3 FINANCIAL AND ECONOMIC REVIEW

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3

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Contents

Vol. 20 Issue 3, September 2021

STUDIES

OUR VISION

ARTICLES

Challenges of the 21st century

Market megatrends

BOOK REVIEWS

Investors' Reactions to Extreme Events in the Hungarian Stock Market*

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This paper examines investors' reactions to extreme events in the Hungarian stock market. We seek to answer the research question whether following extreme events any overreaction of investors can be observed on the Budapest Stock Exchange. With a view to answering the research question, we identify extreme events based on extreme returns on the market portfolio and then – using an event study – we examine abnormal returns on winner and loser equities. After examining investors' reactions, we inspect the performance of the contrarian strategy in the created event windows. The main result of our research is the presentation that – based on the analysis of the differences between the average cumulative abnormal returns after extreme events – investor overreactions can be observed in the Hungarian stock market. The loser portfolios relating to extreme events significantly outperform winner portfolios connected to the event. The excess return of the contrarian strategy cannot be attributed to differences in the market risk of winner and loser portfolios. The excess return of the strategy can be shown only under tighter extreme value thresholds. The clustering of the event windows with short-term reversal, high market volatility and extreme events is beneficial to the performance of the contrarian strategy. In addition, our research also shows that the purchase of loser portfolios or the development of a contrarian strategy after extreme events may generate profit for investors, since after extreme events the loser portfolios usually beat the market on a horizon of 21 days.

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1. Introduction

The purpose of this paper is to analyse investors' reactions to extreme events in the case of equities traded on the Budapest Stock Exchange. We identified extreme events based on the daily returns of the market portfolio that exceeded the salient returns of the market portfolio that could be identified in the prior period. The research aims to find out whether any investor overreaction can be observed as a result of extreme events in the Hungarian stock market. The research heavily relies on the work of *Piccoli et al.* (*2017*)*,* who examined investors' reactions to extreme events in the stock market of the United States. In their work, they presented the results of the contrarian investment strategy in periods after extreme events, relying on an event study. Similar studies were conducted for Hungary by *Nagy – Ulbert* (*2007*) and *Lakatos* (*2016*), but their research did not focus on extreme events. This paper's value added to Hungarian stock market analyses is the analysis of reactions to extreme events.

Major corrections can often be seen in stock markets, but when the market gains momentum, extreme positive returns are not uncommon. Crisis periods are a good example of corrections. During the 2008 global economic crisis, corrections of around 20 per cent could be observed, while in 2020 – after the outbreak of the Covid-19 pandemic – corrections as high as 50 per cent were not uncommon in stock markets. The investment strategy examined by us may provide investors with favourable performance during these turbulent periods.

In the research, extreme events are defined based on extreme returns of the market index, and then – relying on an event study – we examine the abnormal returns on winner and loser equities following the event. If in the period that follows the defined extreme event loser equities significantly outperform the winner equities, investors' overreaction can be confirmed and the contrarian investment strategy may be profitable.

Our results show that investors in the Hungarian stock market overreact to extreme events. There are significant differences between winners and losers. The excess return of the contrarian strategy does not come from the differences between the market risks of the loser and winner portfolios. The excess return also exists with the factors underlying the systematic risk.

The paper first reviews the international literature relevant for the topic and then presents the results of Hungarian stock market research. After laying down the theoretical foundation, relying on the methodology of *De Bondt – Thaler* (*1985*) and *Piccoli et al.* (*2017*), we perform a comprehensive analysis of the Hungarian stock market for the period from 4 January 2000 to 12 March 2021.

2. Investors' overreactions in the stock markets

Fama's (*1970*) theory of efficient markets (Efficient Market Hypothesis) states that the capital market is efficient when information is immediately incorporated into the price of assets. In the case of capital markets, a semi-strong level of efficiency is most often observed, which assumes the incorporation of public information into asset prices. If this is accepted, investors cannot have information that would allow them to realise excess returns. Higher returns can only be achieved by taking higher risks. If the risk of the investment strategy corresponds to the risk of the market portfolio, it is impossible to beat the market. If market efficiency based on the CAPM[1] model exists, the observed differences in returns stem from the difference in market risk.

According to the Uncertain Information Hypothesis, *Brown et al.* (*1988*) argue that positive abnormal returns can be observed in stock markets over a 60-day period following daily price changes of more than 2.5 per cent, after both negative and positive events. This phenomenon supports the Efficient Market Hypothesis, because according to the hypothesis positive abnormal returns are simply attributable to the increase in risk after the events. If the Uncertain Information Hypothesis is valid, abnormal returns should disappear when the risk is taken into consideration. According to the hypothesis, abnormal returns should appear following both positive and negative events. *Corrado – Jordan* (*1997*) believe that the 2.5 per cent threshold is far too low. The authors found that the market reverses if a 10 per cent threshold was applied.

In their paper, *De Bondt – Thaler* (*1985*) examined underperforming and outperforming equities relative to market returns in distinct observation periods (without overlapping periods). Their fundamental assumption was that investors misprice equities in stock markets, despite the expected value of conditional probabilities (Bayes' theorem), possibly overreacting to the value of the new information believed to be unique. Their main finding is that securities that performed poorly earlier will outperform securities that performed better in the past by about 25 per cent in the future. This phenomenon is the overreaction, which essentially disproves *Fama's* (*1970*) Efficient Market Hypothesis. *De Bondt – Thaler* (*1985*) explained the phenomenon of overreaction by the fluctuating nature of the positive and negative information environment, and linked it to *Kahneman – Tversky's* (*1979*) overconfidence theory, according to which investors are overly confident when it comes to forecasting future prices, i.e. they believe that their investment decision will have a positive outcome in the future. *De Bondt – Thaler* (*1987*) also confirmed the Overreaction Hypothesis in their work 2 years later, and *Daniel et al.* (*2004*) also use this hypothesis to explain specific return patterns.

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[1] Capital Asset Pricing Model

Shiller (*1981*) also dealt with the possibility of the Overreaction Hypothesis; however, he referred to the phenomenon when securities market investors overreacted to certain events or announcements as "excess volatility". The Overreaction Hypothesis has been tested successfully on a number of occasions in several markets.

Alonso – Rubio (*1990*) examined the Overreaction Hypothesis in the Spanish stock market. According to the results, the phenomenon can be definitively identified. The portfolios created based on *De Bondt – Thaler* (*1985*) realise a profit that is 24.5 per cent higher 12 months later for the loser portfolios, as compared to the winners. In the German stock market, *Ising et al.* (*2006*) examined the 100 largest companies for which the equity price change between 1990 and 2003 exceeded a negative or positive value of 20 per cent. According to their results, reactions after large price rises support the Overreaction Hypothesis, while there is underreaction to the subsequent price decrease. *Chan* (*1988*) points out that the Overreaction Hypothesis is very susceptible to the applied methodology. In his research, he applied risk corrections in the CAPM model.

The reversal shown by *De Bondt – Thaler* (*1985*) (i.e. the formerly loser portfolio outperform previously winner portfolios) is also referred to in the literature as winner-loser effect, which is in fact the foundation of the contrarian or counter-strategy. However, if the reversal does not occur, i.e. winner portfolios continue to realise high returns, it is advisable to apply the momentum strategy. With the contrarian strategy, we buy loser portfolios and short sell winner portfolios, while it is just the opposite with the momentum strategy.

Of the research related to the momentum strategies, *Jegadeesh – Titman* (*1993*) were the first to state that the price of equities that rose in the past is likely to rise in the future as well, and vice versa. After this, several empirical studies were built on proving both the reversal and overreaction hypothesis together with the related strategies and on identifying them in a variety of markets.

Pham et al. (*2008*) tested the overreaction hypothesis in the Pacific markets over the period 2001 to 2005. They examined the effects of price changes over short (3-day) and long (20-day) periods. Their research was able to validate both the short-term reversal and the overreaction hypothesis in the emerging market of Vietnam and in the developed Japanese and Australian markets. *Himmelmann et al.* (*2012*) examined the major European stock markets based on the EuroStoxx 50 index. Their paper supports the efficient market hypothesis as they found that large price rises and falls are usually followed by average market returns.

Brooks – Persand (*2001*) identified market anomalies with good results when they analysed five Southeast Asian stock exchanges. *Chan* (*2003*) tried to explore reactions to different news. His results show strong sideway drift after bad news,

with investors reacting slowly. On the other hand, he links the reversal linked to extreme price fluctuations to public news. *Hart et al.* (*2003*) underpin the reality of excess return realisable by applying the momentum strategy. They tested the theory on multivariate strategies with a positive result.

Examining the stock markets of the United States, the United Kingdom and Japan, *Hudson – Atanasova* (*2008*) found that future returns depend on the magnitude and sign of previous price changes, but the effect gradually diminishes. After large price changes the market often turns around, while a momentum strategy is advisable in the case of small price changes.

The literature shows that loser portfolios outperform winner portfolios over a horizon of 1–4 weeks. The contrarian strategy may be profitable over this horizon, while in the case of the momentum strategy winner portfolios outperform loser portfolios over a horizon of 12 months (*Jegadeesh – Titman 1993*). The reversal effect can also be observed over the longer horizon of 3–5 years (*Brown – Harlow 1988*). When the transaction costs are also taken into consideration, investors give preference to investment strategies of longer cycle. The reversal effect can be detected in the case of larger, extreme price changes.

There is evidence of market anomalies, which prejudice the sometimes weak, sometimes medium and sometimes strong level of market efficiency, thereby facilitating insider trading, various trading strategies and also the development of stock market bubbles (*Deev et al. 2019*). However, back in 1998 *Fama* (*1998*) also argued that proven market anomalies appear depending on the applied methodology and they are often a mere coincidence.

In their work, *Piccoli et al.* (*2017*) examined the period between 1926 and 2013 based on the daily returns on the equities included in the S&P 500, using the event study methodology. Having examined investors' reactions to extreme events, they point out that investors' overreaction in the US stock market can be observed after extreme events. After the events, loser equities outperform winner securities. As a result of the overreaction, the contrarian investment strategy may generate profit for investors.

Yuan (*2015*) highlights the fact that high-profile events, such as record highs in market indices, forecast investors' behaviour and returns. When the market index is high, a high-profile event tends to prompt investors to sell equities, which has a negative impact on prices.

In their work, *Baltussen et al.* (*2019*) argue that systematic risk explanatory factors, well-known from asset pricing, based on cross sectional differences, are present regardless of the asset class and are able to explain changes in risk premiums, and thus the momentum effect can also be deemed significant. On the other hand, the

work of *Piccoli et al.* (*2017*) shows that the presence of extreme events rather calls for the contrarian strategy in the short run, due to investors' reactions.

Since Hungary is a small, open economy, the bulk of its stock market turnover is constituted by a few securities. In addition, its liquidity is also low. A large part of Hungarian households invest their capital in domestic securities due to liquidity considerations. From the 1990s to the 2000s, several papers examined the efficiency, anomalies and returns of the Budapest Stock Exchange, reinforcing the legitimacy of the domestic securities market (*Rappai* (*1995*), *Grubits* (*1995a;1995b*), *Andor et al. (1999)* and *Lukács* (*2003*)). *Molnár* (*2006*) also analysed market efficiency, summarising the research on the efficiency of the Hungarian stock market. Having reviewed two decades of efficiency research related to the Hungarian market, he concludes that signs of market inefficiency can be identified on the Hungarian stock exchange, but those are not yet sufficient for developing trading strategies capable of realising stable extra return.

Stock market anomalies in the Hungarian stock market were analysed by *Nagy – Ulbert* (*2007*). In their study, they tested the hypothesis of momentum and reversal in addition to systematising stock market anomalies. Their study focused on the periods 1999–2001 and 2005–2007 and included nine equities. The analytical framework was based on the methodology developed for the winner and loser portfolios by *De Bondt – Thaler* (*1985*), but their analysis also integrated the effect of dividends in the returns. Their results show very significant reversal phenomenon in the periods under review. They explain the fact that loser securities outperform previously winner securities in the longer run resulted by investors' mental accounting and connect it to the overreaction hypothesis.

In his paper, *Lakatos* (*2016*) observed the winner-loser effect of De Bondt and Thaler on the Budapest Stock Exchange. In his analysis, he examined domestic Class "A" and Class "B" securities with outstanding turnover between December 1996 and March 2015. His results show that the phenomenon of overreaction can be observed on Budapest Stock Exchange. Over a longer horizon, previously loser portfolios outperform the previously winner portfolios, i.e. the reversal phenomenon can be also observed in the market. He also highlights the fact that the anomaly identified by the study seems to disappear towards the end of the period, i.e. the difference between the abnormal returns of the winner and loser portfolios ceases to exist. Taking his research further, he examined periods of varying lengths, which showed that overreaction can be observed in the case of short periods, but there is no reversal.

Other research on the domestic securities market also touched upon the momentum strategy. In their paper, *Mérő et al.* (*2019*) reviewed the importance of factor models, and their empirical test confirmed that the momentum effect can

significantly explain future returns in the Hungarian stock market as well. Taking their paper further, *Csillag – Neszveda* (*2020*) proved that in the period between 1996 and 2018 companies that performed well in the past significantly outperform the returns of poor performing companies in the future as well.

Based on the review of the literature, we can state that investors' overreaction can be observed in the stock markets of both the United States and Hungary.

In the following, we examine two research questions that can be tested empirically as well. On the one hand, we seek to answer the question whether following extreme events any overreaction of investors can be observed in the Hungarian stock market. On the other hand, we examine whether the contrarian strategy can be profitable after extreme events. Based on our preliminary expectations, we formulated the following assertions:

1. Following extreme events, loser equities significantly outperform winner equities, which implies investors' overreaction.

2. Following extreme events, the application of the contrarian strategy generates profit.

3. Sample and descriptive statistics

Data for the empirical examination were collected from the Refinitiv database. As a starting point for our analysis, we downloaded the daily closing price data of equities traded on the Budapest Stock Exchange and the BUX index for the period from 29 December 1999 to 12 March 2021. The Refinitiv database contains price data for 43 equities listed in Hungary. Of the available data, we included in the empirical analysis equities for which the time series is complete, i.e. in the period under review they were available for trading on the Budapest Stock Exchange. As an additional selection criterion, only those equities were included in the sample for which the number of contiguously missing daily closing prices did not exceed 8 pieces of data. This selection criterion ensured that only the more liquid traded equities were included in the analysis. The selection of the sample is based on the work of *De Bondt – Thaler* (*1985*), where the criterion for the inclusion of equities in the sample for review is that a certain number of contiguous returns is available for them. Thus, the sample facilitated the analysis of larger companies with high turnover, also responding to the criticism that losers may have excess return because there are smaller companies among them. *Banz* (*1981*) argues that the equities of companies with low market capitalisation generate disproportionately high returns compared to companies with high market capitalisation. *Zarowin* (*1990*) also argues that overreaction is attributable to differences in size. In selecting the sample, we made efforts to include in the sample only equities that may be

a relevant investment target for investors. Filtering the data left us with 9 equities in the sample in total. *Nagy – Ulbert* (*2007*) also worked with a sample of similar size in their domestic stock market research. On trading days when a particular equity was not traded, the closing prices were substituted for the last known closing price.

Table 1

Descriptive statistics of daily returns

	Average (per cent)	Standard deviation (per cent)	Risk-adjusted return (per cent)	Cumulative return (per cent)	Number of observations
BUX	0.041	1.486	0.028	395.63	5,289
Richter	0.047	1.824	0.026	409.639	5,289
MOL	0.044	2.053	0.021	238.286	5,289
MTelekom	−0.013	1.701	−0.008	−76.836	5,289
Nutex	0.005	5.364	0.001	−99.921	5,289
OPUS	0.086	4.263	0.02	−11.074	5,289
OTP	0.069	2.338	0.03	806.694	5,289
PannErgy	0.014	2.112	0.007	−34.455	5,289
Rába	0.01	2.093	0.005	−45.416	5,289
Zwack	0.026	1.454	0.018	127.805	5,289

In *Table 1* we present the descriptive statistics of daily returns. The daily returns were calculated from the daily closing prices for the period from 1 January 2000 to 12 March 2021. The average daily return of the BUX index, used as market benchmark, was 4.1 basis points in the period under review, with a standard deviation of 1.486 per cent. The average daily return of Richter Gedeon and MOL were similar to the market return, while OPUS and OTP outperformed the market. In terms of cumulative returns in the period under review, BUX – with a cumulative performance of 395.63 per cent – registered almost 4-fold growth, while OTP registered 8-fold growth.

In *Table 2* we present the descriptive statistics of daily abnormal returns calculated for the event study. Abnormal returns are defined as the difference between the daily returns on equity and the market return (market-adjusted excess return). We chose this method, because the explanatory power of proven asset pricing models (market model, CAPM) was acceptable only for blue chips (Richter, MTelekom, MOL, OTP). In the case of other equities the explanatory powers obtained were very low.

Table 2

Descriptive statistics of daily abnormal returns

	Average (per cent)	Standard deviation (per cent)	Risk-adjusted abnormal return (per cent)	Cumulative abnormal return (per cent)	Number of observations
Richter	0.006	1.46	0.004	−21.372	5,289
MOL	0.003	1.279	0.002	−24.86	5,289
MTelekom	−0.054	1.44	−0.038	−96.77	5,289
Nutex	−0.036	5.332	−0.007	−99.99	5,289
OPUS	0.045	4.267	0.011	−90.122	5,289
OTP	0.028	1.357	0.02	165.868	5,289
PannErgy	−0.027	2.273	−0.012	−93.894	5,289
Rába	−0.031	2.106	−0.015	−93.939	5,289
Zwack	−0.015	1.917	−0.008	−83.066	5,289

In *Table 2* we can observe positive average daily market-adjusted excess return for Richter, MOL, OTP and OPUS. While OTP outperformed the market by an average of 2.8 basis points, OPUS outperformed the market by an average of 4.5 basis points per day. When examining the cumulated abnormal returns, it is clear that only OTP was able to outperform the market. OTP's cumulated abnormal return in the period under review is 165.87 per cent.

In the next step, since the purpose of this paper is to examine investors' reaction to extreme events, we looked for positive and negative extreme events in the Hungarian stock market. For this purpose, we used the methodology applied by *Piccoli et al.* (*2017*). We defined extreme events not on the basis of excess return on equities, but rather based on the excess return of the BUX index, used as market portfolio. Extreme events are events when the daily return of the market portfolio exceeded the extreme returns of the market portfolio observed in the previous period. Market portfolio returns were measured by the daily returns of the BUX index.

We compared the returns of the index observed at time t^{th} with the BUX index returns on the 500 trading days prior to time t^{th} belonging to the 1st and 99th percentiles of the empirical density function, defining the extreme large positive and negative returns in this way. This procedure corresponds to the Value at Risk estimated by a historic simulation in the long and short position. This implies that the 99th percentile of the empirical density function determines the short position's value at risk, while the 1st percentile of the same distribution determines the long position's value at risk. According to our calculations, in the period under review the daily returns below the 1st percentile constitute the extreme negative

events of the period, while the daily returns over the 99th percentile constitute the extreme positive events of the period. Accordingly, the tested sample allowed the identification of extreme events between 7 January 2002 and 12 March 2021.

Table 3
Annual distribution of the identified extreme events

Year	Number of trading days	Number of negative extreme events	Number of positive extreme events
2000	251	n/a	n/a
2001	245	n/a	n/a
2002	249	2	1
2003	250	1	0
2004	254	1	2
2005	253	6	4
2006	252	2	5
2007	245	2	1
2008	251	12	9
2009	251	0	0
2010	254	1	1
2011	253	3	3
2012	244	0	0
2013	246	1	0
2014	248	3	4
2015	249	2	5
2016	252	3	1
2017	251	0	1
2018	244	4	7
2019	246	0	0
2020	251	10	9
2021	50	0	0
Number of observations	**5,289**	**53**	**53**

We identified 106 extreme events in total, of which negative extreme returns and positive extreme returns were observed in 53 cases each. The highest number of extreme events was observed in 2008 and 2020 (*Table 3*). These two years can be considered as crisis years. In the two crisis years, in addition to the higher number of events, the number of negative and positive extreme events is almost the same. 41.5 and 34 per cent of all identified negative and positive extreme events, respectively, can be linked to these two years.

