. He emphasised the importance of communication and cooperation among policymakers to effectively address economic challenges. He also agreed with Professor Auerbach that while central banks and governments were more effective in stabilising the economy in the face of demand-side shocks, they were less effective in responding to supply-side shocks.

Representing the eurozone in the discussion, *Peter Kažimír*, Governor of the National Bank of Slovakia, stressed that in a monetary union such as the eurozone, coordination was crucial. He noted that national fiscal measures must align with common monetary objectives through compliance with shared rules, transparent communication and mechanisms such as the Stability and Growth Pact. He also emphasised the need to avoid fiscal dominance and pointed out that global economic challenges, such as rising energy prices, required further cooperation between fiscal and monetary authorities.

7. Roundtable discussion with the participation of previous Lámfalussy Awardees[4]

As part of the jubilee conference, a roundtable discussion was held in which previous recipients of the Lámfalussy Award discussed their personal connection to Lámfalussy and honoured the renowned economist's achievements. *Jacques de Larosière*, former Managing Director of the IMF and former Governor of the Banque de France, as a close friend of Lámfalussy, emphasised that Lámfalussy had recognised early on that a monetary union without a common fiscal policy could lead to instability, as differing economic policies could threaten the community in the long run. *Robert Holzmann*, Governor of the Oesterreichische Nationalbank, linked his own professional career to Lámfalussy's work, highlighting that as early as 1972, he was already engaged in simulations of European monetary integration. He applied his experiences both at the Austrian central bank and in addressing Hungarian fiscal and social security issues after the change of political regime of 1989. *Andréa M. Maechler*, Deputy General Manager of the Bank for International Settlements (BIS), stated that Lámfalussy's versatility – as a banker, professor and central banker – remained exemplary today, as a multi-perspective approach was essential for solving complex problems.

Ivo Maes, former Senior Advisor at the National Bank of Belgium and a researcher on Lámfalussy's life work, highlighted the foresight of the 'father of the euro',

[4] It can be viewed here: https://www.youtube.com/watch?v=IHZSpTPFNQ4

noting that as early as 2004, he had advocated for central banks' involvement in the prudential supervision of systemic financial institutions. He described Lámfalussy as an introverted, but strongly principled individual who firmly believed in European federalism and central bank independence. According to Maes, Lámfalussy's exceptional ability to assess situations and make sound economic policy judgments rendered him exemplary. *Ewald Nowotny*, former Governor of the Austrian central bank, recalled attending Lámfalussy's lectures as a young economist, finding him both a practicing banker and a brilliant mind. *Boris Vujčić*, Governor of the Croatian National Bank, recalled his 1998 meeting with Lámfalussy in Frankfurt, where Lámfalussy patiently and thoroughly explained the future functioning of the euro. He compared their operation, drawing parallels between the ECB and the former Yugoslav central bank, with the key difference being that the latter was not independent and operated within a confederal fiscal system.

Responding to a question posed by the moderator, Chief Advisor to the Governor, *György Szapáry*, participants expressed scepticism regarding the recent reform of the Stability and Growth Pact, which established fiscal rules. They emphasised that the credibility of fiscal rules was paramount: if major member states did not comply with the rules, smaller countries could not be expected to adhere to them either. *Vujčić* highlighted that the significant debt differences among eurozone members posed a challenge, necessitating fiscal tools that ensured long-term convergence. Regarding the prolonged creation of the European Capital Markets Union (CMU), several participants noted that while there was broad theoretical support, significant disagreements remained in practice, and due to harmonisation challenges, its near-term realisation was an illusion. On inflation prospects, *Maechler* stated that central banks had responded appropriately to high inflation and that a 'soft landing' remained realistic. However, she emphasised that technology – such as AI – was essential for understanding real-time exchange rate dynamics. *Nowotny* expressed concerns about potential deregulation in banking, warning that, as demonstrated by the 2008 crisis, this could have severe consequences. He also recalled Lámfalussy's strict regulatory approach, which was still worth following today.

Report on the 4th International Conference 'Digital Transformation and Sustainability in Global Financial Economics'*

Manuela Ender – Tim A. Herberger

On 16 September 2024, the 4th conference, 'Digital Transformation and Sustainability in Global Financial Economics', occurred at the IU – International University, Campus Munich, Germany. About 30 experts (mainly from Austria, Hungary and Germany) presented and discussed the latest findings on digitalisation and sustainability. A total of 14 research projects on this topic were presented, categorised into 5 sessions. Each presentation was followed by a co-presentation, which kept the conference lively and open for discussion and constructive feedback. The conference featured a wide variety of topics in the field of business administration, which are presented in detail in the following sections.

1. Initial Situation

Digitalisation and sustainability have become key drivers of innovation in the financial industry, transforming business models and risk management practices (*Herberger – Kuttner 2024*; *Herberger – Kuttner 2023*; *Herberger 2023*; *Herberger 2022*; *Herberger – Dötsch 2021*; *Herberger 2020*). One example of business model innovation is the rise of fintech companies, which leverage digital technologies to offer more efficient and personalised financial services. Technologies such as artificial intelligence (AI), blockchain and data analytics enable these companies to provide faster, more accurate and cost-effective solutions, challenging traditional financial institutions to adapt. AI has profoundly impacted the financial industry: it automates processes, reduces operational costs and improves decision-making by analysing vast amounts of real-time data. This technology empowers financial institutions to offer faster services, manage risk more effectively and enhance customer experiences with a more personal touch. Moreover, AI-powered tools are transforming areas such as fraud detection and credit scoring, allowing for faster and more accurate assessments of financial risks. Sustainability is also emerging as

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a key driver of digital transformation in finance. Financial institutions increasingly incorporate environmental, social and governance (ESG) factors into their strategies, leading to the development of new products and services promoting sustainability. For instance, green bonds, sustainable investments and ESG-driven funds are gaining popularity, as consumers and investors seek to align their financial goals with their values. Furthermore, integrating sustainability opportunities and threats into modern risk management and reporting processes is becoming essential (*Ender – Brinckmann 2019*; *Ender – Wimmer 2022*). Financial institutions must now assess how climate change, resource scarcity and other environmental risks might impact their portfolios. This requires sophisticated digital tools and models that accurately measure and report these risks, ensuring transparency and accountability.

Ultimately, responsible digitalisation is critical to the future of finance. Financial institutions must embrace technological advancements, ensure they are used ethically, follow sustainability goals and balance innovation with long-term societal and environmental impact. The potential of all these technologies is unquestionably enormous and reveals significant value enhancements for both customers and financial intermediaries. Nevertheless, where opportunities exist, there are usually risks, which can manifest themselves in different ways and be distributed asymmetrically among market participants. For example, insistence on old structures and habits and a willingness to actively help shape the transformative processes, little flexibility in terms of temporary adjustments required and the associated restrictions, misallocation of financial resources in the implementation of digital and sustainable transformation or regulatory ambiguities that can lead to significant inefficiencies. In this respect, conferences like the conference on 'Digital Transformation and Sustainability in Global Financial Economics' that try to feed scientific findings from practical financial research back into the economy and thus live the 'third mission' are so important.

2. Summary of the Presentations of the Conference

2.1. Session Strategies in Energy and Waste Management

The session opened 'Strategies in Energy and Waste Management' where *Marcel Tyrell*, *Jona Stinner* and *Maximilian Gill* (all University Witten/Herdecke) presented their work titled 'Bitcoin as a Catalyst for Renewable Energy: An Economic Perspective'. They explored the environmental impact of Bitcoin mining and its potential role in renewable energy. The energy-intensive mining process has been linked to significant environmental externalities. The speakers raised the idea of using excess renewable energy for Bitcoin mining, suggesting this could reduce CO_2 emissions, increase production utilisation and potentially incentivise further investment in renewable energy sources. They proposed that such an approach might positively impact the energy sector by creating demand for surplus energy.