Figure 1
Positive and negative extreme returns on the market portfolio
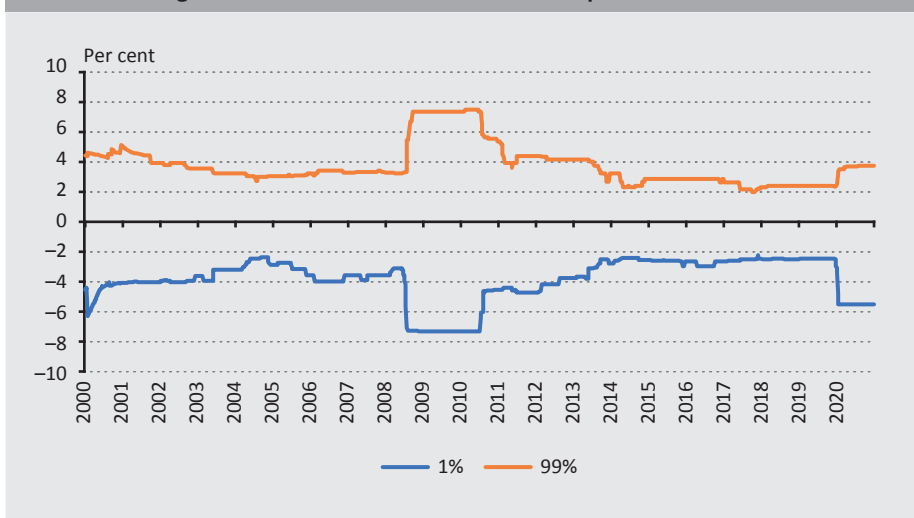
In *Figure 1* we show the extreme daily returns of the BUX index – applied as a market portfolio – calculated using the 500-day rolling VaR method. The figure illustrates the 1st and 99th percentiles belonging to the empirical density function of the BUX returns observed during the 500 trading days prior to time t[th]. Figure 1 clearly shows that during the 2008 global economic crisis volatility in the Hungarian stock market was higher, which also increased the extreme values of daily returns. The same phenomenon can be observed in spring 2020 as well, i.e. the period of the Covid-19 pandemic.

4. Investors' overreactions after extreme events in the Hungarian stock market

After identifying extreme events, we examined investors' reaction using an event study. After defining the extreme event, we created a 21-day time window for each of the 106 events for the event study. For each event window, we constructed winner and loser portfolios according to the abnormal returns observed on the day of the extreme event, relying on the methodology of *De Bondt – Thaler* (*1985*), with equal weighting. The 9 analysed equities were ranked according to the abnormal return observed on the day of the event for each event window, and then the equities in the upper tercile and in the lower tercile were allocated to the winner and loser portfolios, respectively. If the loser portfolios significantly outperform the winner portfolios in the period after the extreme event, it may imply investors' overreaction.

The allocation of equities to portfolios in this manner differs from that applied by *Lakatos* (*2016*), but it is in line with the work of *Piccoli et al.* (*2017*), who argue – following *Brooks et al.* (*2003*) *and Coleman* (*2012*) – that the market reaction to unexpected events is determined on the day when the event occurs. It should be noted that while *De Bondt – Thaler* (*1985*), *Nagy – Ulbert* (*2007*) or *Lakatos* (*2016*) determined the various test periods as non-overlapping periods, in our case certain time windows in the years of the crisis may overlap due to their rate of occurrence and higher frequency. Extreme events cannot be considered as independent of each other; accordingly, we also performed the analysis, following the work of *Piccoli et al.* (*2017*), on subsamples with no overlap and with different combinations of events.

After classifying the equities, we calculated the abnormal returns on the winner and loser portfolios based on equation (1).

$$AR_{n,j,t} = \sum_{i=1}^{k} w_{n,i,j} AR_{i,t} \tag{1}$$

where $AR_{n,j,t}(T)$ is the abnormal return of the portfolio j (winner or loser) of the nth event window on day tth, $w_{n,i,j}$ is the weight of equity ith in portfolio jth, which is the same on each day of the nth event window, $AR_{i,t}$ is the abnormal return on equity ith on trading day tth.

Using the above formula, we obtain the same result as if we calculated the returns on the winner and loser portfolios and then took their difference with the returns of the BUX index. Thus, the abnormal return definition we used allows us to create an equivalent definition of the abnormal returns on winner and loser portfolios based on the above formula.

After creating the winner and loser portfolios, the next step was to calculate the cumulative abnormal returns. In equation (2) $CAR_{n,j}(T)$ shows the (j) cumulative abnormal return on (n) winner or loser portfolio of the given event window on the Tth day of the event window, while $AR_{n,j,t}$ denotes the abnormal returns on portfolio jth (winner or loser) of event window nth at time tth of the event window.

$$CAR_{n,j}(T) = \sum_{t=0}^{T} AR_{n,j,t} \quad T = 1,2,\dots,21 \tag{2}$$

After defining the cumulative abnormal returns, we calculated the average cumulative abnormal returns based on equation (3), aggregating it separately for the loser and winner portfolios, i.e. we derived the average cumulative abnormal returns on the aggregated winner and loser portfolios for time T^{th} of the event window as follows.

$$ACAR_j(T) = \frac{\sum_{n=1}^{N} CAR_{n,j}(T)}{N} \tag{3}$$

After calculating the average cumulative abnormal returns, we took the difference between the average cumulative abnormal return on loser portfolios and the average cumulative abnormal returns on winner portfolios based on equation (4). The significant positive difference in the averages of the cumulative abnormal returns implies the overreaction of investors.

$$ACAR(T)_{dif} = ACAR(T)_{loser} - ACAR(T)_{winner} \tag{4}$$

The methodology presented here is based on the work of *De Bondt – Thaler* (*1985*) and *Piccoli et al.* (*2017*). Of the two works referred to above, it was the work of *Piccoli et al.* (*2017*) that applied the methodology to the analysis of extreme events. Their paper analysed the US stock market and their results show that the overreaction hypothesis can be confirmed in investors' reactions also when making decisions on extreme events.

Figure 2 shows the averages of cumulative abnormal returns for the 21-day event window following extreme events. It illustrates the average cumulative abnormal returns on the created winner and loser portfolios for 106 extreme events. The figure clearly shows that after extreme events loser portfolios outperform winner portfolios. While winner portfolios perform below the market return for 6 days after the extreme event, the average cumulative abnormal returns on loser portfolios are positive. The average cumulative return on winner portfolios is once again positive on the 7th trading day. These results are in line with the conclusions of *Piccoli et al*. (2017). However, it should be noted that the reactions to extreme events in the Hungarian stock market are less pronounced than the results presented by the authors in relation to the US stock markets.

Figure 2
Average cumulative abnormal returns on winner and loser portfolios
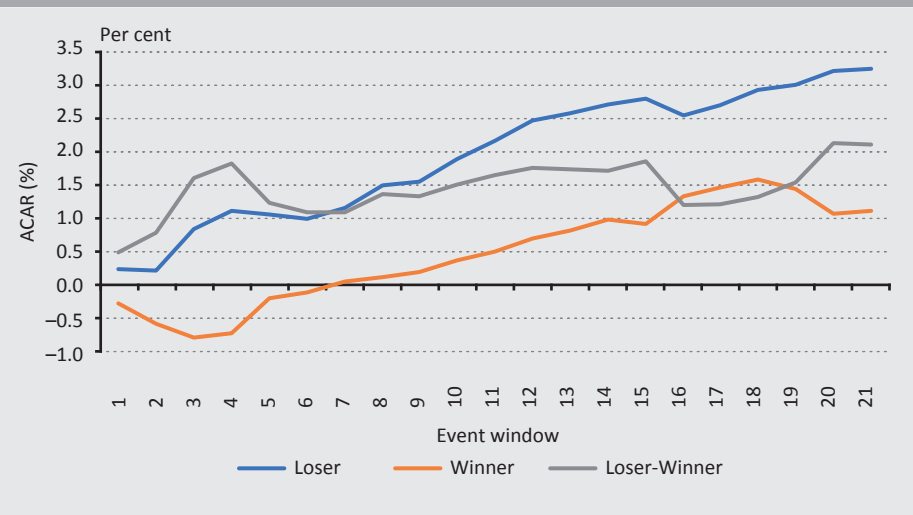
The differences between the average cumulative abnormal returns of the loser and winner portfolios are presented in *Table 4.* The significant positive differences suggest that loser portfolios outperform winner portfolios, which implies that investors overreact after extreme events. When examining the contrarian strategy, i.e. buying loser portfolios and short selling winner portfolios, we find that on average significant positive abnormal returns can be realised in the Hungarian stock market compared to the market portfolio. After extreme events, the contrarian investment strategy may generate profit for investors in the short term.

Table 4
Differences between the average cumulative abnormal returns

Event window	Loser ACAR (per cent)	Winner ACAR (per cent)	Loser-Winner (per cent)	t-test
1	0.243	−0.326	0.568***	19.633***
2	0.278	−0.654	0.931***	24.121***
3	0.945	−0.843	1.788***	38.298***
4	1.261	−0.759	2.020***	34.224***
5	1.263	−0.178	1.441***	21.883***
6	1.240	−0.063	1.303***	19.280***
7	1.425	0.139	1.285***	17.834***
8	1.775	0.193	1.581***	21.668***
9	1.861	0.337	1.524***	21.193***
10	2.212	0.524	1.688***	22.805***
11	2.459	0.679	1.780***	21.450***
12	2.727	0.865	1.863***	21.111***
13	2.832	0.984	1.848***	20.522***
14	3.003	1.181	1.823***	19.663***
15	3.084	1.116	1.968***	20.541***
16	2.816	1.495	1.320***	13.204***
17	3.007	1.627	1.379***	13.152***
18	3.215	1.752	1.463***	13.766***
19	3.352	1.631	1.721***	15.925***
20	3.535	1.210	2.325***	20.690***
21	3.580	1.296	2.284***	19.820***

Note: Asterisks at the differences represent the p-values from the Wilcoxon test. ***p < 0.01, **p < 0.05, *p < 0.1.

5. Performance of the contrarian strategy in the analysed event windows

Following the analysis of investor reactions, we also examined the performance of the contrarian strategy in the event windows after extreme events. With the contrarian strategy, we take long positions in loser portfolios and short sell winner portfolios. In this way, we expect that after the extreme events loser portfolios may outperform winner portfolios, and thus this strategy may help us realise a profit.

When examining the performance of the contrarian strategy, following the method of *Piccoli et al.* (*2017),* we sorted the returns on the winner, loser, contrarian and market portfolios in a panel dataset for 21 days of the event windows created during the analysis of the extreme events. Following this, we examined whether the portfolios thus created also earned excess returns over the market risk premium. We determined the portfolios' beta and Jensen alpha indicators based on the equations of the CAPM model using Pooled OLS estimation. In the paper, we examine the performance of the portfolios in terms of market efficiency based on the CAPM model. Finding a positive significant Jensen alpha indicator in the case of the contrarian strategy implies that that excess return of the strategy is not generated by the difference in the market risk of the loser and winner portfolios. We estimated the Jensen alpha of the contrarian portfolio based on equation (5). The market risk premium was defined as the difference between the BUX index and the 1-year zero-coupon return converted into an overnight return. Zero-coupon risk-free return in the Refinitiv database was available only from 7 March 2002, and thus it was possible to include all 106 events in the analysis. This allowed us to perform an ex-post assessment of the portfolios' performance after the event. At the time of the extreme event this information is not yet known for the investors, since then neither the time of all events nor the market risk premium rate are known.

$$R_{L,i,t} - R_{W,i,t} = \alpha + \beta \cdot (R_{M,i,t} - R_{f,i,t}) + \varepsilon_{i,t} \tag{5}$$

where $R_{L,i,t}$ is the return on loser portfolios, $R_{W,i,t}$ is the return on winner portfolios, $R_{M,i,t}$ is the return of the BUX index, $R_{f,i,t}$ is the 1-year zero-coupon return calculated for one day, α is the Jensen alpha, β is the ex-post market risk, $\varepsilon_{i,t}$ is the error term, and *i* is used for the indexation of the extreme events, while *t* for the indexation of the days in the event window.

Table 5

Estimation results of the CAPM model

Samples	Parameters	Loser-Winner	Loser	Winner
Full	α (%)	0.122** (0.051)	0.134*** (0.045)	0.012 (0.033)
	β	0.082 (0.084)	0.772*** (0.043)	0.690*** (0.046)
	Adjusted R^2 (%)	0.582	52.786	51.851
	Number of observations	2,226	2,226	2,226
Negative extreme events	α (%)	0.157** (0.072)	0.148** (0.068)	−0.009 (0.045)
	β	0.458*** (0.062)	0.967*** (0.036)	0.510*** (0.036)
	Adjusted R^2 (%)	23.088	72.892	41.520
	Number of observations	1,113	1,113	1,113
Positive extreme events	α (%)	0.067 (0.058)	0.110** (0.055)	0.043 (0.046)
	β	−0.599*** (0.045)	0.419*** (0.030)	1.016*** (0.041)
	Adjusted R^2 (%)	25.983	20.549	71.340
	Number of observations	1,113	1,113	1,113

Note: standard errors according to Arellano (1987) are in brackets. ***p < 0.01, **p < 0.05, *p < 0.1.

Table 5 shows the results of the CAPM model estimates. The parameters were determined by Pooled OLS estimation. The Jensen alpha indicators and the corresponding standard errors are presented in the table in percentages. The explanatory power of the models is also provided in percentages. It is clear from the table that when all extreme events are considered, the contrarian strategy provides significant positive excess return. The Jensen alpha is 12.2 basis points (annualised[2]: 35.77 per cent) and is significant at a 5-per cent significance level. On average, the contrarian portfolio generates this much more excess return compared to the market portfolio in the examined event windows. *Piccoli et al.* (*2017*), examining all extreme events, estimate a daily excess return of 14 basis points in the US stock market. When examining the full sample, it can be shown for the loser portfolios that they outperform the market after extreme events. The Jensen alpha indicator is 13.4 basis points (annualised: 39.94 per cent) and is significant at a 1-per cent significance level. The explanatory power of the model is 52.79 per cent. When examining the full sample, no significant excess return can be identified for the

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[2] The annualised values are based on 251 trading days.

winner portfolios. This suggests that the excess returns of the contrarian strategy may be attributable to the loser portfolios' outperforming.

In the case of the subsample containing negative extreme events, the contrarian strategy also generates significant excess return. The Jensen alpha indicator is 15.7 basis points (annualised: 48.16 per cent) and is significant at a 5-per cent significance level. *Piccoli et al (2017)* estimate a daily excess return of 18 basis points for the negative subsample in the US stock market. The explanatory power of the model in this case is already 23.09 per cent. By contrast, in the case of the subsample containing positive events, the contrarian strategy generates no excess returns. This implies that this strategy is more likely to be successful in the case of negative extreme events.

Loser portfolios beat the market under both negative and positive events. For the subsample of positive events, the Jensen alpha indicator is 11 basis points (annualised: 31.71 per cent) and is significant at a 5-per cent significance level. On the other hand, for the subsample of negative events, the Jensen alpha indicator is 14.8 basis points (annualised: 44.78 per cent) and is significant at a 5-per cent significance level. After the extreme event, the loser portfolios beat the market in all cases over a horizon of 21 days.

In estimating the models, we assume that the market risk is known in advance, and thus the β indicators illustrate the ex-post market risk. In the models, the market risk of the contrarian strategy is obtained as the difference between the market risks of the loser and winner strategies. If β is positive and significant, it suggests the market risks of the loser portfolio exceeds that of the winner portfolio, while in the case of negative significant the market risk of the winner portfolio exceeds that of the loser portfolio. For the full sample the β of the loser portfolio is 0.77, while the market risk of the winner portfolio is 0.69. The market risk of the contrarian strategy is 0.08 and is not significant. This suggests that for the full sample the market risk of the loser and winner portfolios is not significantly different, i.e. the differences in returns are not attributable to the differences in market risks. In the case of the full sample, the very low explanatory power of the CAPM model is also attributable to the fact that the market risk of the contrarian strategy is not significantly different from zero. There is already significant positive difference in the subsample of negative events, but the positive significant Jensen alpha indicator estimated under the ex-post β suggests that the performance difference is not only attributable to the differences in the systematic risk of loser and winner portfolios. The work of *Piccoli et al. (2017)* and the results in *Table 4* also highlight the fact that the risk factors included in the popular asset pricing models (CAPM, FF3, Carhart, FF5) do not explain the difference between the performance of loser and winner portfolios. This implies that investors' overreaction to extreme events appears in the stock market as an explanatory factor for returns, independent of other systematic risk factors.

6. Robustness tests

Extreme events are not independent of each other, and several extreme events may appear in a single event window. The analysis of overlapping events may bias our results. In the case of a market correction, loser equities are those that suffer the largest fall, and from a market efficiency perspective based on the CAPM model, these equities are also more susceptible to market changes, i.e. they have higher market risk (β). When the examined event overlaps with an extreme event of opposite direction and the market returns, this opposite event will trigger stronger reaction of loser equities. Then, the excess return of the contrarian strategy cannot be attributed to the overreaction, but rather to differences in the market risk of winner and loser portfolios. This is why we present the results in *Table 5* on the subsample of the non-overlapping event windows under different extreme event definitions. The purpose of the various extreme event definitions is to control for the extreme event definitions that largely determine the strategy.

Table 6				
Non-overlapping event windows according to different extreme event definitions				
Samples	**Parameters**	**Loser-Winner**	**Loser**	**Winner**
Non-overlapping event windows (1 per cent, with 500 days)	α (%)	0.143* (0.084)	0.183** (0.078)	0.039 (0.048)
	β	−0.352*** (0.137)	0.421*** (0.079)	0.773*** (0.077)
	Adjusted R^2 (%)	2.981	7.589	25.608
	Number of observations	735	735	735
Non-overlapping event windows (5 per cent, with 500 days)	α (%)	−0.014 (0.066)	0.044 (0.056)	0.058 (0.039)
	β	−0.060 (0.128)	0.564*** (0.084)	0.624*** (0.067)
	Adjusted R^2 (%)	−0.026	9.309	15.462
	Number of observations	1,071	1,071	1,071
Non-overlapping event windows (1 per cent, with 250 days)	α (%)	0.129* (0.074)	0.151** (0.069)	0.023 (0.043)
	β	−0.173 (0.132	0.486*** (0.075)	0.659*** (0.074)
	Adjusted R^2 (%)	0.873	12.619	27.178
	Number of observations	735	735	735
Non-overlapping event windows (5 per cent, with 250 days)	α (%)	0.067 (0.082)	0.115* (0.065)	0.048 (0.053)
	β	−0.187* (0.106)	0.513*** (0.071)	0.700*** (0.058)
	Adjusted R^2 (%)	0.551	6.932	20.068
	Number of observations	840	840	840

Note: standard errors according to Arellano (1987) are in brackets. ***p < 0.01, **p < 0.05, *p < 0.1.

Table 6 presents the results of the CAPM model estimations on subsample of non-overlapping event windows by different extreme event definitions. The parameters were determined by Pooled OLS estimation. The Jensen alpha indicators and the corresponding standard errors are presented in the table in percentages. The explanatory power of the models is also provided in percentages. When extreme events are identified using the original definition, the Jensen alpha indicator of the contrarian strategy is 14.3 basis points (annualised: 43.27 per cent) and is significant at a 10-per cent significance level. *Piccoli et al.* (*2017*) estimate a daily excess return of 13 basis points on a subsample of non-overlapping events, which in their case is significant at a 1-per cent level. The explanatory power of the model is 2.98, which suggests that less than 3 per cent of the variance of the difference between the loser and winner portfolio returns is explained by the differences in market risk. The market risk of the loser portfolio is significantly lower than the market risk of the winner portfolio, and thus the difference in returns is not attributable to the differences in market risk. The excess return on the loser portfolio is 18.3 basis points (annualised: 58.07 per cent) and is significant at a 5-per cent significance level. This implies that the excess return of the contrarian strategy comes from the excess return of the loser portfolio also in the case of non-overlapping events, and the excess return is not attributable to the differences in market risk. *Table 5* shows that in the case of different extreme events, investor's overreaction can be identified only for extreme events defined under a stricter, 1-per cent threshold. The performance of the contrarian strategy is clearly independent of the length of the time series selected for the purposes of defining extreme events; we can choose 250 or 500 trading days. This suggests that the performance of the contrarian strategy increases under tighter extreme thresholds.