However, they cautioned that while renewable energy usage in Bitcoin mining could lower CO_2 emissions, it would also increase electronic waste due to the additional mining hardware required. The presentation also explored potential regulatory solutions, such as a global Pigou tax on carbon-intensive energy to curb the environmental impact of mining. A global Pigou tax would ideally reduce both CO_2 emissions and electronic waste. By contrast, a unilateral tax would lead to a situation where mining activities shift to regions without such taxes, potentially increasing overall emissions. In conclusion, the presentation suggested that while Bitcoin mining could serve as a catalyst for renewable energy in the short term, its long-term impact may be counterproductive without comprehensive global regulatory measures.

Johann Eickenbrock and *Marcel Tyrell* (both University Witten/Herdecke) discussed in their presentation 'Are Stranded Asset Risks in the Energy Sector Overrated?' whether capital market risks associated with stranded assets in Europe may be overstated. Stranded assets refer to company assets that could lose value abruptly due to changes in policy, technology or market preferences. These risks are particularly high in the energy sector, where companies heavily dependent on fossil fuels may face significant asset devaluation as Europe moves toward a climate-neutral economy. To investigate, they conducted an event study analysing stock price reactions of European energy companies to three distinct events: the inclusion of natural gas and nuclear energy in the EU taxonomy in March 2021, the sabotage of the Nord Stream pipelines in September 2022 and a landmark ruling from the European Court of Human Rights in April 2024 on inadequate climate protection. They classified companies into three risk categories based on their dependency on fossil fuels, using metrics such as fossil fuel revenue dependency and emissions intensity to score each company. Following the 2021 EU taxonomy event, companies with high stranded asset risks did not show significant market reactions, suggesting that investors may not have perceived the event as a reactivation of existing stranded assets. By contrast, companies with medium and low stranded asset risks saw a significant negative response, possibly due to anticipated capital redirection towards natural gas and nuclear energy. The 2022 Nord Stream incident triggered a positive reaction among high-risk companies, with investors potentially expecting increased demand for fossil fuels given the pipeline disruptions. Lastly, the 2024 human rights ruling on climate protection saw a positive market response for companies with low stranded asset risks, indicating market confidence in firms aligned with low-carbon strategies, while high-risk firms showed no significant change. In conclusion, stranded assets do not pose a systematic threat to the energy sector, provided that the transition to climate neutrality is carefully managed.

In the last presentation of the first session with the title 'Success Factors of a Post-Merger Integration', *Antonia Wendel* and *Alexander Bull* (both IU International University) discussed the increasing number and volume of mergers and

acquisitions (M&A) globally, noting that despite their popularity, many M&A transactions do not achieve the desired outcomes. The presenters emphasised that the integration phase plays a crucial role in the success of M&A deals. They noted that companies face challenges such as coordinating complex processes, maintaining daily operations and addressing unforeseen issues, often exacerbated by cultural differences between merging organisations. To explore these challenges, the team conducted a case study on a German company's acquisition of a Dutch waste management company in 2019. They used expert interviews and a structured qualitative analysis to identify specific factors contributing to integration success. Their findings underscored the importance of measurable and controllable integration activities, visible and experienced integration managers, and pre-planned but adaptable integration processes. The study revealed that successful integration requires substantial resources, and a unified vision communicated to all stakeholders. Integration should proceed sustainably rather than as a rush to completion.

2.2. Session Current Transformation Processes in International Banking

The second session shifted the focus to 'Current Transformation Processes in International Banking'. In their presentation 'Implementation Strategies for Sustainable Transformation in German Banks', *Yanik Bröhl*, *Arnd Wiedemann* and *Philip Schwabecher* (all University of Siegen) examined how financial institutions play a critical role in financing sustainable projects and achieving the Sustainable Development Goals (SDGs). They analysed six sustainability reports from major German banks to uncover essential processes for implementing sustainability. They began with a materiality analysis, stressing the importance of identifying and prioritising sustainability topics within each institution. This involved evaluating impacts from both 'inside-out' (business operations' effects on people and the environment) and 'outside-in' (financial risks and opportunities related to sustainability factors). They emphasised the importance of defining strategic action fields based on these priorities and recommended establishing clear sustainability goals with measurable KPIs[1], which should be deeply embedded in each bank's overall business strategy. Robust governance structures were also suggested, including integrating sustainability criteria into executive management responsibilities and forming dedicated committees to oversee these initiatives. The team proposed aligning risk inventories, strategies and credit policies with regulatory requirements, such as those outlined in Germany's Minimum Requirements for Risk Management (MaRisk). By integrating sustainability risks into stress testing and engaging the executive board in managing these risks, banks can better align their risk management processes with sustainable objectives. They pointed out that

[1] Key Performance Indicators

by proactively adjusting their business strategies, banks could mitigate risks and contribute to achieving SDGs through their sustainability outcomes.

The presentation entitled 'The Need to Focus on Transformation Initiatives – Lessons from a Soccer Coach's Halftime Speech' by *Philip Schwabecher*, *Arnd Wiedemann* and *Selina Doreen Wagener* (all University of Siegen) explored how strategies used by soccer coaches during halftime can offer insights for corporate leaders managing transformation processes. They began by discussing transformation as an ongoing process involving fundamental changes in structures and practices, positioning banks as pivotal drivers of societal change. The analogy with a soccer coach's halftime talk highlighted the need for a clear focus in times of uncertainty, a crucial element often missing in corporate transformation efforts. Drawing from sports psychology and management literature, the presenters identified the halftime break as a pivotal moment for intervention and reorientation, much like the midpoint in organisational transformation. In this analogy, the coach represents the executive team, while the players represent the employees. During halftime, a coach's focus on critical issues, tactics adaptation and motivation use are instrumental in turning around a struggling game. Similarly, effective transformation leaders must conduct a precise analysis of past challenges and strengths, address any required tactical shifts and engage employees by reinforcing a positive outlook for the second phase of the transformation.

In the last presentation of the second session on 'Fintech and Sustainability in Mexico: Current Trends', *Claudia Nelly Berrones-Flemmig* (IU International University) examined how fintech innovations influence SDGs in the Mexican financial landscape. She highlighted Mexico's position as a regional leader in Latin America's fintech ecosystem. She cited notable growth in fintech revenues, driven largely by digital payments, lending and enterprise financial management advancements. Berrones-Flemmig identified specific projects within Mexico's fintech sector that align with various SDGs. She used a case study approach to structure her analysis, examining different fintech projects by their target group, primary objectives, educational impact and alignment with SDGs. She emphasised that fintech platforms empower SMEs and individuals through tools that facilitate accounting, financial literacy and access to credit. However, she also noted that many fintech platforms prioritise financial management over direct financial education, suggesting a service gap that could further enhance financial knowledge.

2.3. Session Challenges of Digitalisation in Finance and Controlling

After lunch, the conference resumed with two parallel streams, focusing on distinct but interconnected topics. The first stream, entitled 'Challenges of Digitalisation in Finance and Controlling', included a presentation by *Michael Kuttner* and *Markus Kathan* (both Salzburg University of Applied Sciences), who gave an overview of artificial intelligence's impact on controlling in finance. The presentation

'Controlling and Artificial Intelligence: A Review' introduced AI as a rapidly evolving technology that enables machines to simulate human-like thinking, learning and problem-solving processes. With its ability to automate routine tasks, such as data collection, validation and payment processing, AI presents opportunities to enhance productivity and reduce personnel costs in controlling functions. However, they also highlighted the limitations of AI, noting that it cannot fully replicate human skills such as critical thinking, emotional intelligence and professional scepticism, which remain essential in accounting and controlling. They pointed out challenges, including high initial investment costs, extended payback periods and a shortage of skilled professionals to manage AI systems. The presenters also discussed risks associated with data privacy, algorithmic errors and resistance among employees, who may perceive AI as disruptive in their roles.

In their presentation 'The Savings Behaviour of Private Households as a Factor for Sustainable Economic Growth', *Tatjana Nikitina* and *Maria Skalaban* (both National University for Economy of Sankt Petersburg) began by emphasising the role of household savings in supporting economic resilience and growth. Their study identified various factors affecting savings behaviour, including income levels, interest rates, inflation and access to financial markets. They also highlighted sociodemographic influences like age and education, and psychological factors, such as risk tolerance and future financial goals, as important determinants of how households choose to save. Nikitina and Skalaban compared savings instruments across Russia and Germany, examining cultural and structural differences in financial preferences. They found that German households tend to focus on long-term investments and favour diversified financial products, such as investment funds and pensions. By contrast, Russian households prefer liquid assets, like cash and deposits, due to higher interest rates and economic volatility. The researchers noted that state support, such as tax incentives and pension schemes, encourages savings in both countries, though the structure and impact of these programs vary significantly. They emphasised that developing financial literacy programmes could strengthen savings behaviour, especially in Russia, where there is growing interest but limited knowledge of investment options.

2.4. Session Management during Recessions

The second parallel stream, 'Management during Recessions', explored how companies can navigate economic downturns. In his presentation entitled 'Not for the Faint-Hearted: ESG High Performers in V-Phases', *Jörg Müller* (University of Technology Chemnitz) investigated the risk-return profiles of stocks with high and low ESG performance during stock market 'V-phases', periods characterised by significant decline followed by rapid recovery. He began by framing the importance of ESG considerations within asset management, where sustainable investing has gained prominence. He aimed to answer whether stocks from highly sustainable

companies (high ESG ratings) exhibit different risk-return behaviour compared to less sustainable ones in these volatile phases and, if so, which category is superior regarding risk-adjusted returns. The results revealed a significant difference in risk-return behaviour between high- and low-ESG stocks during V-phases. Stocks with lower ESG scores generally saw returns increase alongside rising volatility, making them more attractive to risk-averse investors. Conversely, high-ESG stocks showed decreasing returns with higher risks, suggesting they might be less appealing in these volatile periods. From a risk-return perspective, Müller concluded that lower-ESG stocks appear to outperform their high-ESG counterparts in V-phases.

In their presentation 'Analysis of Working Capital Management in Times of Crisis', *Martin Tettenborn* (Heilbronn University) and *Tim Herberger* (Andrássy University Budapest) analysed the shifting priorities in inventory and cash management among German industrial firms in response to recent global supply chain disruptions. They explained that while minimising inventory has traditionally been a focus for financial managers aiming to reduce capital costs, the pandemic, and subsequent crises have shifted priorities toward resilience over efficiency. As companies adapt to unpredictable conditions, many have moved from a 'just-in-time' approach to a more conservative 'just-in-case' strategy, maintaining higher inventory levels to mitigate potential shortages. The researchers reviewed the annual reports of nine publicly listed German industrial firms from 2019 to 2023, focusing on metrics such as inventory levels, material costs and revenue fluctuations. Despite revenue variations, inventory levels remained relatively stable compared to sales volumes, with most firms demonstrating proactive inventory management. The study found that in sectors such as automotive manufacturing, which faced severe shortages, companies managed inventory to balance supply constraints against demand fluctuations, particularly for essential materials like semiconductors. They suggested that companies maintain flexibility by adjusting working capital in response to current revenue needs rather than relying on a singular approach.

2.5. Session The Pillars S and G of Sustainability – Social and Governance

The conference shifted its focus to social and governance aspects of sustainability with the last session 'The Pillars S and G of Sustainability – Social and Governance' of the conference. *Christian Weiß* (Salzburg University of Applied Sciences) and *Katja Wiedemann* (DHWB Lörrach) began their presentation 'Promoting Social Sustainability through Personnel Development in ATX Companies' by examining the role of human resource development in advancing social sustainability within Austrian ATX-listed companies. They highlighted the concept of social sustainability as the least developed pillar of the triple bottom line, noting that it lacks a universally accepted definition and has been overlooked in both academic and corporate settings. Weiß and Wiedemann analysed corporate social responsibility and ESG reports from ATX-listed companies, examining how these firms implement

social sustainability practices through human resource development. They observed various measures in place, including job-specific training, leadership development and diversity initiatives to improve employee skills, well-being and inclusion. They outlined different methods, such as on-the-job training, off-the-job seminars, career planning and retirement preparation, which companies employ to support employee growth aligned with social sustainability goals. The presentation concluded with recommendations for companies seeking to enhance their social sustainability practices through human resource development.

Michael Kuttner's (Salzburg University of Applied Sciences) presentation with the title 'Differences in Social Responsibility between Family Businesses and Non-Family Businesses during the COVID-19 Crisis' examined the differences in corporate social responsibility (CSR) approaches between family and non-family businesses during the COVID-19 crisis, focusing on how these organisations adapted to unprecedented challenges. He highlighted that while the crisis impacted both types of businesses, family-owned companies faced unique threats to their survival due to distinctive characteristics and objectives, such as prioritising socioemotional wealth (SEW). He noted that family businesses often emphasise values like family influence, emotional attachment and reputation, which shape their CSR approaches and impact stakeholder relationships. Kuttner's study focused on ten Austrian companies. By conducting interviews with CSR managers and analysing corporate websites, he identified key differences in how these companies managed CSR initiatives. His findings revealed that family businesses tend to pursue long-term, relationship-focused CSR activities with employees, communities and stakeholders, which they see as integral to their resilience. By contrast, non-family businesses prioritised short-term, outcome-oriented CSR actions that directly addressed immediate stakeholder needs during the crisis.

The presentation 'Resilience of City Centres – Future-oriented Business Models in Urban Areas' by *Andreas Höhn* (Andrássy University Budapest) discussed strategies for developing future-oriented business models in urban areas facing significant transformation. He explained that, especially after the COVID-19 pandemic, city centres have been impacted by structural changes that challenge traditional business models. Despite various initiatives, there are still limited comprehensive recommendations for cities navigating these transformations. Höhn proposed using the Business Model Canvas to analyse and design simplified models for sectors such as retail and cultural industries and municipalities to address this. Through iterative testing, these canvas models could provide actionable insights into strategies for enhancing customer engagement and value creation in city centres. His analysis focused on eastern Bavarian cities within the Danube region, offering a cross-city perspective on urban resilience.

The last presentation of the day 'The Role of Corporate Governance in the Resilience of Publicly Listed Companies in Austria and Hungary in the Context of the COVID-19 Crisis' was given by *Tim Herberger*, *Boroka Pallagi* (both Andrássy University Budapest), *Christine Mitter* and *Julia Riepl* (both Salzburg University of Applied Sciences). They explored how various corporate governance practices influenced company performance during the COVID-19 crisis. They began by emphasising that resilience, an organisation's ability to adapt to rapid changes and pre-emptively address risks, is increasingly essential in today's volatile and complex environment. Their research centred on three main governance factors: board gender diversity, CEO age and ownership structure. Their findings indicated that companies with more gender-diverse boards demonstrated lower debt levels, aligning with existing literature that suggests women's risk-averse tendencies positively affect resilience during crises. Similarly, the data showed that older CEOs, with experience and knowledge, tended to lead companies with higher resilience, as measured by return on assets (ROA) before and after the crisis. Regarding ownership structure, family-owned businesses were generally more financially stable before the crisis. However, they exhibited a more significant decline in ROA during the pandemic, indicating that they may prioritise long-term stability over short-term profitability in crises.

The conference concluded with final remarks by *Manuela Ender* (IU International University), who summarised the key insights of the day and emphasised the importance of continued dialogue and innovation at the intersection of digital transformation and sustainability in the finance sector.