Table 7 shows the results of additional robustness tests. The parameters of the CAPM model were determined by Pooled OLS estimation. The Jensen alpha indicators and the corresponding standard errors are presented in the table in percentages. The explanatory power of the models is also provided in percentages. In the first case, we examined the subsample of event windows with short-term reversal. We selected the event windows so that the event window contained another extreme event of opposite direction. On this subsample, the Jensen alpha indicator of the contrarian strategy is 24.9 basis points (annualised: 86.65 per cent) and is significant at a 1-per cent significance level. *Piccoli et al.* (*2017*) identified an excess return of 19 basis points in the case of event windows with short-term reversal. The market risk of loser and winner portfolios does not differ significantly. The excess return of the contrarian strategy is attributable to the excess return on the loser portfolio. It is obvious here as well that the excess return is not attributable to the differences in market risk.

In the second case, we examined the subsample of momentum event windows. We selected the event windows so that they contained another extreme event of the same direction. In this case, we identified no significant excess returns. The market risk of loser portfolios is significantly higher than that of the winner portfolios. In the case of the momentum event windows, the contrarian strategy generates no profit.

Table 7

Robustness tests

Samples	Parameters	Loser-Winner	Loser	Winner
Event windows with short-term reversal	α (%)	0.249*** (0.079)	0.183** (0.073)	−0.066 (0.049)
	β	−0.048 (0.136)	0.701*** (0.053)	0.749*** (0.090)
	Adjusted R^2 (%)	0.122	57.162	58.208
	Number of observations	672	672	672
Momentum event windows	α (%)	0.035 (0.04)	0.092 (0.089)	0.057 (0.073)
	β	0.221** (0.106)	0.860*** (0.059)	0.639*** (0.054)
	Adjusted R^2 (%)	5.763	64.825	57.507
	Number of observations	777	777	777
Event windows with multiple extreme events	α (%)	0.265*** (0.088)	0.244*** (0.081)	−0.020 (0.066)
	β	0.137 (0.098)	0.820*** (0.049)	0.683*** (0.055)
	Adjusted R^2 (%)	2.600	68.320	61.531
	Number of observations	903	903	903
Event windows of high-volatility periods	α (%)	0.157* (0.081)	0.146** (0.074)	−0.011 (0.057)
	β	0.078 (0.104)	0.791*** (0.052)	0.712*** (0.058)
	Adjusted R^2 (%)	0.645	62.249	58.937
	Number of observations	1,113	1,113	1,113
Event windows of low-volatility periods	α (%)	0.087 (0.061)	0.120** (0.052)	0.033 (0.035)
	β	0.095 (0.119)	0.716*** (0.078)	0.621*** (0.059)
	Adjusted R^2 (%)	0.407	33.827	35.262
	Number of observations	1,113	1,113	1,113

*Note: standard errors according to Arellano (1987) are in brackets. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.*

In the third case we examined event windows with multiple extreme events. We selected the event windows such that there was an overlap of more than 1 extreme events in the event window regardless of the direction of the events. On this subsample, the Jensen alpha indicator of the contrarian strategy is 26.5 basis points (annualised: 94.07 per cent) and is significant at a 1-per cent significance level. *Piccoli et al.* (*2017*) identified an excess return of 23 basis points in the case of event windows with multiple extreme events. The market risk of loser and winner portfolios does not differ significantly.

In the fourth and fifth cases, the event windows were grouped based on the volatility of market portfolio prior to the extreme event. Based on the work of *Piccoli et al.* (*2017*), volatility was measured by the standard deviation of the returns on the market portfolio over 126 trading days preceding the extreme event. The median of the measured standard deviations was used as a breakpoint. On the sample of event windows of high volatility, the excess return of the contrarian strategy is 15.7 basis points (annualised: 44.27 per cent) and is significant at a 10-per cent significance level. On the sample of low volatility event windows the excess return of the contrarian strategy is not significant. No significant differences can be observed in market risks in either case.

Based on the robustness tests, we can state that contrarian strategy performs better in the case of event windows with short-term reversal than in the event windows with extreme events of the same direction. The clustering of high market volatility and extreme events is also beneficial to the performance of the contrarian strategy.

7. Conclusions

This paper examined investors' reactions to extreme events in the Hungarian stock market. The literature has already demonstrated many times that investors' overreaction can be observed in the stock market of both the United States and Hungary. Moreover, *Piccoli et al.* (*2017*) observed this phenomenon in the US stock market after extreme events as well. Based on this methodology, we investigated investors' reactions after extreme events in the Hungarian stock market with a view to contributing to the existing Hungarian literature analysing investors' reactions.

The research showed that after extreme events loser equities significantly outperform winner equities, and thus investors' overreaction to extreme events can be observed. These reactions are in line with the reactions presented by *Piccoli et al.* (*2017*), but it is also clear that these reactions are less pronounced for Hungarian equities than in the US stock market. Negative abnormal returns in the case of winners can be observed on the first 6 days after the event. The average cumulative abnormal returns of the contrarian strategy increases significantly in the first 4 days after the extreme event, when we observe a cumulative abnormal value of 2.02 per

cent. Based on the analysis of the average cumulative abnormal returns, investors' overreaction can be confirmed.

After examining investors' reactions, we highlighted the fact that – due to the outperformance of the loser portfolios – application of the contrarian strategy after extreme events generates profit for investors. By purchasing loser portfolios and short selling winner portfolios we followed a contrarian strategy, and showed that these portfolios outperform the market portfolio over a 21-day trading horizon, particularly in the case of negative events. The excess return of the contrarian strategy is shaped by the excess return on loser portfolios, since these portfolios always beat the market on a horizon of 21 days. Furthermore, the significant positive Jensen alpha indicators suggest that the excess return of the contrarian strategy is not attributable to the differences in the market risk of loser and winner portfolios, which implies that investors' overreaction to extreme events appears in the stock markets as a factor explaining returns, independent of systematic risk factors. Thus, the loser portfolios' outperforming reflects investors' overreaction rather than differences in market risk.

The robustness tests showed that the performance of the contrarian strategy can be identified under tighter extreme value thresholds. The clustering of the event windows with short-term reversal, high market volatility and extreme events is beneficial to the performance of the contrarian strategy. This suggests that overreaction and market volatility are not independent of each other. We can conclude from the results that buying loser equities or developing a contrarian strategy after extreme events may generate profit for investors in the short run in the Hungarian stock market.

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A Snapshot of the Ownership Network of the Budapest Stock Exchange*

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In this study, I use the toolkit of network research to explore the network of ownership relations of entities present on the Budapest Stock Exchange as issuers in 2020, applying static methods and exponential random graph modelling (ERGM) analysis. In the snapshot typology and simulation-based capture of the network, not only the network of relations between issuers present on the stock market is analysed, but also the ownership relations of companies connected to the network but not listed on the stock market; thus, the study addresses the ownership network associated with the stock exchange as a whole. The research results provide us with an accurate answer about the morphological characteristics of the network, the network factors determining centrality, the hierarchy of the network, and the evolution of the network with the help of simulations. The study may allow us to obtain a clearer picture of the interlinkages and clusters of companies listed on the stock market, which can be used as a basis for subsequent longitudinal analyses.

1. The stock market as a complex system

The Hungarian stock market (Budapest Stock Exchange — BSE) is a concentrated market, where many products are traded at agreed prices, subject to complex economic transaction systems. In my study, I examine the ownership structure of issuers in the spot market, one of the markets of the stock market, using network research methodology. Many studies on trading in the Hungarian stock market have been conducted, but up to now the system has not been examined much from the point of view of networks affecting ownership relations. This topic is particularly important, as a given company's share price, performance and trading itself are influenced by the ownership relations of the company, i.e. its ties with other affiliated listed and unlisted companies (*Onnela et al. 2004*).

The stock market generates a large amount of non-linear information[1] between numerous actors, which makes it a complex system. Accordingly, its analysis requires a methodology that can minimise and capture this complexity, while preserving the fundamental linkages. One such approach is network analysis. In fact, the correlation structure of the stock market, together with the corresponding stocks, can be considered a complex network system, which, with a finite number of nodes, forms a directed and weighted, complete graph (*Lee – Djauhari 2012*). This also means that network data can be used to test a multi-type relation between actors (*Wasserman – Faust 2010; Taghizadeh et al. 2020*). Network-based analysis of capital markets can thus bring us closer to how actors access information on events, how the network can be clustered and what internal hierarchy it is characterised by, and by introducing exponential random graph modelling (ERGM), we can gain the knowledge to explore the formation of the network, using simulations of edge numbers. In fact, at a further stage, in a longitudinal analysis, this can be used to analyse which nodes have what impact on the evolution of cluster groups, or even on the stock market performance of issuing entities, and how the reaction of each actor to events affects the dynamics of the complex system.

The network-based approach to stock markets is not a novelty methodology. However, most of the academic literature focuses on trading on the stock market; thus, in general, this method is used to explore the behaviour of shares traded on the market, i.e. the relation between shares. Network researchers usually follow two network methodologies: (1) they perform their analysis based on the correlations between the logarithms of stock returns (*Lee – Djauhari 2012*), and (2) they analyse the sales network of stocks, using the minimum spanning tree (MST) method (*Lee – Djauhari 2012; Mantegna 1999; Boginski et al. 2005*). Such analyses have explored trading on the stock markets in a number of countries around the world; to highlight only the most important ones, the works of *Boginski et al.* (*2006*) and *Roy and Sarkar* (*2011*) have examined the US stock market, following the above methodology. In Korea, *Kim et al.* (*2007*) carried out this analysis, *Huang et al.* (*2009*) wrote about the Chinese stock exchange, *Pan and Sinha* (*2007*) performed an analysis for India, and finally, *Tabak et al.* (*2009*) analysed the Brazilian stock market, applying the above methods. Several studies have also addressed the network-based exploration of stock market trading in foreign exchange markets, using daily scales (*Forbes – Rigobon 2002*) and intraday scales (*Münnix et al. 2010*), as well as market indices

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[1] Data organised in a non-linear data structure is considered a key feature of dynamic complex systems. In these data structures, the analysis of data points — due to their holistic interconnectedness and dynamism — follows a causality completely different from the Baconian and Cartesian cause and effect theories. Consequently, when we examine the coupling of system data, analysis categories between the theoretically presumed linear cause and effect are blurred; non-linear cause and effect relation systems emerge, in which cause and effect categories are often interchanged, and we can discern a blurring of the boundary between the two conceptual constructs (for more on this, see *Atmanspacher et al. 1992*).

(*Drożdż et al. 2001; McDonald et al. 2005*)*.* These studies have revealed that stock markets are structured along the lines of geographical activities.

Based on the results, a number of network topological analyses have been published. *Huang et al.* (*2009*) analysed cliques and independent actors emerging in the Chinese stock exchanges to explore the resilience of the network and found that stock markets display a topological robustness against random vertex failures, but are also fragile to intentional attacks. Having analysed the network typology of the Greek stock market, *Dimitrios and Vasileios* (*2015*) concluded that in 2007 and 2012 the Greek market was a 'shallow' market made up of a large number of heterogeneous components, easily affected by a few centrally positioned, big investors or companies.

Much less academic attention is focused on capturing the role of the interpersonal relation network emerging in stock markets. In this vein, however, it is worth highlighting the works of *Taghizadeh et al.* (*2020*) and *Kazemilari and Djauhari* (*2015*)*,* who find that more centrally positioned companies have fewer mediator relations and, consequently, easier access to available resources and information, and that these factors have a strong impact on the pricing mechanism of stocks.

Even fewer articles deal with the network-based analysis of the ownership structure of listed issuers, mainly due to the difficulty of accessing the data. In this conceptual framework, the director board networks of listed companies have been the subject of most research (*Mahdavi Ardekani et al. 2019; Rezaee et al. 2018; Rotundo – D'Arcangelis 2010*)*.* The relation network of directors has been used to examine the structure of the relations and the identity of the economically efficient or key actors in the given networks. Studies provide compelling evidence of a strong correlation between the quality of corporate governance and stock market performance across stock markets (*Khorshidvand – Sarlak 2017; Khodami – Bazraie 2013; Babu – Kumar 2011; You et al. 2015*)*.* Examination of the network of director boards is also of crucial importance for the analysis of ownership relations, because such analyses interpret the nature of the formation and functioning of the network by drawing on theories of social capital and relational capital. In fact, board interlock relations affect the activities of organisations at many points, such as the rights and benefits of the director board, governance system, organisational structure, and quality control, all of which have an effect on the behaviour of stock markets, reflecting the results of mutual interactions between participants seeking to maximise their interests (*Borgatti – Foster 2003*)*.* *Peng et al.* (*2015*) studied the relation between the interlocking directorates of Chinese companies listed on the Hong Kong Stock Exchange and stock market performance. Their findings show that board interlocks improve the stock market performance of companies. *Sankowska and Siudak* (*2016*) studied the network of directorates of large companies and corporate directors in the Polish stock market. The results showed the characteristics of the stock

market network to be identical to those of the small-world networks. Finally, *Singh and Delios* (*2017*) analysed the relation between board structure and risk-taking behaviour of emerging companies.

From this brief academic literature review it is clear that the exploration of the ownership network of listed issuers is still in its infancy even at the international level; the basic analytical focus is not on this topic. However, it may also be an explanatory factor for many of the complex, systemic movements seen in the stock market.

Thus, in my study I conduct a new network-based analysis for issuers present on the Hungarian stock exchange, seeking to answer the question of what network typology, clustering and hierarchy can be discovered in the ownership network of listed and unlisted companies and firms in December 2020. The analysis provides a comprehensive picture of the structure of the Hungarian stock exchange and the related network of companies, treating the actors as a specific, complex graph. Exploring the network structure can help identify stock market risks, and non-linear analysis can also be of practical value, e.g. in portfolio optimisation based on it.

2. Network research and ERGM

Network analysis is based on the graph theory, in which a graph G is composed of two sets (N and E) (*Paparrizos 2003*). Elements N are called nodes, vertices or simply points *(nodes),* which are arranged in ordered or unordered pairs of elements, and are interconnected by edges, arcs or links *(edges).* Graph G = (N, E) is connected if there exists a path from any vertex of set N to any vertex of that set. When analysing a graph, we determine the size of the entire graph, the size of the connected component, the degree and distribution of vertices, the clusters of the graph, which are formed on the basis of edges, and the hierarchy of the network. It is easy to visualise a graph, where nodes are usually drawn as points or circles, while edges as directed arrows or simple lines (*Dimitrios – Vasileios 2015*).

Networks can always be characterised by a kind of structuring, a topological structure, according to the ordering of edges, which is measured by a number of metrics. One such metric is network density, the other is degree distribution. When calculating the density indicator of networks, we divide the fully connected theoretical edge number by the measured number of edges. The degree distribution of nodes, which forms the clusters and hierarchy, is not uniform for empirical networks measured with real data, and theoretical graphs. In contrast to random network described by *Erdős – Rényi* (*1960*), where degree distribution follows a normal curve, for small-world networks and scale-free networks, the majority of vertices have a small degree, while a mere minority of them have an extremely

high degree distribution; their distribution deviates significantly from the normal curve. Nodes in the central positions of scale-free networks are often called hubs, which make it possible to calculate the clustering coefficient of a network, i.e. the closely interconnected cliques and communities. Empirical investigations of networks measured with real data show that they are characterised by a higher network clustering coefficient than stochastic networks of the same size. Based on the high clustering coefficient measured on scale-free networks, a theoretical network model, known as 'small-world' (*Watts – Strogatz 1998*), and the scale-free theoretical network were developed (*Barabási – Albert 1999*)*.* With these theoretical networks, it is possible to validate the measured networks, i.e. to determine to what theoretical model the network typology diverges. Clusters, however, not only help to identify the cliques in the network, but also trace out the hierarchy of the network itself. In fact, the hierarchy of a network (measured by K-core metric) can be inferred from the internal connectivity of the cluster parts (*Newman et al. 2006*).

However, network analysis includes not only static but also dynamic methodologies; one such methodology — currently used by several network researchers concerned with stock markets — is the method of exponential random graph modelling, i.e. ERGM. ERGM falls into the scope of statistical exponential network modelling. The class of exponential random graph models includes Markov random graphs of edge and dyadic independence models, and many other graph distributions (*Frank and Strauss 1986*)*.* Of these, ERGM allows the joint and controlled study of the effects of network parameters. In other words, ERGMs provide an opportunity to understand in dynamic models how and why network connections are formed.

Network connections are organised into patterns, and the presence of some connections (ties) promotes the appearance of others. The ERGM analyses these endogenous effects, often referred to as 'structural' effects, i.e. it interprets the internal processes of the network relation system, complementing them with the exogenous effects of the network, such as the effects of attributes associated with nodes (*Lusher et al. 2013*)*.* Based on the findings of *Watts* (*1999*)*,* ERGM works with randomness and probabilistic random graph modelling. By incorporating randomness, statistical models work with expected values, from which we can draw conclusions about whether the observed data are consistent with the theoretical (anticipated) data. Markov random graphs are defined by a particular dependence structure between network ties (*Robins et al. 2007*); thus, during an ERGM, we estimate the presence of network edges from several predictor variables, and use model parameters to estimate its given effect, direction, and significance in the studied network (*Lusher et al. 2013*)*.*

For this reason, ERGM models network effects of interest in the formation of edges, e.g. the effect of transitive triads, the k-star effect, the effect of assortativity (homophilic, heterophilic relations), the effect of distributions, the effect of degrees and the effect of attribute variables. It also compares the models formed on the basis of the effects of these network variables with the observed network in an effort to reveal the causes of network edge formation.

To capture exponential random graphs, I use the notation and terminology prescribed by *Robins et al.* (*2007*)*.* Each pair i and j of actor n in set N is denoted by the expression Y_{ij}, which is a network connection variable, whose value is $Y_{ij} = 1$ if there is a network connection from i to j, and $Y_{ij} = 0$ if there is no connection. We specify y_{ij} as the observed value of Y_{ij}, with Y being the matrix of all variables, while y being the matrix of observed connections, i.e. our observed network itself. Y may be directed or undirected. A configuration is the totality of nodes and the subset of connections between them. For example, a 2-star shape is a set of three nodes in which one node is connected to the other two, whereas a triangle is a set of three nodes connected to each other. The configurations are defined hierarchically in the model; thus, a triangle contains as many as three 2-stars.

The general form of (homogeneous) exponential random graph models is as follows:

$$\Pr (Y = y) = \frac{1}{\kappa} \exp \{\Sigma_A \eta_A g_A(y)\} \tag{1}$$

where: (i) the summation is applied to configuration type *A,* whose different sets represent different models (e.g. dyadic independence or Markov random graph); (ii) η_A is the parameter corresponding to type *A* configuration; (iii) $g_A(y)$ is the network statistic corresponding to configuration *A* (for a homogeneous Markov, this is the number of type *A* configurations observed in the network: e.g. the number of triangles); (iv) κ is a normalising factor ensuring that (1) is a probability distribution. The model represents the probability distribution of a graph on a fixed set of nodes, where the probability of a graph being created depends on the presence of different configurations expressed by the model. ERGM can thus be used to interpret the structure of a typical graph as the result of a cumulation of specific and local configurations, with the parameters providing information on the presence of structural effects observed in the network data.

Based on *Chatterjee and Diaconis* (*2013*)*,* the exponential graph formula has been revised in recent years, resulting in the following general form of the class of exponential random graph models:

$$p_\beta(G) = \exp \left(\sum_{i=1}^{k} \beta_i T_i(G) - \psi(\beta) \right) \tag{2}$$

The premise of the equation is that G_n is the space spanned by all simple graphs on n-labelled vertices ('simple' means undirected, with no loops). Thus, G_n contains 2 elements. In the equation, $\beta = (\beta_1, ..., \beta_k)$ is a vector of real parameters, $T_1, T_2, ..., T_k$ are functions on G_n, and $\psi(\beta)$ is a normalising constant. Usually, T_i is taken to be the totality of various subgraphs, e.g. $T_1(G)$ = edge number in graph G, while $T_2(G)$ = the number of triangles in G. *Frank and Strauss* (*1986*) showed that when T_i is treated as edges, triangles and stars of different sizes, the resulting random graph edges form a Markov random field. *Wasserman and Faust* (*2010*) and *Rinaldo et al.* (*2009*) developed a geometric theory of models. The statistical applications of the ERGM and the development of network analyses of practical relevance have been elaborated by *Snijders et al.* (*2006*) and *Robins et al.* (*2007*).

In my study, the network descriptive statistical and morphological analyses and the ERGM analyses were performed with the R software package and the MPNet software (*Wang et al. 2009*).