3. Concluding Remarks and Outlook

The day in Munich, with a facultative get-together the evening before, was characterised by an intensive discourse around digitalisation and sustainability in a global financial economy. The high volume of submissions, the diverse range of contributions and the significant interest in the conference highlight the importance of the topics. The insightful feedback from co-presentations by experienced researchers also offered opportunities to advance research projects further.

A conference anthology (*Herberger – Kuttner 2024*) on the conference in 2023 was published in German in November 2024 by Nomos Publishing, containing many of the papers presented at Salzburg University of Applied Sciences in Puch/Urstein in 2023. A corresponding anthology is also planned for this year's conference, which will probably be published in late summer 2025 and include many of the papers presented. The future of the conference is also secured, as it is expected to take place in September 2025 in Budapest at Andrássy University. A call will be published for papers in early 2025 (www.andrassyuni.eu/forschung/ausschreibungen-calls/aktuelle-ausschreibungen-und-calls).

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Green Finance and Sino-Hungarian Cooperation – Report on the Budapest Renminbi Initiative Conference*

Fruzsina Franciska Halász – Györgyi Puhl – Dávid Szabó – Zsófia Tamás-Szabó

On 23 September 2024, the Magyar Nemzeti Bank (the central bank of Hungary, MNB) hosted the Budapest Renminbi Initiative Conference for the eighth time. In order to strengthen good relations with China, the series of events launched by the MNB in 2015 was organised around two themes this year: the role of green finance in the internationalisation of the renminbi, and the present and future of Sino-Hungarian financial cooperation under the Belt and Road Initiative (BRI). The event, co-organised with Bank of China (CEE) Ltd., also commemorated the 75th anniversary of diplomatic relations between Hungary and the People's Republic of China. The distinguished national and international experts who spoke at the conference agreed that green financial cooperation is a key element of the Belt and Road Initiative, which is increasingly important in the development of Sino-Hungarian relations. China is supporting European sustainability ambitions and sustainable economic growth through green investment.

The event was opened by *Barnabás Virág*, Deputy Governor of the MNB. In his opening speech, Virág underlined that 2024 was a special year in two respects, as we celebrated the 100th anniversary of the founding of Hungary's central bank and the 75th anniversary of the establishment of Hungarian-Chinese relations. The increasingly close Hungarian-Chinese relations were well symbolised by the Budapest Renminbi Initiative proposed by the MNB and the related conference, which had contributed to deepening financial and economic relations in both Hungary and the Central and Eastern European region. In addition to the internationalisation of the renminbi, another key theme of the conference was the green sustainability transformation and green finance, in which both Hungary and China were leading the way. A key milestone was reached in 2021 when the MNB became the first central bank in Europe to include the promotion of

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environmental sustainability in its mandate. Under the MNB's Green Programme, a number of initiatives had been launched, such as the Green Mortgage Bond Purchase Programme and the Green Home Programme. Deputy Governor Virág also highlighted the Chinese Belt and Road Initiative in terms of Sino-Hungarian relations, which was the topic of the second panel discussion, noting that the Chinese initiative would make a significant contribution to Hungary's role as an economic bridge between the West and the East, as it would stimulate financial cooperation alongside trade and infrastructure development projects, with a particular focus on sustainability.

Chao Yang, First Officer of the Embassy of the People's Republic of China in Hungary, was the special guest at the event's opening ceremony, who praised the friendship between the two countries, which was further strengthened by the visit of Chinese President Xi Jinping in May 2024. In his opinion, we were living in a century of change, in which geopolitical tensions, the recovery of economies after the pandemic and deglobalisation all represented new challenges. China had always supported global economic development and growth, as well as globalisation and the stable functioning of supply chains through its international initiatives, such as the Belt and Road Strategy. International use of the renminbi (RMB) continued to expand, with the value of swap agreements reaching USD 593 billion by 2023 and cross-border clearing in RMB reaching USD 745.8 billion. In December 2023, the share of RMB in global payments reached 4.4 per cent, compared to 2.3 per cent in January. The ever-closer relationship between the two countries was well demonstrated by the fact that China had become Hungary's largest trading partner outside of the EU, and Chinese investments (BYD, CATL, etc.) had created more than 10,000 new jobs. As for the international use of the renminbi, he said that the use of the renminbi was being specifically encouraged among the countries of the East and East Africa.

The third keynote speaker at the opening ceremony was *Jingzhen Lin*, Executive Vice President and Executive Director of the Bank of China. In his speech, he praised Hungary's role in the internationalisation of the renminbi as a regional renminbi clearing hub. Hungary was the first country in the region to establish a renminbi clearing bank and issue green panda bonds. In his opinion, the two countries would be even more closely linked in the future, with direct working capital investment from China to Hungary having reached USD 8.12 billion in 2023. According to Lin, use of the renminbi was becoming more common thanks to regional economic, commercial and financial cooperation, the development of green finance and financial digitalisation. The Bank of China, building on the partnership between the two countries, would continue to work to promote the use of the renminbi in the international market, contribute to the development of green finance and support the realisation of its business opportunities in Hungary.

Latest results of RMB internationalisation – How is green finance promoting the RMB's presence in the global arena?

In the first panel discussion of the conference, the participants discussed the role of green finance in the internationalisation of the renminbi. In his opening speech, *Penghui Jin*, President of the Shanghai Head Office of the People's Bank of China, explained that the Chinese central bank was encouraging financial institutions in both countries to provide more RMB-denominated products, making it easier for companies in both countries to use the renminbi for trade and investment. The central bank also aimed to promote innovation and the use of green financial products, as well as to strengthen communication and cooperation on green financial products and green financial information to achieve green financial market connectivity.

The moderator of the panel was *Ádám Banai*, Executive Director of the MNB, responsible for monetary policy instruments, financial stability and foreign exchange reserves management. Among the panellists, he welcomed *Zoltán Kurali*, CEO of the Government Debt Management Agency, *Feng Li*, Deputy General Manager of the Industrial and Commercial Bank of China (ICBC) (Europe), and *Christoph Nedopil Wang*, Founding Director of the Green Finance and Development Centre at Fudan University.

Zoltán Kurali began by pointing out that the potential of the renminbi was significant and that, recognising this at an early stage, Hungary had already issued four panda bonds to date. With these bond issues, Hungary aimed to ensure its continued market presence in China. There was high demand for green bond issues in the local investment community, thanks in part to the close bilateral relations between the two countries. RMB also played an important role in diversifying Hungary's foreign exchange reserve portfolio. Feng Li then spoke about ICBC's strategy to support the development of Chinese enterprises in export markets, including green investments. To date, ICBC had established 419 overseas branches in 49 regions and countries. In Europe, they were present in 16 countries, with 3 branches in operation in the CEE region. ICBC's local presence not only enabled it to serve Chinese businesses, but also helped local European businesses to enter the Chinese market. Christoph Nedopil Wang gave a concrete example of how the internationalisation of the renminbi could support the green transition. Energy companies, such as Indonesian, Thai and Pakistani energy companies, were heavily dependent on transactions with Chinese suppliers, for example for the purchase of solar panels and batteries. In such cases, the internationalisation of RMB, in particular the use of Chinese financial instruments such as panda bonds, supported the financing of Chinese green technologies to be imported into the country.

The panellists pointed out that as China's global economic weight had increased, the renminbi's international weight had also intensified in recent years. However, RMB's weight in global payments was far below the weight of China's GDP in the global economy, but this gap also represented a huge opportunity. Chinese exporters were leading the global green economy and playing a dominant role, as they accounted for around 80 per cent of solar panels, wind technology, batteries and new energy vehicles; this potential generated further demand for the internationalisation of RMB and the use of green financial instruments.

The present and future of Sino-Hungarian financial cooperation under the Belt and Road Initiative

Hungary is one of the main pillars of the Belt and Road Initiative, which aims to strengthen Eurasian connectivity through infrastructure investments, green and digital projects, and financial and people-to-people links. During the second panel discussion of the conference, participants discussed the present and future of Sino-Hungarian financial cooperation in the framework of the BRI.

Kexin Li, CEO of the Bank of China (CEE) Ltd. in Budapest, gave an introductory presentation on the results of the Hungarian-Chinese cooperation and how the financial system could be shaped to meet the needs of future-oriented investments in China and Hungary under the umbrella of the Belt and Road Initiative. The CEO pointed out that in 2015 the Hungarian Branch of Bank of China had become the first RMB clearing bank in Central and Eastern Europe. In 2023, Chinese FDI in Hungary reached USD 8.12 billion. By the end of August 2024, the Hungarian branch of Bank of China had increased its RMB clearing volume by around 50 per cent on an annual basis and issued USD 500 million of sustainable development bonds under the BRI in 2024.

The panel was moderated by *Gergely Baksay*, Executive Director of the MNB, responsible for economic and fiscal analysis and statistics. Among the panellists, he welcomed *Hongcheng Li*, Assistant President of the Silk Road Fund (SRF), *Chengxiang Li*, Head of the RMB Business of Economics & Strategic Planning Department of the Bank of China (Hong Kong), and *Lin Zhang*, Senior Investment Manager of Contemporary Amperex Technology Co., Limited (CATL).

First, Hongcheng Li praised Sino-Hungarian relations, noting that SRF focused mainly on equity investments and also used various investment and financing instruments to support BRI projects. The fund invested in a wide range of areas, such as infrastructure, energy, industrial and financial cooperation. They aimed to ensure financial sustainability and prioritise support for green projects. At the end of June 2024, the Silk Road Fund had total investment of around USD 24.3 billion.

The SRF had set up a Sustainable Investment Committee to align sustainable investment with the international market and regulatory environment.

According to Chengxiang Li, the fact that the relationship between the People's Republic of China and Hungary had reached the level of an all-weather comprehensive strategic partnership, including in the financial field, would help strengthen relations between the two countries. Li pointed out that the Bank of China was the oldest Chinese bank, which had been present in Hungary since 1997 and since then several other Chinese banks had entered the Hungarian financial ecosystem. He praised the Hungarian government's Eastern Opening Policy and the fact that Hungary was one of the first countries to join the BRI. Li pointed out that Hong Kong had the world's largest RMB liquidity stock outside mainland China, with more than RMB 600 billion, and a significant proportion (about 70 per cent) of the world's RMB remittances were channelled through Hong Kong.

Lin Zhang explained that CATL was a world leader in new energy technologies and by the end of 2023 the company already covered 37.5 per cent of the global electric vehicle battery market. CATL aimed to promote the uptake of electromobility and efficient energy storage in Europe, in line with the European Union's green and sustainable ambition to achieve climate neutrality by 2050. In 2022, the company announced a EUR 7.3 billion investment project to build a battery plant with a capacity of 100 gigawatt hours (GWh). CATL took several factors into account when choosing Hungary as the location for the factory: On the one hand, the country had a long history and experience in the automotive industry; on the other hand, it had a well-developed logistics infrastructure, but most importantly, it had a welcoming, favourable investment environment. CATL was increasingly using renminbi in international transactions, thus supporting the internationalisation of the Chinese currency.

During the panel discussion, the speakers agreed that the internationalisation of RMB offered many opportunities for economic operators. Chinese companies could invest more easily in the region thanks to more diversified financing options, and by using the renminbi in their international transactions, they could reduce their dependence on other currencies and transaction costs, thus increasing their financial efficiency.

Following the second panel, MNB Deputy Governor *Barnabás Virág* stressed in his closing remarks that we were living in an era of great transformation, which represented both a challenge and an opportunity. For the banking sector, green finance and digital finance may be the solution – being not just new megatrends, but transforming our lives. The nations, companies and societies which were the first to benefit from these transformations would be the most successful.

In addition, the Deputy Governor of the MNB emphasised that deglobalisation was not the answer to the challenges of the global economy and that success required joint, innovative work.

The full event can be viewed on the conference website: https://www.mnb.hu/en/the-central-bank/conferences/budapest-renminbi-initiative-conference-2024

Report on Some of the Sessions of the 2024 HEA Congress*

Ferenc Tóth – Benjámin Nagy – Emese Kreiszné Hudák – Gábor Szarka

On 5–6 September 2024, the town of Nyíregyháza hosted the 62nd Annual Congress of the Hungarian Economic Society (HEA), one of the most important annual conferences for the Hungarian economics community that has significant traditions. György Matolcsy, Governor of the Magyar Nemzeti Bank (MNB), gave a presentation at the opening plenary session. In this report, we provide an account of the roundtable discussions of bank leaders, as well as the Monetary Policy, Competitiveness, and Sustainability and Corporate Competitiveness sessions.

Roundtable discussion of bank leaders

At one of the most prominent, well attended and popular sessions, the *roundtable discussion of bank leaders,*[1] *Pál Péter Kolozsi,* Director of the MNB's Monetary Policy Instruments, Foreign Exchange Reserve and Risk Management, gave a welcome speech as the President of the HEA's Financial Section, highlighting the 100th anniversary of the MNB's establishment. Afterwards, *Barnabás Virág,* Deputy Governor of the MNB, member of the Board of the Competitiveness Section of the HEA and moderator of the discussion, gave an introductory presentation entitled 'The situation of the domestic economy and banking system in the midst of the storms of the 2020s', presenting current economic environment. In many areas of life, he considered the present decade – full of crises and war – to be a decade of great transitions. The key question was who could best respond to the challenges of transition, because the banks, companies and economies that were able to do so would be the successful ones. First, he gave an international macroeconomic snapshot, showing that so far European economies had been the losers in this period of major transitions, while China and the US had returned to trend-like growth more quickly. Regional disparities may persist in the coming years to the detriment of Europe. The global inflation wave seemed to be subsiding, but at the

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[1] The discussion can be viewed here: https://www.youtube.com/watch?v=qUypdgEDWJA&t=316s

same time we were experiencing crises with unemployment at historically low levels, which was a new element. In the 2020s, the situation within Europe had reversed, with growth accelerating in Southern Europe and slowing in the Northern region and Central and Eastern Europe (CEE). Countries integrated into the German production chain were particularly suffering. In addition, CEE faced challenges such as high energy intensity and the aforementioned tight labour market, while access to finance had become more expensive, with each economy having to pay its own risk premium. As Hungary's region was close to the war zone, the premium was higher here than in the 2010s and in more distant regions of the EU. Hungarian economic policy should therefore focus on reducing this premium. His presentation focused on three key issues: inflation and its consequences, consumption developments and the slowdown in investment. Inflation had been brought down for the time being, but we still could not be satisfied; furthermore, a significant proportion of households were not yet feeling any improvement. Consumption figures were in line with regional data, with consumption up by 8 per cent versus 2019, but rising by only 2 per cent in the EU. The big question was how much of this consumption was realised domestically and how much abroad, often through digital channels where there was no VAT revenue. At the same time, Hungary was a structurally low-consumption economy, even for its level of development. There was no economy where you could demand both a high consumption rate and a high investment rate. Investment in Hungary had fallen substantially and was broadly below the regional average over the past year and a half. This trend had to be reversed. The Hungarian economy needed stability, confidence and predictability. The banking system had performed well. In terms of profitability, its return on equity had improved by around 10 percentage points, putting it among the best in Europe, and the share of non-performing loans had declined. Domestic corporate credit dynamics had moderated, but were close to the regional average. Unfortunately, there was a marked jump in terms of fraud in the digital space for both card payments and remittance in 2023. The MNB was actively working to prevent fraud, with the launch of the artificial intelligence-based, real-time, centralised fraud detection system on 1 July 2025. In addition, from 1 September 2024, a completely new, domestic, secure mobile payment solution based on the instant payment system, the qvik, a QR code payment system, had been launched and made available to all consumers, free of charge and free of financial transaction fee, which also offered merchants a significantly cheaper solution than before.