3. Data used for the stock market network analysis

The data used for the analysis are based on listed issuing companies on the BSE in December 2020.[2] At the time of the investigation, a total of 96 different companies[3] made up this base population. With the help of the OPTEN database,[4] I developed the corresponding ownership network, using a code written in Python, as a result of which a complete network of 96 entities and their associated private owner companies could be analysed.[5]

However, it is important to point out that the list of issuers on the BSE, i.e. the base population comprises all issuers, including corporate bond issuers, mortgage bond issuers or investment unit issuers, each of which must meet different liquidity parameters or publicity criteria; consequently, it was important to clarify why I was actually managing these companies in a network, as companies issuing different shares are characterised by totally different market conditions, attitudes, commitments and approaches.

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[2] https://bse.hu/pages/issuers. In my analysis, I analyse all issuers listed on the stock market, irrespective of the instrument they might hold.

[3] It is important to touch on the question of how much the presence of the Hungarian State may distort the sample. My study focuses on ownership linkages, so I have investigated to what extent the basic parameters of the network change if the Hungarian State is excluded from the base population. For the network test, I performed a regression based differential network analysis (R-DNA) in line with *Schmidt* (*2019*), and the test results showed that the presence of the Hungarian State does not substantially affect the basic network typology for company ownership, so I did not exclude it from the analysis. As regards the network of private individuals, for obvious reasons, no private persons were connected to the Hungarian State; hence, this issue did not arise in that network.

[4] https://www.opten.hu/?lang=en

[5] Given the robustness of the database and my limited access to OPTEN, a cross-sectional data capture was feasible based on the data; thus, changes in the past are not discussed in my study due to lack of data.

My goal was to conduct a network-based research that considers the stock market as a whole market, based on ownership relations.[6] This is not a unique approach in the academic literature; *Cont* (*2001*) followed this methodology in his famous article on price variations in various types of financial markets. To do this, he first discussed the issue on the basis of a list of total issuers, and later, he analysed the different statistical properties of asset returns separately. *Mehra and Prescott* (*1985*) also worked with this base population in their famous longitudinal study of US regulations on share issuance, covering the 1889–1978 period. Indeed, the same modelling is also often seen when artificial neural network (ANN) modelling is used to analyse stock market exchange rates for aggregate and different share issuers (see *Moghaddam et al. 2016*).

With all this, of course, I would like to point out that my model — and the modellings referred to above — works with a robust model specification, which, of course, allows and requires a number of subsequent specified modellings for different share issuers. As *Raddant and Kenett* (*2021*)*,* who also followed the same robust modelling and pattern, note in their paper, the financial system is a highly complex entity with cross-border interconnections and interdependencies; thus, robust modelling sheds (may shed) light primarily on how closely interconnected the environment is where the different markets operate, and, as a consequence, how shocks and events in the market can be easily amplified and turned into general (in their paper: global) events.

The robust modelling method allowed the analysis of two networks: (1) company ownership network of listed firms with 6,806 nodes (firms) and 8,363 edges (ownership linkages), and (2) private individual network of the same listed firms with 5,902 nodes (owners) and 6,083 edges (ownership linkages). Network data can then be regarded as complete networks or complete graphs. In my analysis, therefore, each company or private individual corresponds to a node, and a linkage from node i, pointing to node j, exists if node i has an ownership share in the case of j. Consequently, in my analysis, I work with directed graphs, following the methodological works of *Garlaschelli et al.* (*2005*)*, Chapelle and Szafarz* (*2005*) and *Salvemini et al.* (*1995*)*.*

The OPTEN database also provided a possibility to use the geospatial software ArcGIS to analyse the ownership distribution of the given networks according to the municipalities in Hungary for companies and private individuals.

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[6] However, here again I consider it important to emphasise the limits of my research results in terms of interpretation. I do not undertake, for example, to make findings on trade and ownership relations themselves; my aim is to explore ownership relations on a network basis, which could, of course, later be a source of a number of further research opportunities.

4. The ownership network of the Budapest Stock Exchange from the companies' perspective

Companies that are issuers in the Hungarian stock market and the overall network of firms owned by them consist of a total of 6,806 nodes and 8,363 edges, the network representation of which is shown in *Figure 1.*

Figure 1
Ownership network of issuers present in the Budapest Stock Exchange (N = 6,806)
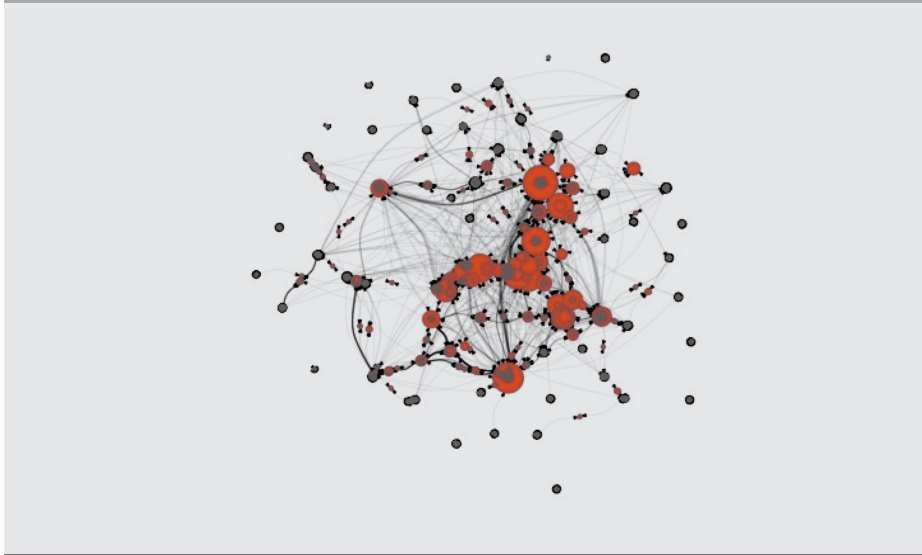
Figure 1 clearly shows the emergence of a huge network of firms around the issuers present in the BSE, which strongly determines the stock market position of the share issuing companies. A key feature of the network is that it is a fully interconnected network, and not decomposed into subnetworks, which indicates a particularly high level of network interdependence between companies and markets. In the chart, actors with a central position have been magnified by their degree, which shows that centrality positions are rather unevenly distributed in the network, where we find a very small number of actors with a very high company ownership share, and a very large number of actors who, quite the opposite, are characterised by remarkably few ownership linkages. This is illustrated in *Figure 2,* which shows the degree distributions of the whole graph in log-log curves and histograms.

Figure 2
Degree distributions and log-log curves
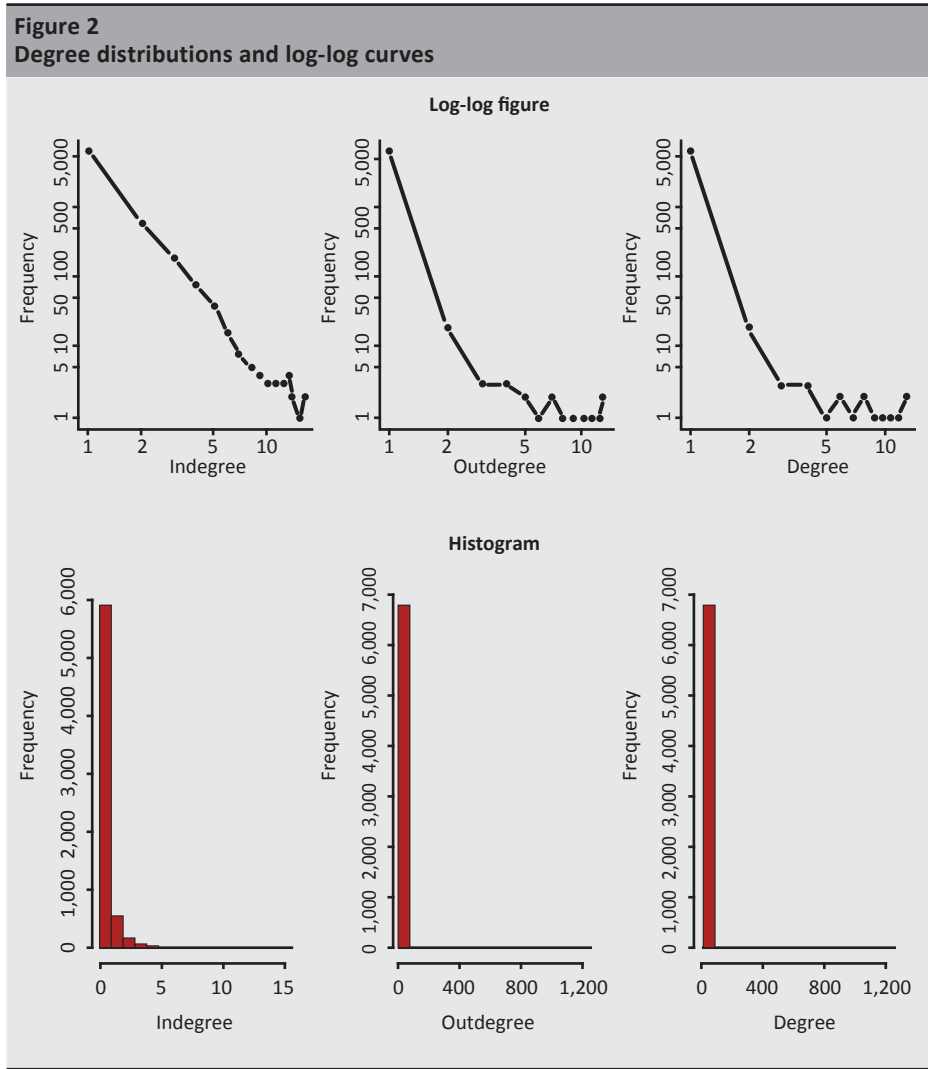
From the log-log curves and histograms it can be seen that the overall degree distribution and the outdegree follow a much more uneven and centralised distribution than the indegree distribution. This is because the stock market network is characterised by a rather low density (0.0002), but a high centrality index. If we look at the centrality index and examine the network by hub and by authority, we arrive at *Figure 3.*

Figure 3
**Centrality — hub and authority (N = 6 806)**

Hub network   Authority network
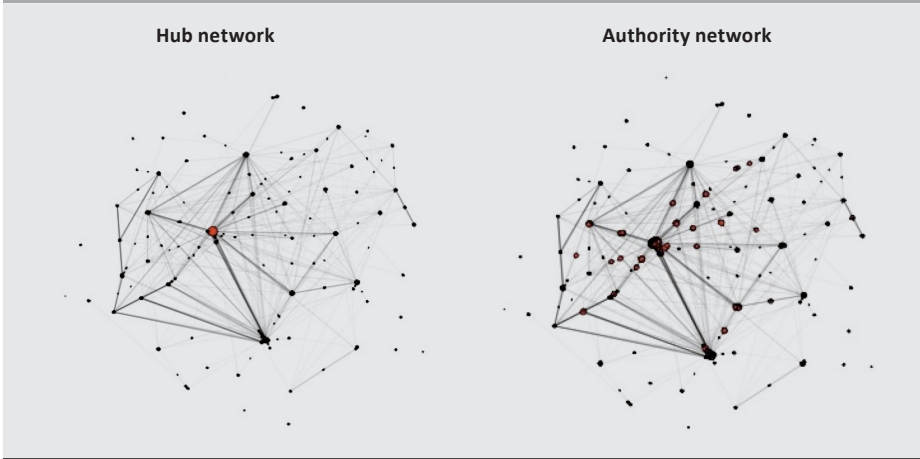
At the centres of the networks constructed on the basis of centrality indicators we find companies characterised by significantly different ownership relations, compared to other nodes. For companies in a central position, these overarching ties result in (1) an appropriate communication and business space, and (2) a monopoly over information. In addition, companies in the central tiers communicate with fewer intermediaries, which gives them relatively fast access to data. However, there are differences in the number of central actors in relation to hub and authority networks. Both centrality indicators were created on the basis of the eigenvector centrality, but while in the case of the hub, the index indicates which central actors are connected to many other well-positioned central actors, the authority indicator shows which actors, although not in a central position, are owned by a very large number of central actors. It is clear from this that, while well-positioned firms among listed and unlisted firms have relatively little contact with each other, each well-positioned firm is surrounded by a fairly broadly owned network of firms.

This brings us straight on to the identification of the subgroups of network clusters; however, due to the large number of elements, from this point on I will not make the whole network the object of analysis, but only the subnetwork of 845 nodes capturing the central core of the network. Once the analysis is narrowed down to this subgraph, the characteristics of the network can be more accurately captured. Using hierarchical cluster analysis to analyse this subgraph, we arrive at *Figure 4.*

Figure 4
Subnetwork on the basis of hierarchical clustering (N = 845)
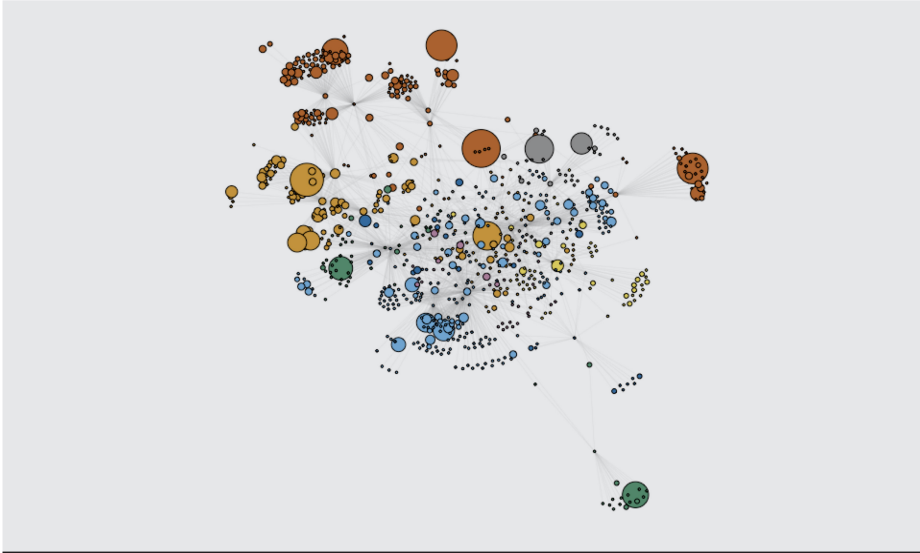
The density of the network has increased accordingly (0.031), compared to the overall network density, and the subnetwork is clearly decomposed into 14 clusters. Given the studies on hub and authority, this high clustering coefficient is not surprising. These 14 cliques actually make up a set of companies engaged in different economic activities; one in the banking financial field, another in real estate business, still another cluster in asset management, and the area of communications is also represented. The typology of clusters is shown in *Table 1*.

	Table 1 **Network cluster typology**			
Cluster	**Name of cluster**	**Main actors**	**Node**	**Per cent**
1	Banks 1	OTP, MKB, K&H, CIB	165	19.5
2	Lending, Real estate	Fund Finance, K 85, GRABOPLAST	138	16.3
3	Asset management	OPUS GLOBAL	107	12.7
4	Banks 2	Erste	90	10.7
5	Banks 3	Gránit, MFB, Budapest Bank, Export-Import Bank	71	8.4
6	Former socialist system large enterprises	Magyar Posta, MÁV, T-MOBIL, Airport	48	5.7
7	Communications firms	Vodafone, GIRO, Magyar Telekom, M Factory Kommunikáció, NISZ	47	5.6
8	Stock market, Asset management, Electricity	Budapest Stock Exchange, MAVIR Magyar Villamosenergia, Hungarian Mint Ltd., OVERDOSE Vagyonkezelő	38	4.5
9	Informatics, Former socialist system large enterprises 2	IQSYS Informatika, RÁBA, VOLÁN	33	3.9
10	Banks 4	Raiffeisen, UniCredit	31	3.7
11	Banks 5	Citibank, Takszöv, Exporthitel	22	2.6
12	Former socialist system large enterprises 3	MOL	21	2.5
13	Asset management	i-Vent Vagyonkezelő, PrimoInvest Kft, CFG PARALEL	18	2.1
14	Agriculture	Bonafarm	16	1.9
TOTAL:			**845**	**100**

At first glance, we get a really interesting network cluster typology. This is because cluster typology has been constructed by the distance between the edges, i.e. a network-based inclusion of the ownership aspect has shed new light on those trading.[7] The table reveals that banks form various clusters in accordance with ownership aspects. In fact, they can be divided into 5 distinct clusters, with quite different central positions. It is also worth noting the close clustering of companies that were state-owned large enterprises under the socialist system (RÁBA, VOLÁN; or Magyar Posta, MÁV). The clusters show a strong predominance of clusters engaged in financial activities, real estate business or wealth trade. Furthermore, it can be concluded that the presence of clusters producing a specific product is relatively low. In fact, the table reveals that there are three major clusters in the

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[7] In this case, of course, not only entities that are issuers are included in the analysis, but also companies whose products are not admitted to the stock market. It is precisely for this reason that cluster typology attempts to typologise the network of firms surrounding the issuers of the stock exchange.

ownership network: the first one mainly consisting of banks (OTP, MKB, K&H, CIB), owning about 20 per cent of the total network; the second one engaged in lending and real estate business (with an ownership of 15 per cent); and the third one engaged in asset management (OPUS GLOBAL), whose ownership share is around 13 per cent. These clusters own about half (48.5 per cent) of the total network, which indicates an extraordinarily high concentration of ownership.

After identifying the clusters, it is worth reviewing the hierarchy of the network, whose circular network diagram, log-log statistics, and histogram are summarised in *Figure 5.*

Figure 5
Hierarchy of the network (N = 845)

*Note: * N=845 Bandwidth=0.1745.*
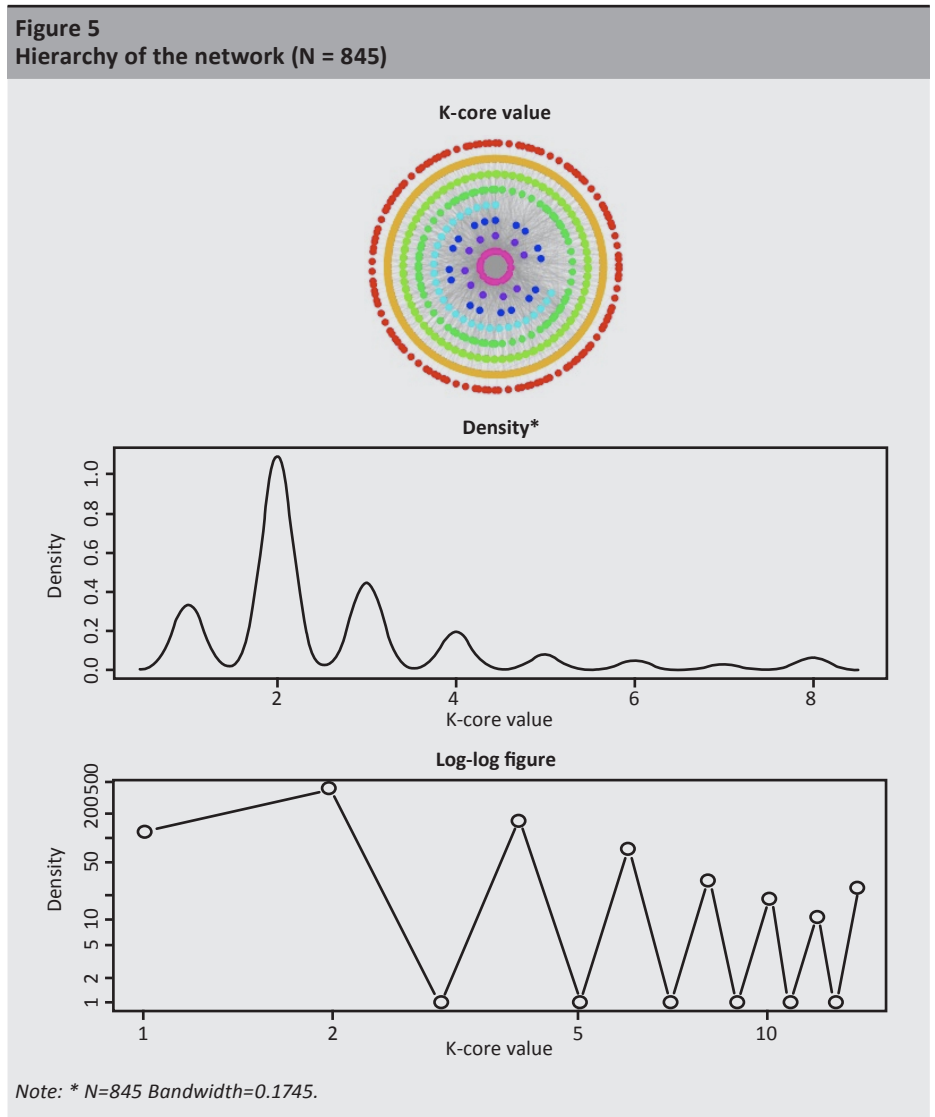
Not surprisingly, based on the clustering indicators of the network, a highly hierarchical network is formed by the network of company ownership. As shown in *Figure 5,* on the basis of the K-core value, the network can be hierarchically divided into three levels: the core, the semiperiphery and the periphery, i.e. the part where connections are dense, semidense and scattered. The central core has a closed structure and is made up of 24 companies with the strongest ownership linkages to the remaining elements of the network. These companies are listed by name in *Table 4* in the Appendix. The core level has high connectivity and centralised influence across the network as a whole, and it has strong ownership linkages to semiperipheral and peripheral companies as well. In terms of the number of elements, peripheral firms constitute the largest K-core group, but these firms play a negligible role in the evolution of the overall network.