This was followed by a roundtable discussion, with the participation of *Ádám Egerszegi*, Deputy CEO of MBH Bank Nyrt. responsible for digitalisation and operations, *László Harmati*, Retail Deputy CEO of Erste Bank Hungary Zrt., *Éva Hegedüs*, Chairman and CEO of GRÁNIT Bank Zrt. and Secretary General of the HEA, *Pál Simák*, Chairman and CEO of CIB Bank Zrt., and *László Wolf*, Deputy CEO of OTP Bank Nyrt. and Vice President of the HEA.

The bank executives discussed the issue of lack of demand. This decade was forecast to see the lowest global GDP growth since the Second World War. The current decade was not only about digitalisation, but also about the proper use of artificial intelligence. There were banks where a significant proportion of card transactions were online purchases, and around 50 per cent of this volume was spent at foreign merchants. It was not consumption that has fallen, but domestic trade, and cross-border trade and the turnover of foreign online shops was increasing. Household capital exports had also accelerated. The declining interest rate path had helped to kick-start retail lending growth, with mortgage lending expanding significantly (although it had fallen slightly in recent months, but on average was still approaching earlier peaks in 2024). Overall, the outlook for retail lending was positive. There had been a strong increase in unfunded personal loans, one reason being that digitalisation was much stronger here, which had made it easier to access effectively. The other reason was that there had been a massive, deferred purchase of consumer durables, which was now being financed by loans. Another incentive was to smooth consumption, which could now be done with a much lower interest rate loan. Further improving the credit infrastructure and speeding up credit approval could play a very important role in deepening retail credit market. Growth in corporate lending had been limited, with a strong increase in the share of foreign currency loans, but this had been at a natural collateralisation level. The recovery of corporate lending required confidence and predictability, which was not only a question of interest rates, and the system of guarantees and subsidies should also be rationalised. Overall, credit quality was currently good in all segments, with a low ratio of non-performing loans, no material risks, and only the drought could have some negative impact in the agricultural sector. In respect of savings, it was noted that Hungary had traditionally had a high savings rate. This decade was about the democratisation of investment, with investment banking now managing not only the wealth of the rich, but also smaller savings. Household savings were typically held mainly in mutual funds and to a much lesser extent in deposits. Investing in government bonds was also noteworthy. Here, banks were facing a draining effect, as more and more people were transferring their savings to the Hungarian State Treasury. At the same time, there was a significant layer of people who do not have any real savings. Raising the financial transaction fee and introducing a currency exchange fee involved a significant risk that foreign financial fintech providers could gain a bigger role and that part of Hungarian savings could flow abroad. The Hungarian banking sector could not do anything about this, as it was in an uncompetitive position vis-à-vis foreign service providers. As regards profitability, on the very day of the panel discussion, it was announced that the consolidated profit of the banking system in the first half of the year had amounted to HUF 972 billion. Bank executives believed that the introduction of the financial transaction fee could lead to significant losses in the second half of the year. The extra profit tax would be more burdensome for some banks, but overall the banking

sector was still expected to end 2024 with a significant profit. From an economic policy perspective, the high profitability of the banking sector was welcome, as growth and economic development could only be achieved if banks were able to support the expansion of the business sector.

Monetary policy section

The Monetary Policy section focused on understanding central banks' responses in the turbulent economic environment of the challenging 2020s.[2] The session was opened by *Előd Takáts,* Chairman of the Monetary Policy Section of the HEA, Advisor to the Bank for International Settlements (BIS), Professor and Rector Emeritus of the Corvinus University of Budapest and Visiting Professor at the London School of Economics and Political Science (LSE). In his opening speech, he stressed that the objective of monetary policy was to create and maintain confidence in money, and as such it was one of the foundations for the proper functioning of society and the economy.

In his opening presentation, *Zoltán Jakab*, Chief Economist at the International Monetary Fund (IMF), examined the extent to which the current high inflationary environment globally had been caused by expansionary monetary and fiscal policies in the United States and the euro area. The results showed that these macro policies, along with steepening Phillips curves, had had a detectable impact on inflation in 2021 and 2022, especially in the US.

The roundtable discussion following the presentations was joined by *Ádám Banai,* co-Chair of the Monetary Policy Section of the HEA and Executive Director of the Magyar Nemzeti Bank, responsible for monetary policy instruments, financial stability and foreign exchange reserves management, and *Piroska Nagy Mohácsi,* Visiting Professor at the LSE and former Head of Department and Advisor to the IMF. The discussion was moderated by *István Madár,* member of the HEA Board and senior macroeconomic analyst at Portfolio.hu.

According to *Előd Takáts*, the world's central banks had been raising interest rates in synchrony in response to the global inflation shock, although he noted that developing countries had reacted faster to rising prices than developed ones. He said that the period in which the inflation-targeting regime was established and the decade before the coronavirus pandemic and its global economic environment differed sharply from the environment that had been emerging in the 2020s. Along with the dominance of the USA, the earlier period was characterised by globalisation, integrated value chains, rising global labour supply and demographic trends pushing down trend inflation, resulting in low inflation. In recent years, these

[2] The session can be viewed here: https://www.youtube.com/watch?v=s6ptKPUxOaE&t=2s

structural trends had reversed, putting upward pressure on inflation globally. Central banks needed to ensure price stability in this changed environment, with its multiple structural challenges, in the face of bloated balance sheets and accumulated losses from previous crisis management. Climate change impacted financial stability through physical and transition risks. The central banks' actions were determined by the mandate, which may require different roles for each country. In addition, he said that the issue of digital central bank currencies could also be worth exploring, in particular how such an innovation could contribute to the fulfilment of central banks' mandates, especially in terms of preserving public confidence in money.

Ádám Banai stressed that in addition to high inflation, the economic effects of the string of crises, the global pandemic, the Ukrainian-Russian war and the energy crisis of recent years had severely undermined business and consumer confidence, which may take a long time to recover. He also expressed that the shocks of recent years had highlighted the need to think much more broadly as a central bank, to monitor not only real economic and financial market developments, but also the risks arising from geopolitical conflicts, commodity market developments resulting from technological change, or the globalisation of commodity markets through online platforms. He stressed that central banks had a responsibility to mitigate the effects of climate change, as increasingly extreme climate events had inflationary effects, for example through food price volatility, and due to the financing need of the green transition, it was necessary to build incentives into the financial system to mobilise resources towards green investments.

Piroska Nagy Mohácsi pointed out that in a turbulent economic environment, with high and volatile inflation, central banks had a credibility deficit to change their monetary framework and move to a higher inflation target. In her view, the Fed's move to average inflation targeting had also contributed to the increase in price dynamics in the US. She also pointed out that, in addition to monetary policy, market structures and the intensity of competition had also influenced price dynamics. She highlighted the negative consequences of central bank asset purchase programmes: central banks had significantly influenced market developments and financing conditions, and had accumulated losses as a result of asset purchases, among other things, which could cause them credibility problems. She suggested that a formal mechanism be established to provide an indication of the market conditions under which a central bank asset purchase programme should be launched and stopped. She expressed concerns about the central bank's targeted green asset purchase programmes, but also highlighted that climate change had implications for financial stability and that financial system participants should be encouraged to manage these new types of risks. She also stressed that central banks should actively work on the development of a stand-alone digital currency, as this would help them to preserve their monetary sovereignty in the future.