5. Validation — Or: What theoretical network does the Hungarian stock market network resemble?

Before moving on to the ownership network of private individuals, I would like to make a small digression on how similar the ownership network of the Hungarian stock market is to the theoretical networks. The validation method can be used to obtain a reference point on the structure and typology of the network. I compare the company ownership network with three theoretical networks; (1) the Erdős–Rényi random network, (2) the small-world network, and (3) the Barabási scale-free network. The log-log diagram of the degree distribution of the theoretical networks simulated with identical node numbers is shown in *Figure 6,* and its main statistics are summarised in *Table 2.*

Figure 6
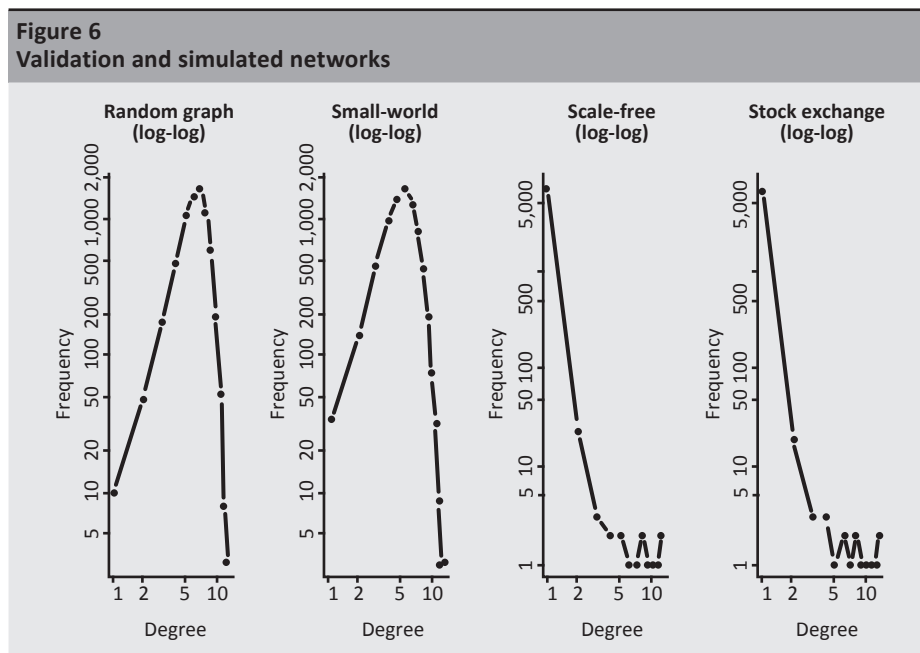**Validation and simulated networks**

Figure 6 clearly indicates that both the stock market network and its subnetwork converge to the degree distribution of scale-free networks. After an OLS regression analysis, it can be seen that the stock market network is significantly different from the random network and the small-world network. In neither case do we obtain a significant F-value for the ANOVA test, nor is the t-value of regression significant. By contrast, the network is found to be significantly consistent with Barabási's theoretical scale-free network. Indeed, based on the OLS regression, the F-value of the ANOVA is significant (16.593), and the regression t-value (4.073) also shows a significant result. All of this means that the stock market ownership network is a scale-free network. From the statistics in *Table 2*, it can also be seen that theoretical and real networks are characterised by sharply different edge numbers, average path lengths and densities.

Table 2				
Validation statistics				
	Node number	**Edge number**	**Density**	**Average path length**
Stock market	6,806	8,363	0.0002	3.15
Random	6,806	4,633,959	0.2002	1.80
Small-world	6,806	6,806	0.0003	35.39
Scale-free	6,806	6,805	0.0003	11.038

It is clear that (unsurprisingly) the random network is characterised by the largest number of edges, from which the stock market network differs significantly. However, roughly similar densities can be identified across the small-world network, the scale-free network and the stock market network. The difference between these networks lies in the average path length, as the value of the average path length is much lower in the stock market network than in either the scale-free network or the small-world network.

In summary then, the stock market network shows neither random network features nor small-world network characteristics; it mostly resembles the scale-free network, but has typically a much smaller average path length than the theoretical reference network. It follows that while the scale-free network is known for its high hierarchy, if we add to this the low average path length measured, the stock market ownership network is found to have an even higher centralisation and an even sharper hierarchy than the theoretical model, i.e. the network displays an extremely large number of nodes with extremely few connections, and very few nodes with a very high number of connections. This also means that for the actors in the central core, a faster information flow and a higher number of connections can be measured in comparison to the theoretical network.

6. The ownership network of the Budapest Stock Exchange from the perspective of private individuals

In the following, I briefly turn to the relation network of companies and private individuals trading in the stock market, which is illustrated in *Figure 7.*

Figure 7
Network and hierarchy of private owners (N = 5,902)

Network representation   K-core hierarchy
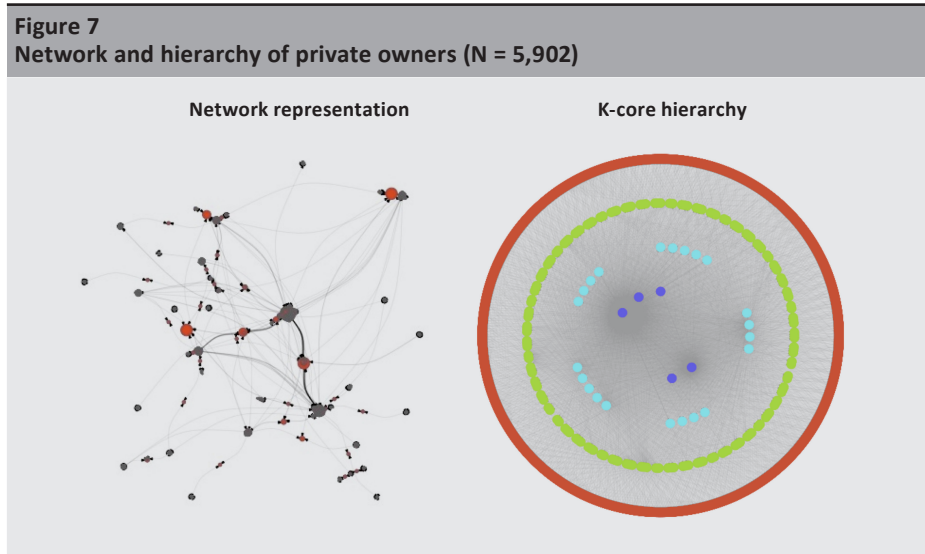
The network of private individuals shows a much less centralised and interconnected network than what we have seen for companies. The total network consists of 5,902 nodes and 6,083 edges, with a density roughly equal to that of the company network (0.0002), but for all other metrics, it is characterised by much lower values. This means that far more clusters (32 in number) can be identified in the network, and it is characterised by a much smaller ratio of cores (5 in number) than that shown for the company network. The hierarchy of the network is simpler, as in terms of element number, we can observe far more peripheral nodes and far fewer semiperipheral nodes. This means that the ownership network in the stock market is a much more loosely, much less tightly interconnected network when analysed in relation to private individuals, but at the same time, from a hierarchical perspective, it traces out a network that is even more centralised and that provides an even narrower range of opportunities for core actors.

7. Spatial distributions of networks

The geostatistical distributions of the networks can be used to reveal how ownerships are distributed in Hungary at the level of municipalities, and which municipalities have outstanding values. *Figure 8* shows the networks of company ownership and private individual ownership in a GIS diagram with kernel distribution, projected onto the map of Hungarian municipalities.

Figure 8
Kernel distribution of networks

By company (N = 6,806)

Distribution by settlement

- 0.000000 − 1.000000
- 1.000001 − 5.000000
- 5.000001 − 13.000000
- 13.000001 − 24.000000
- 24.000001 − 51.000000
- 51.000001 − 96.000000
- 96.000001 − 147.000000
- 147.000001 − 5,785.000000

By private individual (N = 5,902)

Distribution by settlement

- 0.000000 − 1.000000
- 1.000001 − 6.000000
- 6.000001 − 13.000000
- 13.000001 − 21.000000
- 21.000001 − 21.000000
- 21.000001 − 50.000000
- 50.000001 − 148.000000
- 148.000001 − 2,387.000000

Figure 8 shows that the capital city plays a prominent role for both the company and the private individual networks. 65.8 per cent of the companies are registered and 38.1 per cent of private individuals live in this municipality, which reflects a particularly high concentration in Budapest. In addition, large cities and their catchment areas are home to firms, but only to a negligible proportion, compared to the capital. At the county level, for companies, the counties of Pest (7.3 per cent), Fejér (2.4 per cent), Borsod-Abaúj-Zemplén (2.4 per cent) and Hajdú-Bihar (2.4 per cent) are the counties where companies are registered; and for private individuals, Pest (17.9 per cent), Hajdú-Bihar (3.9 per cent), Borsod-Abaúj-Zemplén (3.3 per cent) and Fejér (3.3 per cent) are again the counties where the owners most live, apart from the capital. The dominance of the capital is not affected by the fact that for the company network the network includes 586 municipalities in Hungary and for the private individual network 793, as compared to Budapest, the ratio of these municipalities is completely insignificant. The same can be observed in the case of municipalities outside Hungary, where the ratios are again very low. For companies a total of only 9 different companies (0.1 per cent) and for private individuals 53 foreign municipalities (0.8 per cent) can be found in the network.

This indicates that the share of foreign-registered firms in the company-ownership and private-individual-ownership stock market networks is negligible, as both have a share of less than 1 per cent, and for both networks the capital plays a role as a priority municipality.
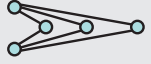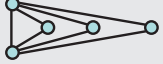
8. Exponential random graph modelling

At the end of my study, I present the results of the ERGM simulations performed for the whole network. The parameter estimates of the ERGM were compared with 10,000 individual Markov chain Monte Carlo (MCMC) network simulations. MCMC simulations produced networks with the same node number and density as the observed network. From comparison with these, the MPNet software generated parameter estimates of the model, which indicate the strengths and direction of endogenous network patterns. The parameter estimates of the network are presented in *Table 3.* Significant parameters are marked with an asterisk (*). A positive (negative) estimate indicates a larger (less) configuration in the network than expected, with other effects of the model taken into account. The magnitude of parameter estimates cannot be directly compared along the different effects, as the scaling of the statistics varies.

Table 3
Parameter estimates for ERGM simulations

Network effects	Figures of network effects	Parameter value (Estimate — SE)
Arc		−0.041
2-star		64.617*
3-star		318.904*
4-star		781.802*
5-star		4,320.958*
Triad		−1.542
4-cycle		84.170*
Isolate		−1.393*
Hub (degree effect)		22.428*
Multiple 2-paths		71.058*
Transitivity (closure of transitive paths in the case of multiple 2-paths)		−1.501
Alt-edge triangle		−1.243

*Note: * = the parameter estimate is twice the absolute value of the standard error, which means that the effect is significant.*

Based on the ERGM, the network is characterised by a negative arc effect (−0.041), but this effect is not significant. In short, pairwise interconnections do not play a dominant role in the network architecture. What plays an important role in the development of the network, though, is the affiliation to centrally positioned actors and clusters. We can see this in the network-forming power of the 2-, 3-, 4- and even 5-star shapes, which all have positive and significant values. This means that network centres play a crucial role in the development of the network, and they are surrounded by a multitude of poorly interconnected companies. The same result is also supported by the hub effect, i.e. the positive and significant effect of degree distribution (22.428).

The strong centralisation effect of the network is further supported by the negative and non-significant value of the triad effect, as this means that triple-closed connections do not materially shape the network. This is, however, contradicted slightly by the positive and significant role of quadruple-closed connections (84.170), but this can be explained by the fact that quadruple ties are formed quite often between hubs, which also points to a strong centralisation of the network.

The multiple 2-path effect is also positive and significant, indicating that in the measured network, due to the other effects of the model, there are more 2-paths than we might expect, i.e. the network is formed by a greater number of connections with central nodes that are linked to the same companies. On the other hand, the transitivity effect (transitive triad effect) is negative and non-significant, suggesting that these 2-paths do not close but condense around specific nodes. We observe the same lack of closure between actors in the finding that we do not obtain a significant value for alternative-edge triangles either.

9. Conclusions

In my study I analysed the ownership network of Hungarian stock exchange issuers. In an attempt to provide a complete yet robust network analysis, I have analysed not only the relation network of listed companies, but also the ownership relations that do not appear in the stock market. I looked at the network from two angles: (1) from the companies' perspective and (2) from the perspective of private individuals. I examined the detectable network characteristics of the Hungarian stock market by applying a methodological approach, namely network research and network simulation, which is perhaps less represented in the Hungarian academic literature, but is gaining ground in related literature abroad. However, I do not think by any means that my analysis gives a complete picture of the current situation. I believe that, at a further stage, it would definitely be worthwhile to complement the data with longitudinal analysis, to compare and analyse network typologies in terms of different markets, and to broaden the interpretative horizon of the analysis by including additional variables and indices.

From the companies' perspective, we can see that a huge network of firms is emerging around the issuers listed on the BSE, which strongly determines the network position of the issuing companies. Network analyses have shown that there is a high network interdependency between firms. From a clustering point of view, although the network is decomposed into several major clusters, a clique of three clusters owns about 48.5 per cent of the total network of companies. This results in a very highly hierarchised and centralised network typology. The same result is also supported by the ERGM simulation analysis, which shows that network formation is significantly influenced by network clique affiliation and ownership structure.

The network relies on a vast number of tightly interconnected and centralised network morphological shapes; thus, the morphology of two-, three-, four- and even five-star shapes has a particularly strong influence in terms of network formation, meaning that with respect to ownership, a very large proportion of firms are owned by a small number of firms. We see the same in the network-building power of the multiple 2-path-effect graph in contrast to the triad effect, which also suggests that the ownership structure is distributed between few nodes, but firms are simultaneously connected to several centrally located firms. Finally, the significance of square connection indicates that in terms of ownership, we can also measure strong cross-ownership between centrally located firms, which plays an important role in the formation of the network.

By contrast, for private individuals, we find a much more loosely interconnected network, which is, however, even more centralised than the company network. The few core actors in the hierarchy have even higher information flows and relational capital at their disposal than what is seen for firms. Furthermore, both networks are highly dominated by domestically owned firms, and within these, mostly by firms registered in the capital, Budapest.

What all of this seems to imply is that the ownership network of the Hungarian stock exchange is a scale-free network, which shares many similarities with the networks of the 'shallow' Greek and the topologically robust Chinese stock markets. In Hungary as well, the structure of ownership relations of the entities present as issuers in the Budapest Stock Exchange is characterised by a large number of heterogeneous components, which can easily be affected by a few centrally positioned actors or companies. It is also clearly evident that these ownership linkages go far beyond a single issuance market, showing a strong interconnectedness across markets. This is evidenced by both static and dynamic analyses. However — as the Chinese and Greek examples have shown — this also implies that the Hungarian stock market network is characterised by a typology that is fragile and not very resilient to environmental changes. In fact, from a network perspective, the academic literature agrees that on the one hand such highly centralised robust graphs can provide a very fast flow of information to network members, but on the other hand they may limit the appearance and success of new entrants in the system, and in the event of shocks, if centrally positioned actors do not react appropriately, the network can easily become vulnerable.

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Appendix

Table 4					
List of companies with a place in the core					
Name	**Degree**	**Outdegree**	**Indegree**	**K-core value**	**Cluster number**
OPUS GLOBAL Plc.	86	8	78	8	1
Appeninn Vagyonkezelő Holding Plc.	106	5	101	8	1
4iG Plc.	96	3	93	8	1
OTP Bank Plc.	275	14	261	8	2
MKB Bank Plc.	170	12	158	8	2
Kereskedelmi és Hitelbank Ltd.	11	11	0	8	2
OTP Ingatlanlízing Ltd.	8	8	0	8	2
OTP Jelzálogbank Ltd.	99	6	93	8	2
OTP Alapkezelő Ltd.	76	4	72	8	2
OTP Ingatlan Befektetési Alapkezelő Ltd.	98	3	95	8	2
CIG Pannónia Életbiztosító Plc.	43	3	40	8	3
MKB-Pannónia Alapkezelő Ltd.	66	3	63	8	3
Richter Gedeon Plc.	62	2	60	8	4
Citibank Ltd.	12	12	0	8	5
MTB Magyar Takarékszövetkezeti Bank Ltd.	10	10	0	8	5
Magyar Exporthitel Biztosító Ltd.	9	9	0	8	5
Takarék Jelzálogbank Plc.	44	5	39	8	5
Raiffeisen Bank Ltd.	11	11	0	8	7
GRÁNIT Bank Ltd.	12	12	0	8	9
MFB Magyar Fejlesztési Bank Ltd.	142	11	131	8	9
BUDAPEST Hitel- és Fejlesztési Bank Ltd.	9	9	0	8	9
Magyar Export-Import Bank Ltd.	68	7	61	8	9
Erste Bank Hungary Ltd.	145	9	136	8	10
MOL Magyar Olaj- és Gázipari Plc.	95	7	88	8	12

Methodological Background of the New Motor Third-Party Liability Insurance Index of the Magyar Nemzeti Bank*

Gabriella Merész – Norbert Holczinger – Koppány Nagy

In order to provide an accurate description of developments in the Hungarian motor third-party liability insurance (MTPL) market, as well as to inform the public and stimulate competition, the Magyar Nemzeti Bank (the Central Bank of Hungary, MNB) has elaborated an index to indicate the MTPL premium level. The method offers a comprehensive picture of changes in average premiums, as it uses data from the central itemised MTPL database to cover not only the population switching insurers but also remaining contracts and new entrants. It reduces bias due to seasonal effects and trends by eliminating changes in the stock composition. It can also illustrate how much the premium has changed in relation to the change in the magnitude of claims, taking into account the estimated average change in claims. In our study, we present the statistical and methodological considerations used in the calculation of the MTPL index and describe the relevant characteristics of Hungarian MTPLs.

1. Introduction

The market for compulsory motor vehicle insurance started on 1 July 1991; up to then it had been a charge built into the price of fuel and thus paid for at every refuelling. Since 1 July 1991, risks have been covered by a standalone, compulsory insurance contract to be taken out separately for each motor vehicle. Motor third-party liability insurance (MTPL) is currently regulated by Act LXII of 2009.[1] Due to its compulsory nature, it is the product with the largest number of contracts in the

[1] Act LXII of 2009 on motor third-party liability insurance https://mkogy.jogtar.hu/jogszabaly?docid=a0900062.TV

Hungarian insurance market, as MTPL accounted for 40 per cent of the 14.5 million insurance contracts outstanding on 31 December 2020. In 2020, the 5.8 million outstanding, in-force contracts accounted for one fifth of the gross premium income (HUF 247 billion) in the non-life segment and for more than one quarter of profit after tax (HUF 23 billion). The pandemic situation played a significant role in the extent of the latter, but even after eliminating the one-off effect of Covid-19, the result would have been substantial, in line with the previous 3-year, sector-level business profit of over HUF 10 billion.

The significant weight of the MTPL business line is not specific to Hungary. Although its extent varies more widely across countries, the product accounts for 16 per cent of total non-life insurance premium income in Europe (*EIOPA 2021*)*.* Although we were unable to find sufficiently detailed, up-to-date data in the course of our research, previous information suggests that in Central and Eastern Europe, the weight of MTPL contracts regarding non-life insurance segment exceeds the EU average, but this share is decreasing compared to 2004, due to the strengthening of property insurance products (*Wieczorek-Kosmala 2016*)*.* Premium income in the MTPL market in the countries covered by Insurance Europe grew 1 per cent in 2015 and 4 per cent in 2016 to reach EUR 61 billion. The increase is mainly attributable to Turkey (76 per cent), Poland (43 per cent) and Hungary (34 per cent) (*Insurance Europe 2019*)*.* Nevertheless, average premiums in Hungary remained below the European average in 2016. There may be several reasons for this, such as different vehicle stock and varying service and labour fees, but a detailed analysis of this is beyond the scope of this study.

Overall, MTPL is a business line that affects a broad cross-section of society and also has a substantial impact on insurers' performance. It is, therefore, not surprising that the study of this product, and in particular of changes in premiums, is receiving a great deal of attention from the professional community and the wider public.

Prior to 1 January 2010, the announcement of MTPL premiums was concentrated in a campaign period (the November preceding the reference year), which was then replaced by continuous premium announcement. The insurance anniversary for vehicles purchased after the abolition of the single end-of-year anniversary, i.e. after 1 January 2010, is no longer 31 December, but the date on which the MTPL for the vehicle was taken out, which is, of course, a different date during the year for each motorist. This also made it more difficult to compare premiums. However, there was a market and societal need to compare changes in premium levels, i.e. to establish a reference point. In the past, some brokerage firms developed methodologies and published data in this respect, but these cannot give an accurate picture of market developments, as the intermediaries only have information on the contracts they mediate.

The reports produced by international organisations also contain data on the evolution of MTPL premiums, but these cannot usually provide accurate answers to questions about changes in the average premium. Moreover, in our experience, a detailed methodology for the published data is not available, and the frequency of updating the reports is not necessarily sufficient for up-to-date monitoring of developments. The annual Consumer Trends Report published by the European Insurance and Occupational Pensions Authority (EIOPA), for example, only shows the evolution of total premium income, with no information on average premiums (*EIOPA 2021*). In the case of the data in the report published by the professional organisation of European insurers, the Insurance Europe, the main problem – apart from methodological issues – is the timeliness of data. The last report was published in 2019 (*Insurance Europe 2019*). However, the wide range of information available to the MNB has made it possible to create a comprehensive MTPL price index that provides a complete, up-to-date overview of changes in average premiums.

In this study, we describe the statistical background of the index, especially the data used for the calculations, and the methodology. In the second section, we present the key features of the central itemised MTPL database (KKTA) created and operated by the MNB, which forms the basis for the calculations, and analyse the data used in the light of the main factors determining the MTPL premium. Section 3 presents the methods used to determine the premium level of the MTPL index, while fourth section considers the indicators for the average premium level of other vehicle categories. In the fifth section, some weaknesses of the method are discussed, and the results are then described in the sixth section.

2. Available data

According to the amendment to Act LXII of 2009 on MTPL, adopted in the autumn of 2018, the itemised motor third-party liability insurance contracts and claims database (KKTA) created and operated by the MNB will assist all actors in the MTPL market. In addition to supervisory use, insurers performing KKTA data supply can request aggregated data. Motor third-party liability insurance contracts and claims are submitted to the KKTA in an itemised form on a quarterly basis by insurers obliged to supply data. Since 1 January 2011, the database has been collecting data on all domestic MTPL contracts and claims, with a level of detail adapted to legal and professional actuarial standards. The system currently has data available on nearly 22 million contracts and 1.5 million claims; thus, the database offers a wide range of possibilities for actuarial calculations and analyses.

Data quality requirements are ensured by a three-level data check. Submission of data is possible if the format of the data is in accordance with the XSD schema available on the MNB's website.[2] If data provision has passed the formal check, the next step is a content check for acceptance, in the course of which the system checks the completeness of the required data and basic quality compliance. In the last step, content errors that do not prevent acceptance are displayed to the MNB, which may request correction if a content error is confirmed. This three-step check ensures that the data is correct and usable. Despite the automatic processes built into the system, data quality problems cannot be completely ruled out, but the checks carried out by the MNB's experts and the multi-stage review of the data used for publications minimise the likelihood of major errors.

We are not aware of a supervised database with the same level of detail, but it is worth noting a similar example from abroad. In Estonia, there is a register of MTPL contracts, which contains contracts for Estonian vehicles and insurance events occurring in Estonia. The database includes a number of queries, such as information on the claims history of a vehicle, the validity of motor third-party liability insurance, or even a map showing the location of claims. The queries are available free of charge.[3]

The KKTA provides a comprehensive database of the full range of contracts in the market at the end of the given period (quarter), including new contracts and those in which the insurer did not change. Since MTPL insurance is required by law, we obtain a nearly complete picture of the motor vehicles in use. This is true even if we know that not all motor vehicles have an MTPL contract. Indeed, based on the available data, the number of uninsured motor vehicles is relatively low, at around 2 per cent (*MABISZ 2020*), i.e. the database covers virtually all domestic motor vehicles. Our goal is to create a metric that objectively measures changes in premiums. Objectivity also requires that the impact of portfolio composition changes on premiums be eliminated from the data. To this end, we examined in detail the portfolio of domestic MTPL contracts, which consisted of 5.8 million contracts as on 31 December 2020. The segment affecting the population, and within it, passenger cars accounted for 69 per cent of the portfolio in terms of the number of cars and 65 per cent of it in terms of the 12-month regular premium[4] as at 31 December 2020 (see *Figure 1*).

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[2] The technical guidelines for the central itemised MTPL database (KKTA) are available on the MNB's website. https://www.mnb.hu/felugyelet/adatszolgaltatas/biztositok/2018-evre-vonatkozo-adatszolgaltatasok/a-kozponti-kgfb-teteles-adatbazis-kkta-technikai-segedletei

[3] Motor Insurance Register, Eesti.ee. https://www.eesti.ee/en/traffic/traffic-management/motor-insurance/#motorinsuranceregister8

[4] 12-month regular premium: the premium for insurance policies valid during a given period for one insurance period (one year) in the insurer's statistics.

Figure 1
Distribution of the number and 12-month regular premium of MTPL contracts by main vehicle type at 31 December 2020

Source: MNB
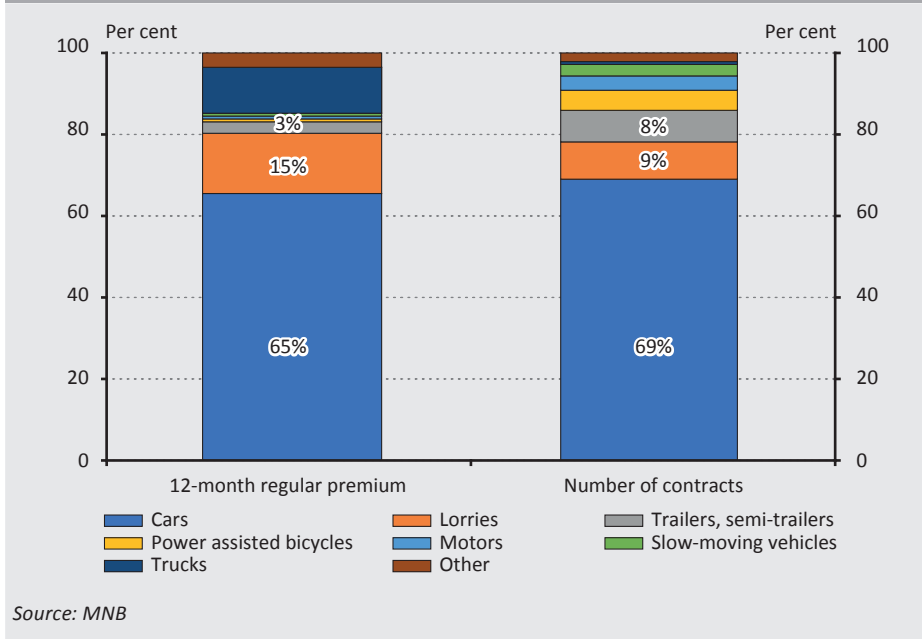
The MTPL index measures the changes in the average premium of passenger cars; thus, in the following, we look at the data on MTPL contracts for passenger vehicles. For each contract, the number of contracts with an anniversary date in the given quarter is known, which shows strong seasonality due to the campaign period previously regulated (before 2010). One fifth of the contracts are still linked to what is known as '31 December – 1 January'[5] or calendar anniversary stock. This stock differs significantly from the others in terms of its characteristics, as it consists mostly of contracts in bonus-malus ratings B8 and B10, and the vehicle keepers are older persons. The composition of vehicles is also different from the average, as the overall portfolio composition has shifted towards more powerful vehicles in recent years, while these motor vehicles are typically less powerful. The specific characteristics of the portfolio are also reflected in the insurance premiums; thus, if we examine the quarterly series, and changes in premiums during the year, seasonal and trend-like effects can cause bias (see *Section 3* for details). In order to analyse the average premium level and to draw the right conclusions, it is thus necessary to eliminate these effects.

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[5] Although the initial recognition date for these contracts is 1 January, for administrative reasons, some insurers set 31 December as the anniversary date, while other institutions set 1 January.

Before further investigation, it is useful to clarify the principles of premium calculation. The insurance premium is the compensation given for services and claims payments provided by the insurer, i.e. for risk bearing. In simple terms, we can think of the insurance premium as being something that should include, as a minimum, cover for claims and technical risks, called the risk premium part, plus the insurers' costs, profit expectation and tax liability, also known as the entrepreneurial premium part. The traditional calculation of premiums is based on mathematical models; the most commonly used and simplest principle for calculating non-life insurance premiums is the expected value principle. Traditional non-life insurance premium calculation techniques are reviewed by *Arató* (*2001*).

For passenger car MTPL premiums, insurers apply a number of differentiating factors, which are basically related to the vehicle keeper or the insured motor vehicle. In our experience, the most important elements are:

• the vehicle keeper's
  – age
  – place of residence
  – bonus-malus rating
  – the date the vehicle keeper obtained the driving licence (driving experience)

• the vehicle's
  – make
  – engine power
  – fuel type
  – age

As the KKTA does not cover all of the above criteria (*MNB 2018*) and does not include information on driving experience and the vehicle's make, fuel and age, we are not in a position to analyse their evolution over time. However, it is possible to examine the stability of the stock in relation to the other elements. We have chosen the first quarter of 2016 as the starting point, because for the sake of stable results, this is also the period that (1) represents a time series of sufficient length to provide a benchmark for the MTPL index, and (2) is less distant in time from the introduction of the KKTA, thereby increasing the reliability of the data. The last data are from the fourth quarter of 2020, allowing us to examine the evolution and possible seasonality of the above factors over the last five years.

The age of vehicle keepers can be considered stable over the time span under review, with changes of 1–2 percentage points in the six age groups we have examined. For example, the weight of the 40–49-year-old age group, i.e. the largest group of vehicle keepers, has ranged between 26 and 27 per cent throughout the period (*Figure 2*).

Figure 2
Distribution of MTPL contracts by age of vehicle keeper
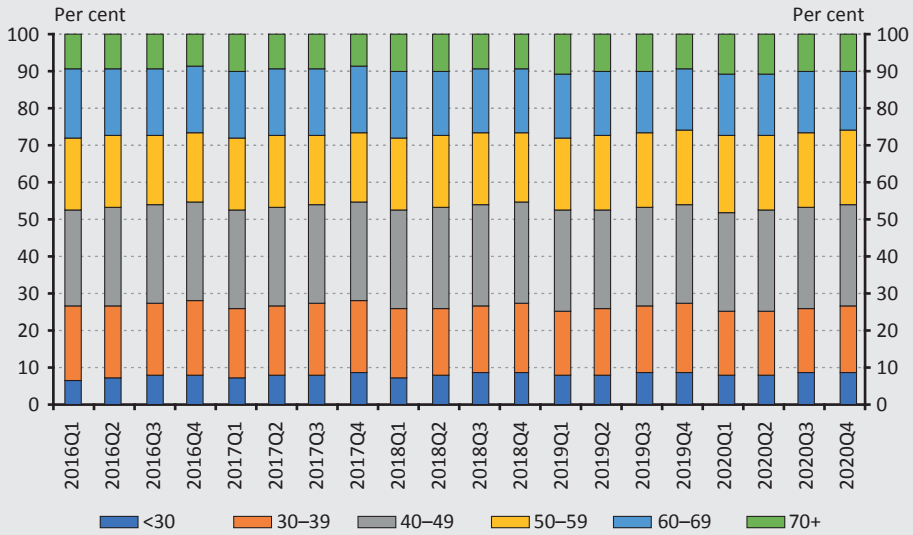
Source: MNB

Regional distribution is similar, i.e. the address distribution of vehicle keepers is stable in terms of regions: the share of those with a Budapest address ranged between 15.6 and 16.5 per cent in the period under review, which represents a minimal shift (*Figure 3*).

Figure 3
Regional distribution of MTPL contracts (capital – countryside)
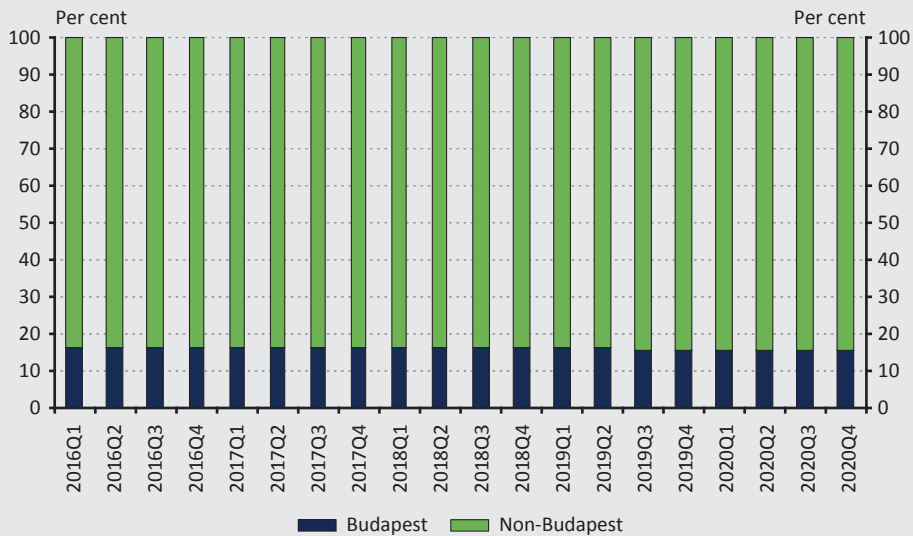
Source: MNB

By contrast, there has been a major shift in the engine power of insured passenger cars in recent years towards more powerful passenger vehicles (*Figure 4*). This phenomenon is well illustrated by the fact that the share of cars with an engine power of 71 kW or more was only 40.9 per cent in the first quarter of 2016, which rose to 53.7 per cent by the fourth quarter of 2020.

Figure 4
Distribution of MTPL contracts by engine power of insured motor vehicle

Source: MNB
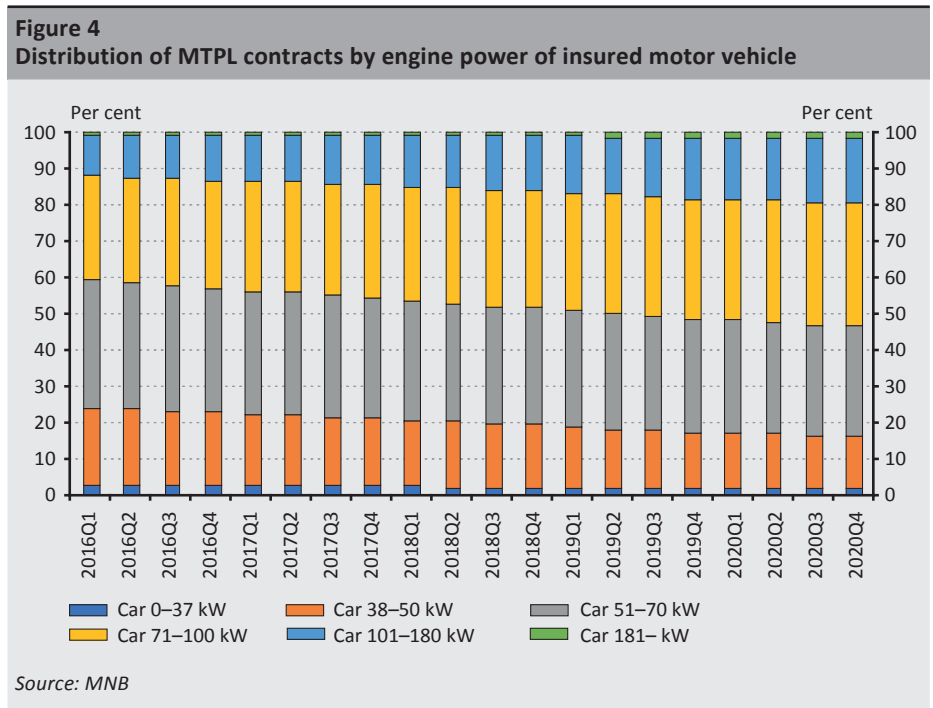
The bonus-malus (BM) rating cannot be considered constant over time (*Figure 5*), as it typically varies depending on the claims in the given year: in the case of no claims, the rating will improve year by year until it reaches the most favourable category (B10), whereas if damage occurs, the rating goes down by 2 categories all the way to category M4. In addition to the anniversary bonus-malus variation, the seasonal effect of the calendar anniversary stock mentioned earlier is also important. To exclude these, variations in the bonus-malus ratings need to be addressed.

Figure 5
Distribution of MTPL contracts with an anniversary date in the respective quarter by BM rating of the insured motor vehicle

Source: MNB
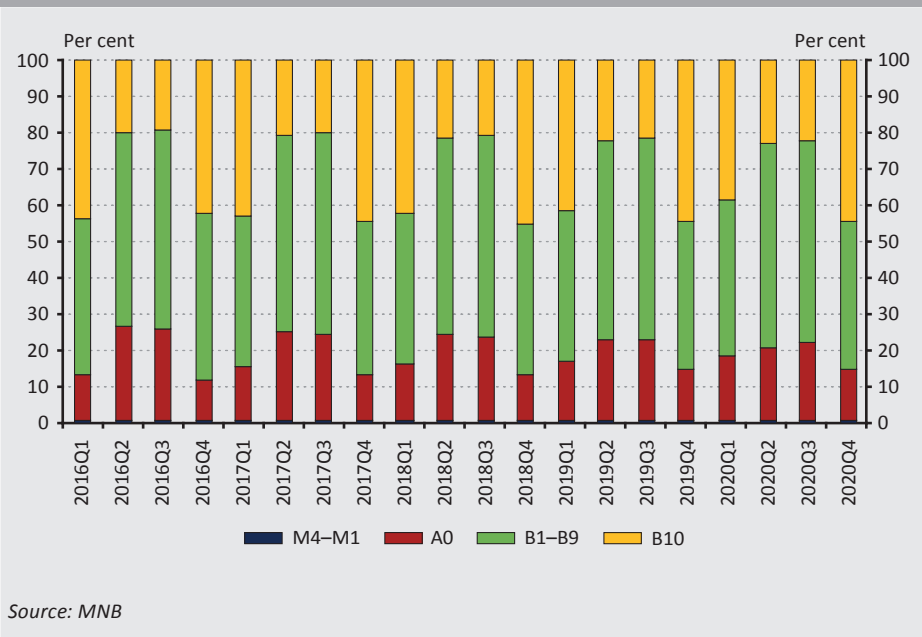
Thus, our analysis suggests that among the principal factors affecting the MTPL premium, bonus-malus rating and vehicle power have changed substantially over time, i.e. they may bias the results when we examine changes in average premiums. For this reason, these effects should be eliminated in the premium change analysis. By contrast, the age and regional distribution of vehicle keepers remains stable over time and therefore do not affect the analysis of the changes in premiums and the interpretation of the results.

3. Index relating to the average premium level for passenger cars

The purpose of creating the MTPL index was to define a measure that would allow the public to be informed about changes in average premiums. In this context, it was also important to condense the information properly. To achieve this, an index showing the average variation in percentage terms was deemed an appropriate choice. It is not overly complex; hence no insurance expertise is needed to interpret it, but it does describe the market and its developments well.