Competitiveness section

The Competitiveness section of the HEA examined the topics of human capital, innovation and productivity.[3] The event was moderated by *Gergely Baksay*, Executive Director of the MNB and President of the Competitiveness Section of the HEA, who said in his introduction that amidst the changed circumstances of the 2020s, a competitiveness revolution was needed in order for Hungary to continue its success from the previous decade. The presentations of the session covered first the training of human capital and then the combination of human and material capital embodied in innovation, i.e. all of the factors of the model of knowledge, talent, technology and capital,[4] defined by György Matolcsy, Governor of the MNB.

György Szapáry, Chief Advisor to the Governor of the MNB, addressed the issue of sustainable teacher supply in public education.[5] Ensuring sufficient numbers of teachers was a challenge for many reasons. On the one hand, the number of students enrolled in teacher education had decreased by about one quarter between 2020 and 2023 compared to previous years, and on the other hand, there were a number of students leaving this career both during and after their training. The age pyramid of teachers was characterised by ageing. Over the past two decades, the proportion of teachers over 50 had doubled (from 23 per cent to 47 per cent), while the proportion of young people starting their careers had fallen from 15 per cent to 7 per cent.

In order to train and retain sufficient numbers of teachers, György Szapáry presented several possible solutions in his presentation. In particular, a fair remuneration system and teacher incomes of stable value, as well as a reduction of the burden on teachers, could contribute to a sustainable increase in their numbers. Past experience showed that a career in teaching was an attractive option for young people, with a predictable salary structure. With the introduction of the teacher career path model in 2013, the number of applicants for teacher training increased significantly, while the number of those choosing to enter the profession had also decreased, as the pay increases had not been implemented. As a result of the wage increases that had been introduced, the salaries of Hungarian teachers had risen significantly: while in 2022 the average salary of a teacher was 58 per cent of that of a general employee with a degree from tertiary education, in 2024 it was 72 per cent. The government had set a target for teachers' salaries to reach 80 per cent of the average graduate salary by 2026. In line with this, continued pay increases,

[3] The session can be viewed here: https://www.youtube.com/watch?v=O2aMOIYUeMM.
[4] https://novekedes.hu/mag/matolcsy-gyorgy-a-4t-modell
[5] The presentation is based on a discussion paper published by the experts of the Magyar Nemzeti Bank, whose authors are György Szapáry, Péter Asztalos, Donát Kim, Nándor Marmoly and Ákos Szalai. The study can be downloaded from: https://mkt.hu/wp-content/uploads/2024/06/Javaslatok-a-pedagogusok-utanpotlasanak-biztositasa-erdekeben_2024_clean.pdf

differentiated pay increases for teachers in the most disadvantaged settlements and fine-tuning of the reward and promotion system could also help to sustainably increase the number of teachers. Additionally, non-financial incentives also played an important role: reducing the workload for teachers, for example by increasing the number of support staff, and better communication between school district centres and schools could also make a real difference in teachers' working conditions.

Péter Szatmári, Deputy Rector for General and Development Studies at Milton Friedman University, presented the changing higher education ecosystem. He noted that there were currently nearly 300,000 students in Hungarian higher education, with 63 institutions under mixed ownership, including 21 model-switching institutions. There were 40,000 foreign students studying in Hungarian higher education. However, the drop-out rate of 15–20 per cent of students was a challenge, with an increasing number of cases of competence problems. New students could be supported on the hand by improving public education, and on the other hand by training of universities in learning methods and other skills for new admissions. Another long-term challenge for higher education, as for public education, was the ageing and replacement of teachers. Career progression structures could play an important role in addressing this: sabbatical leave could be a solution, and in model-shifting institutions, additional rewards could be provided through performance appraisal systems. The graduate career tracking system had an important role to play, and it was also worth finding out whether graduates found employment in their field of study. Regarding the competitiveness of higher education, Péter Szatmári explained that Hungary had seven universities that were regularly included in international rankings, but more institutions should be included in the future.

Bianka Horváth, Senior Adviser to the Governor of the MNB and Associate Professor at METU, presented the value creation potential of the high-tech sector and artificial intelligence (AI). In the 2010s, economic growth had been supported by three factors: rising employment, rising investment rates and productivity improvements. Of these, productivity improvements may have been the most important factor in this decade, and investment in human capital and technology would therefore play an increasingly important role. Companies in high-tech industries were more resilient to crises, more independent of economic cycles and had higher returns than other industries. Spending on innovation and research and development (R&D) was closely correlated with productivity. Nowadays, the highest value-creating capacity was represented by high-tech industries: in Hungary and the regional countries, the pharmaceutical industry, the info-communications sector and the creative industries (including most importantly software development) had the highest labour productivity. However, there was large variation in labour productivity in the leading sectors between countries and between companies

within countries. The next wave of productivity improvements was expected to be related to artificial intelligence. The key to success was how effectively and quickly countries and companies could adapt AI technology. The IMF calculated that artificial intelligence could affect up to 40 per cent of jobs in developed countries. AI was not a substitute for, but in most cases a complement to, existing tasks. The professions of the future would require complex skills, creativity and technological knowledge. Therefore, raising the digital skills of the population was an important factor in increasing competitiveness. To reap the benefits of AI, we also needed to be aware of the risks. If cybercrime were a national economy, it would be the world's third largest economy, according to IMF calculations. It was important to look at AI as an opportunity, while identifying risks and constraints.

Magdolna Csath, PhD member of the Hungarian Academy of Sciences, former member of the National Competitiveness Council and Vice-Chair of the Innovation Section of the HEA, reviewed the relationship between innovation and productivity competitiveness. In her introduction, she recalled the Pareto principle, according to which the majority of results, up to 80 per cent, were achieved with 20 per cent of the costs. As the most commonly used competitiveness indicator was a composite index, it was worth focusing on those sub-indicators that had the most impact on Hungary's competitiveness position. GDP per hour worked was substantially lower in the Visegrád countries than in Austria. Hungary's productivity as a percentage of the EU average was the 7th lowest in 2023 and only amounted to 60 per cent of the Austrian average. One of the most important components of productivity was how productive each sector was. In Hungary, the pharmaceutical and chemical industries had high productivity, but accounted for just 0.9 and 1.4 per cent of the total economy, respectively. Productivity and innovation were also low in the sectors that dominate Hungary's economic structure (food, automotive). In terms of productivity, Hungary was less evenly matched across industries than Austria. In Hungary, the highest chemical productivity was ten times that of the lowest value-added hotel and catering sector, while in Austria the difference between the highest and lowest productivity was 5.5 times. In Hungary, the share of innovation and knowledge-intensive jobs was low in the total workforce. Overall, the role of small, but highly productive and innovative sectors in the Hungarian economy should be strengthened in order to boost competitiveness.

In his presentation, *Gergely Baksay* compared the economic growth of the United States and the European Union over the past 25 years. The main conclusion of the presentation was that the source of the persistent US growth surplus compared to the European Union had been faster productivity growth. This was almost entirely driven by digitalisation and the performance of the info-communications sector (ICT). Labour productivity in the ICT sector had increased fivefold in the United States over the past 25 years, while in the European Union it had less than doubled

over the same period. Moreover, in the US, not only the productivity of the sector but also the number of employees had grown much more dynamically. The digital revolutions of the last 50 years could be divided into four main parts: the first wave was personal computers, the second wave was driven by the internet, and in the third wave the spread of mobile phones and smart devices was the basis for the technological change. The fourth technological phase, which was now beginning, would bring us the era of artificial intelligence (AI). The EU had missed out on the waves of the digital revolution in the past and the same thing seemed to be happening in the field of artificial intelligence. AI had emerged in the US, and it appeared that US companies may be its beneficiaries. US companies led the ranking of the largest technology companies by capitalisation. The EU did not lag significantly behind the US in ICT investment, and in some European countries (such as Estonia, Sweden and the Czech Republic) it even exceeded the US, but the latter was still much stronger in bringing developments to market, with a much higher penetration of venture capital as a key factor.