3.1. Average premium level

For the sake of stable results, the base for the MTPL index is the first quarter of 2016, which (1) represents a time series of sufficient length, and (2) is less distant in time from the introduction of the KKTA, increasing the reliability of the data. In the calculation, out of the outstanding and in-force or suspended contracts at the end of the given quarter, essentially those with a positive 12-month regular premium and an anniversary date in the given quarter were taken into account. This also includes those new contracts for which the initial recognition date is in the given quarter. We looked at the 12-month regular premium of these contracts in terms of forint value, summed it up and divided it by the number of contracts to obtain the average 12-month regular premium. This allows us to observe the actual changes in the average 12-month regular premium.

Figure 6
Current average premium values for passenger cars and their moving average

Source: MNB
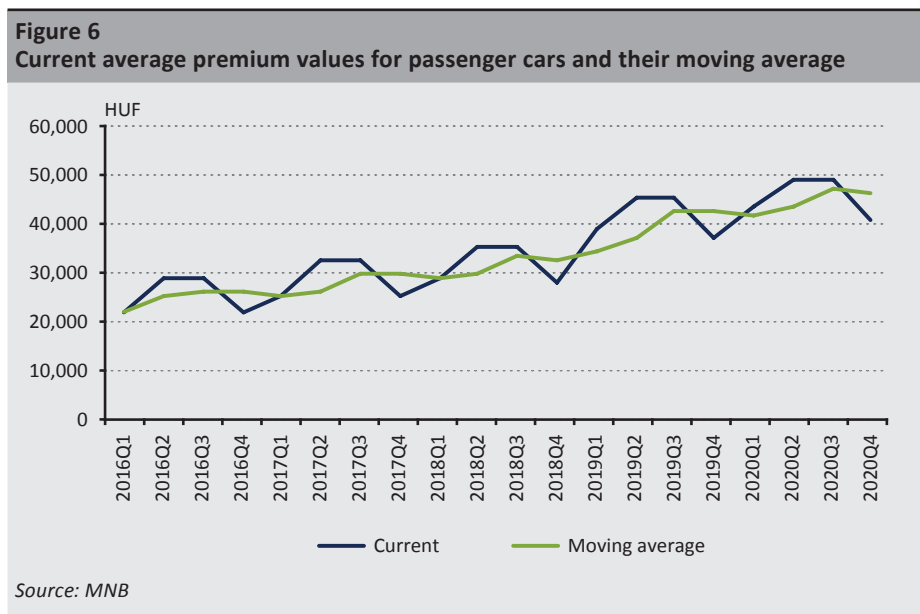
There is significant seasonality in the current values: due to the aforementioned calendar anniversary stock, in the year-end roll-over campaign, the fourth and first quarters all have lower average premiums. In our view, this effect should be eliminated from the data set, as it strongly biases the results. To do this, as a first step, we tried to smooth out the curve by using a simple moving average, i.e. the average of the previous three quarters. What we found, however, is that although this procedure dampens the seasonal effects, it does not remove them, but only prolongs them. In other words, it is not able to follow market changes adequately; noticeable changes can be seen only after a time lag or with a delay. A good example of the lagged effect is the incorporation of insurance tax into the MTPL premiums,

which can be identified by a comparison of average premiums in 2018 and 2019 (*Figure 6*).

3.2. Smoothing the average premiums for passenger cars

Several parameters were considered in the data to determine whether there could be observed marked stock transformation over the five years under review, or significant seasonality in the anniversary ratio (see *Section 2*). On this basis, the composition of passenger cars by power category and the seasonality caused by the old campaign period need to be smoothed out in order to arrive at a premium level. This smoothing is performed by projection on the stock composition, i.e. based on our preliminary analysis, at the end of the given quarter, we clarify the stock in relation to two factors for passenger car power ratings and bonus-malus rating. This adjustment also corrects for changes in the average premium level due to the transformation of stock composition by power rating; as described earlier, the composition has been moving from lower towards higher powered vehicles. With this composition, we smooth out the previous quarters, multiplied by the effective average 12-month regular premiums of anniversary contracts in the current quarter concerning the segments (*Figure 7*). Therefore, this shows us what the average premium would have been for previous periods, if in previous quarters, there had been a stock composition corresponding to the current stock composition at the end of the quarter. The query is based on quarterly updated data, and the stock composition may change; hence the back data may also be subject to modification. These are always taken into account in the method, because filtering applies to contracts that are outstanding and have an anniversary date (start) at the end of the given quarter. First, we considered the entire passenger car stock, including fleet vehicles and also those not in normal use. Fleet contracts, however, are typically calendar anniversary contracts, which may cause seasonal bias; moreover, their risks may differ from those of individual contracts. The latter is also true for passenger cars not in normal use, as it includes, for example, taxis, which have a different risk from that of normal-use, ordinary cars. Hence, in order to achieve the most robust and reliable results possible, the stock covered by the index was limited to individual and normal-use vehicles. Thus, we confined ourselves to residential contracts for the most part.

Figure 7
MTPL index compared to the current average premium value and its moving average

Source: MNB
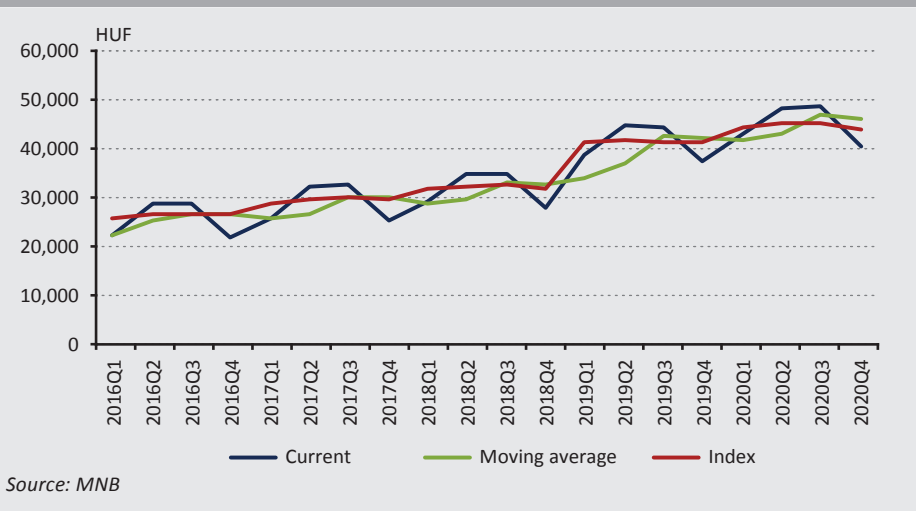
For the aforementioned reasons, the index was calculated not only for the total domestic stock, but also for a Budapest and non-Budapest disaggregation (*Figure 8*). Several approaches were explored as to what regional groupings might be useful. We found, however, that further disaggregation of areas outside the capital into county seats and other cities does not provide much additional information compared to the 'non-Budapest' disaggregation: both the absolute value of average premiums and their variation show a very similar picture.

Figure 8
MTPL index in Budapest and non-Budapest

Source: MNB
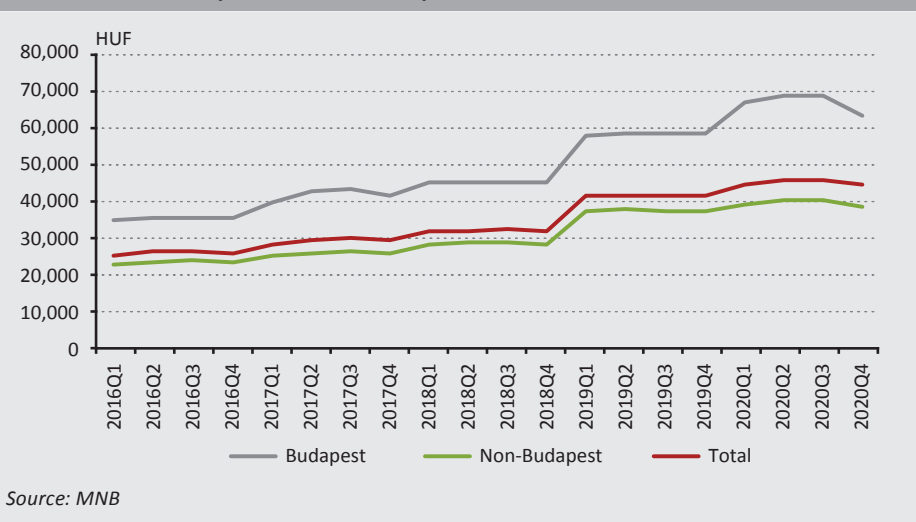
In the fourth quarter of 2020, the national average premium for normal-use passenger cars was HUF 44,523, while in Budapest it was HUF 63,213, compared to the premium of HUF 38,908 for contracts outside the capital. Budapest premiums are thus much higher, a phenomenon explained by the different risks involved. Our calculations show that the difference in premiums can be almost entirely attributed to the difference in damage probabilities.

3.3. Adjusted MTPL index

In addition to establishing the MTPL index, we also created a so-called adjusted index, which shows a kind of net premium level change. Indeed, the interpretation of nominal changes in MTPL premiums may in itself be misleading, since – because of the equivalence principles mentioned above – the premiums are required to follow the movements in the insurer's expected expenses, such as claims expenditure and costs, also including tax payments.

For motor third-party liability insurance – under various headings – a tax liability has been incurred since 2013. The rules on the accident tax were contained in Chapter II of Act CIII of 2011 on the Public Health Product Tax (Neta Act). The amount was collected by the insurers from the clients and was forwarded by them to the state; thus, it had to be paid to the insurer together with the insurance premium or instalment, but administratively, the insurance premium and the tax were separated. The basis of the tax was the annual motor third-party liability insurance premium, and the tax rate, in principle, was 30 per cent of the annual MTPL premium. However, there was an upper limit, according to which the annual tax could not exceed HUF 83 per day per motor vehicle, which the insurer had to charge for each day of the period of risk bearing involved: thus, the tax rate was maximised.

From 2019, the legislative background changed: due to the changes to the tax law announced for 2019, the accident tax was abolished from 1 January 2019, and gradually replaced by the insurance tax with the anniversary of the MTPL contracts. In 2019, this tax type was incorporated into the premiums, meaning that the two items are no longer separate; hence the tax change represents a jump in relation to the average premium level. However, this amount received is paid by the insurers to the budget in the form of a tax after collection. The premium level increase due to the one-off tax effect should be ignored, as this phenomenon can lead to incorrect conclusions.

To exclude the tax effect, we looked at the tax rate to be taken into account for the average 12-month regular premiums instead of the itemised adjustment, since the KKTA only includes the premium plus insurance tax (12-month regular premium), and not the premium without tax. We therefore examined on a group-by-group basis, whether 23 per cent of the 12-month regular premium or the daily limit of

HUF 83 determines the insurance tax. Based on itemised data filtered for different months, we estimated the effective, empirical value of the tax (i.e. taking into account the daily limit of HUF, 83 in addition to the 23 per cent tax rate) at 21 per cent, and, to reflect this simplification, adjusted the index values after 31 March 2019 by 21 per cent.

Another important component of the adjustment is the estimated claims expenditure for the given segment at the time of index calculation. The total claims expenditure is the combined amount of the overall claims payment volume for each claim and the RBNS reserve applicable for the given reference date (and for annuitants, even the annuity reserve and the annuities paid), less the value of recovery and regress reserve, to which the insurer is entitled in the case of statutory conditions. We looked at these amounts in terms of forint value.

In some cases, the increase in the average premium may be due to non-insurance-specific developments. This could include an increase in the euro exchange rate, which has an impact (1) on international claims settlements, but more importantly, (2) on the costs of servicing and repairing motor vehicles. This is often reflected in the price of spare parts mostly purchased from abroad. There is also an increase in the labour costs for damage repair. The bias effect due to a possible increase in claims expenditure per contract can also be adjusted.

However, claims settlement is a time-consuming process, as there can be a considerable time lag between the incurrence and the reporting or actual claims payment. This necessitated an estimate of already incurred, but not yet reported claims. Therefore, for each quarter, we looked at the amount of claims expenditure for the quarter of incurrence in the given quarter: we examined the run-off of claims in a kind of claims-run-off triangle. In this, the amount in a given row was the total claims expenditure for claims incurred in the relevant quarter, with the diagonal showing the claims expenditure recognised and/or paid in the quarter of incurrence. We analysed the dynamics of how the claims expenditure for the quarter of incurrence compares to the total claims expenditure incurred in a given quarter. The dynamics show a substantial divergence in the last four quarters, as the full run-off is not yet visible in these quarters (*Figure 9*)*.

Figure 9
Ratio of claims expenditure for the quarter of incurrence compared to total claims expenditure

Per cent

Source: MNB
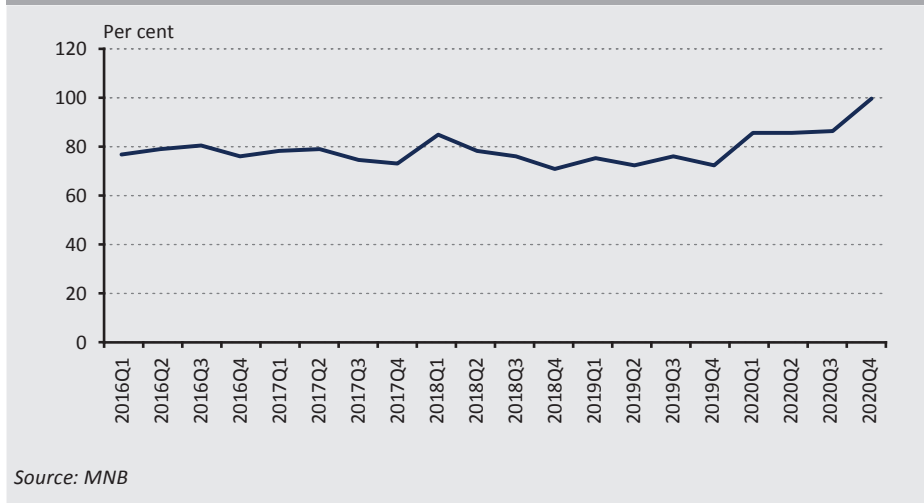
The closer this value is to 100 per cent, the higher the percentage of the total claims expenditure is in the quarter of incurrence. This becomes higher and higher as we get closer to the current quarter, since we do not yet have data for those that would appear in, say, quarters 2 to 4 after the incurrence. Thus, we looked at the claims expenditure for the quarter in which the claims were incurred as a percentage of the total claims expenditure in the quarters preceding the last four quarters. An overall ratio was calculated from the average of these values. In order to also take into account late claims reporting or the effects of claims reviews, we multiplied the data for the last four quarters by this value. This is how we obtained the total claims expenditure for each quarter. The value of claims expenditure also includes the reserves built up; thus, when a claim is paid, the actual payment may be higher or lower than this, or, in practice, there are reserve reviews that may result in significant reserve release or build-up. This phenomenon may even lead to large fluctuations in the claims expenditure, with a seasonal effect due to the typically year-end review of reserves. To exclude this bias effect, moving-average smoothing was applied (*Figure 10*). The decline in the last four quarters is likely to reflect the impact of the coronavirus, i.e. the effect of reduced turnover due to working from home and curfew restrictions can be seen. The impact of this will be felt in the long term, but it shows up here too.

Figure 10
Changes in claims expenditure per stock
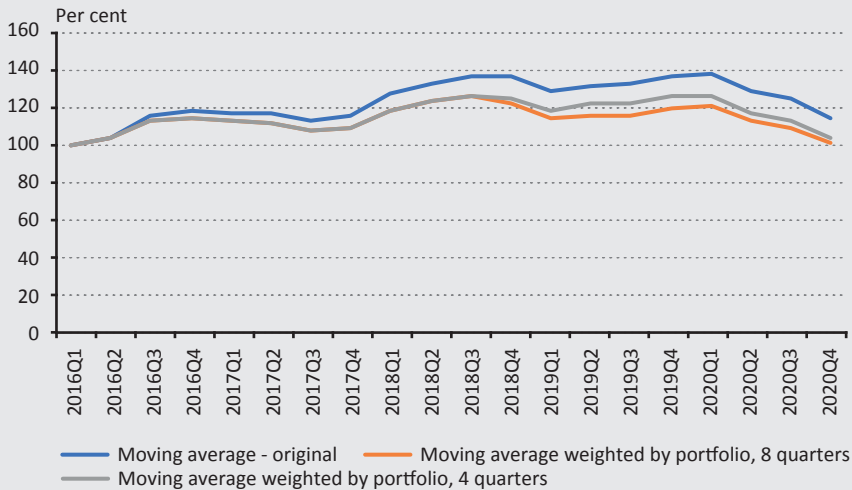
Source: MNB

When calculating the MTPL index for the average 12-month regular premiums, we also took into account changes in the composition of annual and infra-annual stocks, the impact of which may also affect claims. As there are today a higher proportion of more powerful vehicles on the roads compared to the first quarter of 2016, we can also assume that larger vehicles cause more damage. Therefore, we adjusted the value of the claims expenditure with the current stock composition, more precisely, with the bonus-malus and the vehicle power, thus obtaining the estimated claims expenditure corresponding to today's stock composition for the previous quarters. In other words, we also used this to calculate the average claims expenditure for a given contract. The obtained values were compared to the first quarter of 2016, and the MTPL index was divided by the resulting number. This is the adjusted MTPL index (*Figure 11*).

Figure 11
Adjusted MTPL index

Source: MNB
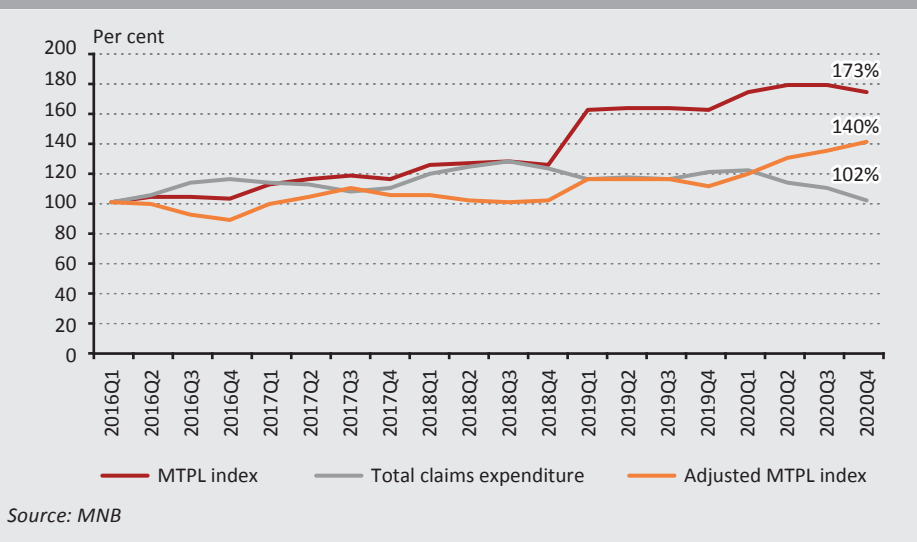
Using the itemised database, the method can show not only the population switching insurers, but also the evolution of the 12-month regular premium of the remaining contracts and new entrants, thus providing a more detailed picture of the market premium level. On the other hand, the adjusted index shows the index without tax and claims expenditure, which essentially reflects how much of the increase in the average 12-month regular premium is not explained by the increase in tax and claims expenditure.

4. Other vehicles

The change in passenger car premiums directly affects the largest part of the population, but the evolution of the average MTPL premium for other types of vehicles may also be of interest. The distribution of fleet and individual contract premiums is different for these other vehicle categories, as most of the trucks and trailers used for transport belong are covered by fleet contracts concluded by transport companies with individual offers. This is also the case for the stock of larger buses. In view of this, other vehicles with the largest stocks are examined separately. For these vehicles, we distinguish between the average 12-month regular premium and number of units for the total stock and for individual contracts, and also highlight the types of vehicles with a larger stock. For these categories, instead of looking at the quarterly change, we look at the annual change, comparing the current quarterly average premiums with the same period of the previous year to exclude seasonality due to the calendar anniversary. Since the basis of comparison is the previous year, and not the first quarter of 2016 used for the MTPL index, the effect of the insurance tax is not present,

as the premiums of the earlier years taken as a basis of comparison already include it. In the case of the first publication, the basis for comparison is the anniversary stock in the fourth quarter of 2019, the 12-month regular premium of which already includes the tax effect; thus, this does not alter the comparison.

For other MTPL vehicles, it was decided to use a narrower data set, and therefore, in the public publication we present figures for the units, average premium and annual change for the vehicle relating to normal-use passenger cars and taxis, motorcycles, mopeds, buses (with a breakdown into smaller and larger buses, as their premiums are quite different), lorries, trucks and heavy trailers. These categories are shown both on an individual and on a fleet basis.