Sustainability and business competitiveness section

Richárd Végh, CEO of the Budapest Stock Exchange and President of the Sustainability Section of the HEA, welcomed the participants at the full-house event.[6] In his keynote speech, he stressed that the success of the green transition depended on technological innovations and their effective deployment, which would require huge financial resources. Capital markets played a key role in financing the green transition and could provide a solution to raise the necessary funds. He estimated that to meet the EU's targets, 8 per cent of GDP should be spent on sustainability every year. Another important role of capital markets was to mitigate risks, which could help green investments to take place. In his introduction, he also stressed the need for listed companies to develop strategies in response to climate change and ESG challenges. To achieve economic sustainability, it was essential for companies to put innovation into practice from a profit-driven perspective. He concluded by pointing out that Europe was lagging behind in the development of capital markets, especially compared to the US and Asia, and that capital market reforms were needed for a successful green transition.

Diána Ürge-Vorsatz, physicist, climate scientist and Vice-Chair of the UN's Intergovernmental Panel on Climate Change (IPCC), began her presentation by stressing that sustainability issues, especially climate change, had a direct impact on our daily lives and competitiveness: the world's infrastructure was built on a climate that no longer existed, and we were experiencing this in our daily lives. Competitiveness and sustainability could not be separated. Climate change was

[6] The session can be viewed here: https://www.youtube.com/watch?v=9fnYfLJzu-0

already having a severe impact on our economies and if we did not act effectively to combat it our competitiveness would continue to deteriorate. The only way to remain competitive was to put in place effective climate protection measures, because climate impacts could significantly limit human life and economic activity in the future. Addressing climate change must be seen not only as an environmental imperative, but also as an economic one. Without innovation and the right climate action, our infrastructure, economy and competitiveness were at significant risk, and thus tackling change could not be delayed any longer.

Csaba Kandrács, Deputy Governor of the Magyar Nemzeti Bank responsible for Financial Institutions Supervision and Consumer Protection, and Member of the Sustainability Section of the HEA, emphasised that in order to raise awareness, it was important to understand the importance of sustainability and for everybody to take steps in their own specialist field. In addition to GDP, new metrics were needed to truly assess sustainability. The Hungarian central bank had also developed sustainable GDP indicators and wanted to see an increase in the share of green financing. In addition to the introduction of new green financial products, the protection of biodiversity was also a priority and efforts to achieve green goals must continue.

Zsófia Beck, Managing Director & Partner, Regional Energy Industry, Boston Consulting Group, highlighted the importance of the energy industry and the energy trilemma, stressing that energy security, sustainability and competitiveness needed to be balanced. The energy crisis and the invasion of Ukraine had created a new situation. Europe had become more focused on security of supply, trying to find solutions at national level, when some issues could have been solved at the European level. Investment in sustainability had not stopped, but the costs had increased dramatically. In addition, the issue of competitiveness had also come to the fore and we needed to consider what was worth investing in. She also showed that significant financial resources – some estimates put the figure at EUR 1,000 billion – were needed to expand the energy mix and renewable sources. Regarding the situation in Hungary, she mentioned the increasing demand for electricity, which was an important factor in the context of both industrial investment and sustainability objectives. Financial and technological commitment, as well as effective infrastructure development, were essential to achieving Hungary's sustainability goals while maintaining its competitiveness.

Anikó Raisz, State Secretary for Environmental Affairs and the Circular Economy at the Ministry of Energy, focused on the social importance of sustainable development and the circular economy. She stressed that achieving sustainability between social, economic and environmental interests was a huge challenge, relevant for present and future generations alike. Moving to a circular economy, she noted that, given the permanence of materials, the exponential increase in waste was unsustainable

and had become a global problem. She mentioned that there were also positive steps towards sustainability in Hungary, such as waste collection and recycling of secondary materials. A shift to a circular economy was essential and the costs of waste management for future generations should not continue to be borne by taxpayers. Coordination at national level and the involvement of the private sector were essential to achieve the sustainability goals. At the end of her presentation, she mentioned that the creation of industrial symbiosis areas, where one company's waste could be another's raw material, might represent be an important step towards improving sustainability and competitiveness.

The panel discussion following the presentations was moderated by *Rita Szalay*, Director of ESG Services at PwC Hungary. The panellists were *Attila Chikán Jr.* (Chairman and CEO of Alteo Nyrt.), *Károly Mátrai* (CEO of MVM) and *Szabolcs Tóth* (Deputy CEO of Waberers Nyrt.).

Participants stressed that sustainable development was an important task not only for governments, but also for individuals and companies, and that all stakeholders had to take responsibility for protecting the environment. Last year, MVM Zrt. had adopted a new strategy, one of the central pillars of which was the green transition. The goal was to achieve carbon neutrality in their production by 2035, and to this end the company was planning to spend around EUR 34 billion on green investments over the next decade, including digital switchover and grid development. ALTEO Zrt. had been addressing sustainability issues since its foundation two decades ago, which was not only an obligation but also a competitive advantage. As a market leader in logistics, Waberers had a significant environmental footprint in the transport sector. The company was continuously investing to reduce its emissions and offer alternative, zero-emission solutions to its customers. Customer interest in such green services was low and prices could be higher, limiting the spread of green investments.

The second question of the panel discussion looked at the changes in sustainability practices and industry shifts in the recent past. Achieving ESG certification was a key objective for MVM, which was why the company had taken significant steps towards a green transition. MVM already produced 87 per cent of its electricity carbon neutrally and had set ambitious targets for increasing the use of renewable energy sources. For Alteo, in addition to improving its ESG rating, the issuance of green bonds had also enabled a significant expansion of renewable capacity. Technological progress created huge opportunities but also challenges, such as emission reduction obligations. The transport sector was responsible for significant emissions, but with a focus on sustainability, Waberer's offered alternative, zero-emission solutions. In addition to current innovative technologies, traditional methods also played an important role, and improving operational efficiency was a priority to reduce environmental impacts.

The panellists agreed that sustainability efforts were necessary not only for companies, but for all levels of society. A commitment to sustainability was not only an obligation, but also a competitive advantage in today's market environment. Responding to ESG challenges would be essential for companies in the future, with technological advances and responsible business behaviour as key drivers.

The panel concluded by asking where companies felt the greatest pressure to move towards sustainability and the costs of compliance or non-compliance. The pressure was coming from many directions: regulators, consumers and investors. The biggest problem, however, was the financing side, as some banks had already indicated that they would not finance certain fossil investments, such as natural gas-based projects, after 2030. Natural gas was essential for the stability of the energy system, especially in balancing renewable energy sources. It was therefore important that the financial sector continue to support these investments. Obtaining ESG certification not only brought prestige, but also generated investor interest, which had a positive impact on the company's share price. In addition, compliance with the EU taxonomy was an advantage in loan financing. In the transport sector, electric vehicles were not yet widespread, as technological breakthroughs alone were not sufficient; a market environment was needed where they pay off. The increase in external costs such as fuel prices or road tolls could be a key driver for the wider spread of sustainability solutions in the near future. Overall, all three participants agreed that the pressure for sustainability was increasing from all directions and that there could be business benefits from compliance, but that in some sectors, such as energy and transport, financing and market conditions also played a critical role, alongside technological solutions.

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Manuscripts should be submitted in accordance with the following rules:

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- The unnumbered footnote of the author's name contains his/her position, the institution the author works at, his/her email address and any other relevant information and acknowledgment regarding the article.
- Papers always begin with an abstract which should not exceed 800–1,000 characters. In the abstract a brief summary is to be given in which the main hypotheses and points are highlighted.
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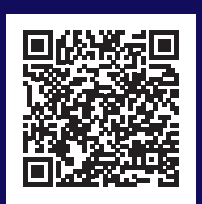

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