5. Limitations of the model

The MTPL index measures the changes in average premiums and thus condenses information. Premiums for individual contracts can differ markedly from the average premium; in fact, the degree of their change can also vary considerably from the average. We looked at how 12-month regular premiums are distributed by bonus-malus rating. The empirical distribution of premiums shows that market pricing is not concentrated around an average value, but that there are also 12-month regular premiums even quite far from the average. Currently, most of the contracts fall into bonus-malus categories A0 and B10; hence we present the results for these two BM ratings in *Figure 12.*

Figure 12
Distribution of passenger car premiums for A0 and B10 BM ratings by HUF 5000 interval; 31 December 2020

Source: MNB
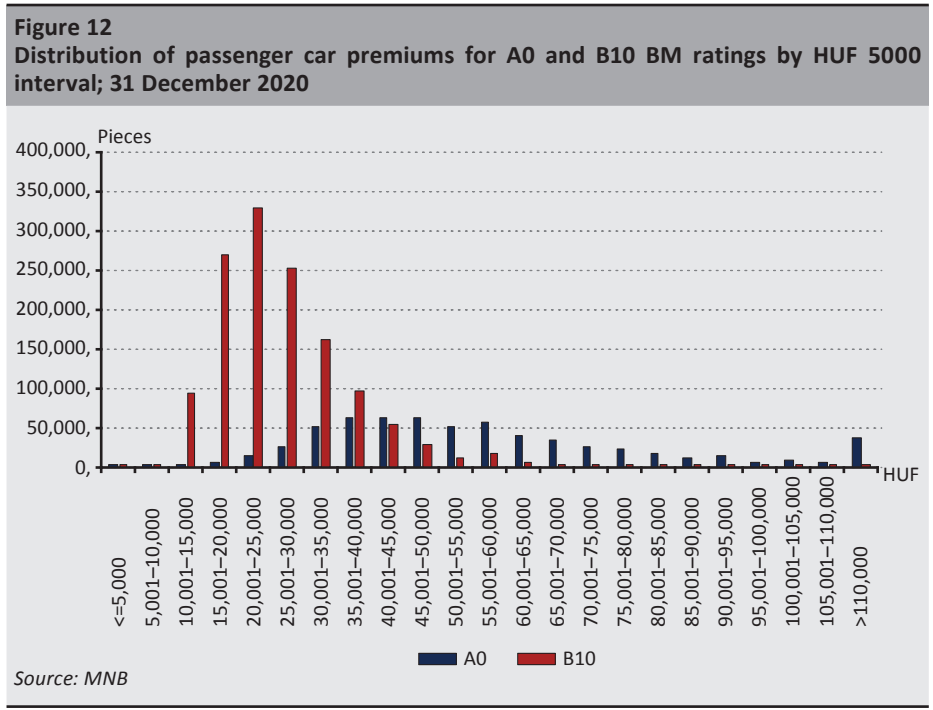
It is clear that while the B10 stock with a favourable claims experience is more concentrated at a lower average 12-month regular premium level, this can show much higher values typically for vehicle keepers who are new to the market.

One possible way of excluding the above phenomenon is to use a model-point approach, i.e. to look at the premium variation for type contracts. A similar methodology is used by insurers in the case of the annual cost ratio (ACR) to be calculated for savings life insurance policies, where the calculations need to be made for an insured person aged 35 (*MNB 2015*). However, for the MTPL, we believe that the index can provide more accurate information. The primary reason for this is that the number of parameters used to calculate premiums for MTPL contracts is several times higher than the number of assumptions used for savings life insurance policies, making it difficult to define the parameters of a typical contract. The other reason is that – unlike life insurance policies – in the case of MTPL, the KKTA provides the opportunity to create a representative index.

For claims expenditures, a 5-year data period may not necessarily cover the time span for total late claims, but the claims history is expanded with each passing quarter. Other limitations of the model include the fact that quarterly data provision does not yet capture contracts where the month turn is the last day of the 3rd month in the quarter and the new 12-month regular premium will only apply from the first day of the following quarter. These are negligible in quantity and do not bias the MTPL index materially. With several insurers, the 12-month regular premium for the March anniversary contracts are still included in the KKTA with the reference date of the previous year. For this reason, the actual quarterly premiums are not obtained on the reference date at the end of the quarter. Also, the premiums for the current quarter containing the month of the anniversary are usually higher than what we see in the following quarters. This may be explained by the higher average premium for cancellations in the period following the anniversary date, particularly cancellations due to non-payment of premiums. If contract holders with a higher average premium 'do not pay', they are cancelled; thus, their average premium is omitted from the next quarterly query. Finally, we have not considered the potentially significant exchange rate impact of cross-border claims. Thus, it can be seen that the model has several limitations, but we believe that none of them causes a serious bias in the results.

6. Conclusions

In this study, we described the methodology and statistical and mathematical background of the MTPL index. In our opinion, the main advantage of the index is that it expresses the changes in average premiums in a concise and understandable way. It is also informative in the sense that it employs the current stock composition by bonus-malus rating and vehicle type, and is sufficiently comprehensive in that it uses the itemised data available in the database since the first quarter of 2016. The adjusted MTPL index shows how the index has changed without the tax effect and in proportionality to claims expenditures.

The results indicate that in the fourth quarter of 2020, average MTPL premiums were 73 per cent higher than the average premiums in the first quarter of 2016. Around one half of the increase is due to the incorporation of the accident tax into MTPL premiums in 2019. Compared to the same period of the previous year, there was a 9-per cent increase in the premiums for anniversary contracts. However, the increase in average premiums is typically related to passenger vehicles in Budapest. Based on the adjusted index, between the first quarter of 2016 and that of 2019, the increase in average MTPL premiums was in line with the evolution of claims and the tax change. The rise that started in 2019 accelerated from the second quarter of 2020; thus, the scissors opened: the adjusted index moved from around 110 per cent to 140 per cent. The main reason for this is the more favourable claims trend in the wake of the pandemic situation: although individual claims expenditure and claims utilisation have increased in recent quarters (likely partly due to the rise in the euro exchange rate), the smaller number of damage records led to an overall decrease in claims expenditure. By contrast, a large share of the entrepreneurial premium part appears as a fixed cost for insurers, rising with general inflation and wage inflation; thus, it cannot necessarily keep up with a one-off expected reduction in claims expenditure due to extreme situations. The increase in the adjusted index indicates that insurers view the reduced claims expenditure associated with the curfew restrictions caused by the Covid-19 virus as a one-off effect.

It is hoped that following its first release in 2021 for other vehicle types (*MNB 2021*), the regular, quarterly publication of the MTPL index and that of the data will increase the transparency of the MTPL market, and thus also can help to increase public confidence. A further additional effect could be the stimulation of competition, to which the aggregated data available to insurers from the KKTA may also contribute through the reduction of information gaps and consequently by more accurate premium calculation.

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Examination of Applicants for Home Purchase Subsidy for Families in Terms of Prior Commitment to Having Children and Extent of Property Acquisition, Based on the Data of a Credit Institution*

Kata Plöchl – Csilla Obádovics

By examining a credit institution's database for the period 2016–2020, the authors aimed to discover the extent to which Home Purchase Subsidy (HPS) for families applicants use the subsidy received in return for committing to having children in Hungary. The current study also examines which social groups the HPS provides essential assistance to with home purchasing, and at which income level and property value the subsidy motivates the purchase of a second home. Using cluster analysis, the authors found that groups with modest incomes and housing are the most likely to commit to having children in advance. Though the subsidy assists this group the most with housing, the amount received from the subsidy is small. Moreover, the current study revealed that 8 per cent of applicants used the subsidy to purchase a second property.

1. Introduction

The importance of home ownership in Hungary dates back to the socialist regime. For 80 per cent of Hungarian families, a privately owned residential home is not only the main asset, it also represents a secured standard of living that is often the result of several generations of work. In accordance with European traditions, Hungary is currently engaged in a universal redistribution program, one with economic and social dimensions (*Dániel 1997; Dániel 2004; Csermák 2011; Levi 1993; Rothstein 1998; Bényei 2011; Kováts 2007; Békés et al. 2016*). As part of the program, the state assumes an allocation role in developing higher quality home ownership. Assuming self-provision, the subsidy scheme allocates public funds to existing private capital with the aim of making housing objectives more affordable (*Sági et al. 2017; Maleque 2019*).

Hungarian housing policy has oscillated between extensive periods supporting home ownership and lean periods during which home ownership was barely addressed at all. Housing policy measures taken while a government is in office generally extend well beyond an election cycle, which, due to the protracted nature of housing subsidies – difficult to calculate and particularly hard to regulate – underscores the significance of responsible policy making.

Opinions concerning a subsidy scheme's degree of differentiation vary; however, the consensus holds that any potential subsidy scheme should be selective, long-term, and sustainable. Such a subsidy may operate efficiently in a global framework of home construction, improvement, maintenance and funding and, in addition to the short-term objectives, sets clear medium- and long-term targets for all economic agents under the prevailing housing situation (*Csermák 2011; Mayo 1993*).

The Hungarian government has addressed the country's demographic issues in a comprehensive manner since 2010. In this sense, the current Hungarian family policy has a dual objective. On the one hand, it aims to help young people bear as many children as they wish. On the other hand, it also strives to support those who already have children (*Novák 2020*). The policy acknowledges that demography has a major impact on the future of countries (*Singhammer 2019*). The importance of demographic objectives is evidenced by the fact that the fertility rate in Hungary – but also across Europe – is declining, and thus so is the population (*Beaujouan et al. 2017; Dorbritz – Ruckdeschel 2007; Neyer et al 2016*). The overarching goal behind demographic policies is the revival of childbearing willingness, which will reverse the declining fertility rate and contribute to population growth (*Sobotka 2017*). *Lesthaeghe* (*2011*) identifies the existence of a home as a key factor influencing demographic trends. Housing policy, in terms of both the quality and quantity of new housing, has a positive impact on the number of children born (*Fitoussi et al. 2008*). The incentive is even greater if the housing subsidy is coupled with preferential loans due to the flow of families with children to settlements on the fringes of cities, which has a positive effect on the agglomeration population trends (*Székely 2020*).

2. Features of the 2016 new housing policy; key changes since its introduction

The improved performance and greater fiscal stability facilitated the launch of a more intensive housing policy campaign. The government launched the current Family Protection Action Plan in 2016, building upon the meagre housing policy that had been in place since 2005. The programme does not stray from the ambitions of previous housing policies (*Hegedűs 2006; Kiss – Vadas 2006; Mádi 2008, 2017*). More specifically, it continues to prioritise the purchase of new property, but also focuses on the purchase and improvement of used homes. In addition to supporting the creation of new homes, its objectives include the encouragement of childbearing (*Szikra 2016*), boosting construction, improving the property market (*Tóth – Horváthné 2018*), and stemming the tide of depopulation in small, rural villages.

Table 1 lists the eligibility criteria for the HPS for families. These conditions are stipulated in Government Decrees 16/2016[1] and 17/2016[2] and in their respective amendments.

Table 1	
Basic conditions for applying for HPS, including changes in conditions, between 2016 and 2020	
CONDITION	**STATUTORY REQUIREMENT**
Eligible applicants	• Hungarian or foreign citizen • member of a building community, owner of an undivided share in common property (effective: Government Decree No 273/2016 (IX. 15.))
Eligible applicant based on age	• 18-40 years: for existing and anticipated child • over 40 years: only for existing child
Applicant's place of residence or documented proof thereof	• registered residence in Hungary • residence permit in Hungary that extends beyond 3 months • immigration permit
Applicant's marital status	• married, cohabitation, single, divorced, widowed
Comfort level of the property	• suitable to meet housing needs
Employment-related requirements	• at least one partner must be employed upon application. • legal relationship for auxiliary activity (effective: Government Decree No 686/2020 (XII. 29.))
Existence of prescribed minimum period of continuous social insurance relationship (interrupted for no more than 30 days)	• 180 days in the case of 1–2 child/children • 365 days in the case of 3 children • 180 days in the case of used property, irrespective of number of children • 365 days in the case of applicants in a favoured small region (effective: Government Decree No 109/2019 (V. 13.))
Subsidy may be used for	• construction or purchase of new property, purchase of used property • expansion of existing property with at least one room (without new commonhold unit title) • development of new living quarters: loft conversion, adding a storey to the house • in the case of favoured small regions, also for renovation (effective: Government Decree No 109/2019 (V. 13.))
Age of supported child	• 24-week foetus, up to 20 years of age • 12-week foetus, up to 25 years of age (effective: Government Decree No 273/2016 (IX. 15.))
Supported children include	• own child, foster child, child adopted by the applicant • child under the applicant's guardianship for minimum 1 year (effective: Government Decree No 273/2016 (IX. 15.))
Ownership in subsidised property may be held	• only by the supported person(s) • by the supported person's child through inheritance (effective: Government Decree No 686/2020 (XII. 29.)) • in the case of married couples (cohabitants) it must be owned jointly by the partners

Minimum floor area	New flat (house)	Used property
for 1 child	40 (60) m²	40 m²
for 2 children	50 (70) m²	50 m²
for 3 children	60 (80) m²	60 m²
for 4 or more children	60 (80) m²	70 m²

Source: Based on Government Decrees 16/2016 (II. 10.) and 17/2016 (II. 10.), and their amendments.

[1] Government Decree No 16/2016 (II. 10.) on the state subsidy for the construction and purchase of new homes
[2] Government Decree No 17/2016 (II. 10.) on the Home Purchase Subsidy for Families for the purchase and extension of used homes

Subsidy exclusions and restrictions to reduce the number of opportunistic applicants were also introduced (*Table 2*). Nevertheless, the majority of these restrictions have been eased or cancelled since their introduction.

Table 2	
Other conditions for applying for HPS and changes therein between 2016 and 2020	
CONDITION	**STATUTORY REQUIREMENT**
Disqualifying reasons	• outstanding taxes and dues • Central Credit Information System negative debtor list • obligation to repay subsidy if conditions of a previous subsidy have not been fulfilled
In the case of subsidy drawn down in respect of specific child	• any subsidy drawn down earlier must be repaid or no subsidy may be requested for the child • the applicant may choose the more favourable option (effective: Government Decree No 46/2019 (III. 12.))
Precondition for applying for subsidy in respect of an anticipated child	• the child anticipated under the subsidy received by the applicant prior to HPS must be born by the time the HPS application is submitted
Deadline for the birth of the anticipated child	• 4 years in the case of 1 child • 8 years in the case of 2 children • 10 years in the case of 3 children (this option is only available for new property)
Sanction for unborn children or for fewer children than anticipated	• the amount drawn down unlawfully must be repaid together with the default interest specified in the Civil Code • if the applicant committed to having three children, the subsidy must be repaid with fivefold interest
Maximum property price limit	• no limit for new property • HUF 35 million in the case of used property (repealed by: Government Decree No 46/2019 (III. 12.))
Maximum ownership interest in existing property	• no restriction for new property • min. 50 per cent in the case of used property (repealed by: Government Decree No 26/2018 (II. 28.))
Use of proceeds from sale of property purchased with previous subsidy	• no restriction for new property • in the case of used property, the proceeds from the property sold within 5 years must be reinvested in the property purchased with the current subsidy (repealed: Government Decree No 26/2018 (II. 28.))
Mandatory stay in the subsidised property	• minimum 10 years residence, only for the owners and the subsidised persons • it may be registered as the registered office of the owner (effective: Government Decree No 152/2019 (VI. 26.))

Source: Based on Government Decrees 16/2016 (II. 10.) and 17/2016 (II. 10.), and their amendments.

Although the level of the subsidy has not changed since its announcement, the subsidy for the favoured small regions – and the high subsidy amount meant to foster the realisation of the complex objective – had a favourable impact on those wishing to move to such locations (*Table 3*).

Table 3 **HPS rates and changes therein between 2016 and 2020**		
	SUBSIDY RATE	
In the case of non-favoured small regions	**New property**	**Used property**
for 1 child	HUF 0.6 million	HUF 0.6 million
for 2 children	HUF 2.6 million	HUF 1.43 million
for 3 children	HUF 10 million	HUF 2.2 million
for 4 or more children	HUF 10 million	HUF 2.75 million
In the case of favoured small regions	• with a complex objective, it corresponds to the subsidy applicable for new property • with a specific objective, 50 per cent of the subsidy applicable to new property	
In the case of a subsidy already claimed in respect of a specific child	• the subsidy claimed earlier must be repaid or no subsidy may be requested for the child • from the options above, the one more favourable for the applicant may be chosen (effective: Government Decree No 46/2019 (III. 12.))	
Subsidy for children subsequently born	• in the case of used property, HUF 0.4 million for each child • no extra subsidy in the case of new property	
Subsidised loan	• HUF 10 million for new property and 3 children • HUF 10 million for new property and 2 children (effective: Government Decree No 209/2018 (XI. 13.)) • used property: for 3 children: HUF 15 million and for 2 children: HUF 10 million children (effective: Government Decree No 46/2019 (III. 12.))	
Source: Based on Government Decrees 16/2016 (II. 10.) and 17/2016 (II. 10.), and their amendments		

3. Data and methodology

Purposes of the analysis: to provide a comprehensive overview of families that benefited from HPS-based subsidies and the effect this had on the number of existing and anticipated children and type of property purchased; to assess the childbearing willingness of these families; to identify the similarities and differences in applicant groups based on the relationship between income and property value. Secondary information was processed within the context of laws and technical articles on housing subsidies.

Using a credit institution database covering the period 2016–2020, we performed the analysis using anonymous data of 625 households who have benefited from the housing subsidy in the regions of western Hungary, Central Transdanubia, and central Hungary. The relevant information for the analysis from the database

includes the time of the subsidy drawdown, the number of anticipated children, and subsidised property type and location. Information related to the family's disposable income, the market value of the purchased property, and the existence of previous property is available only in the case of those applicants who took a loan as well (391 households). In this paper, the segmentation of the families by size always includes the number of existing and anticipated children.

This study provides a general characterisation of HPS beneficiaries based on the number of children, propensity to have children, and the type of property purchased with the subsidy. A cluster analysis was used to group the population of those applying for a loan in addition to the non-refundable HPS, based on the relationship between family income and property value. The measurement scales of the variables are the same, but their value range differs significantly. This prompted standardisation before the procedure. Since cluster analysis is sensitive to outliers, we excluded cases that distort modelling, resulting in 371 applicants being analysed. The "best solution" is elusive in the clustering procedure (*Obádovics 2009*); accordingly, we performed the hierarchic cluster analysis using several procedures (centroid, cluster average, and Ward's method). The centroid method returned the cluster with the highest number of unique features. Based on the hierarchic cluster analysis, we estimated the number of distinct groups to be between five and eight. Following the hierarchic method, we finally accepted seven cluster results based on the K-means clustering procedure. The lower, five cluster solutions were rejected, as three groups comprised 91 per cent of the total population. While the key objective of the analysis was to identify unique characteristics, the cluster characteristics could not be precisely defined due to the high number of elements. In the case of more than seven clusters, there were also clusters with a single element, and thus these solutions were also rejected.

4. Analysis of HPS beneficiaries

4.1. Overview of national data among HPS applicants

According to the analyses prepared by the Mária Kopp Institute for Demography and Families (KINCS), almost 170,000 people applied for the subsidy by the end of 2020 (*KINCS 2019, 2020b; Papházi et al. 2021*). Ninety per cent of the beneficiaries of the non-refundable subsidy already had at least one child when applying for the subsidy: 15 per cent of them had one child, 47 per cent had two children, and 38 per cent had or planned to have three or more children, also taking anticipated children into account. The ratio of large families among HPS beneficiaries is several times higher than the ratio of large families in Hungary (8 per cent)*.* More than a third of the applicants plan to have additional children (59 per cent have one, 39 per cent have two and 2 per cent have three). The highest childbearing willingness is among those who will become two-child families once the anticipated child is factored in (58 per cent), and 38 per cent among those agreeing to have three children (*KINCS 2019*)*.* Furthermore, 14.9 per cent of the applicants were only motivated

to have additional children due to the subsidy's incentive effect (*KINCS 2020a*). In terms of property type, the purchase of used property tends to dominate both the applicants who anticipate having children (69.2 per cent) and the applicants already with a child or children (68 per cent), with the higher propensity to have children associated with used property (*KINCS 2019*).

According to the Hungarian Central Statistical Office (HCSO) database, the positive impact of the subsidy on the number of children is not detectable from 2016 to 2019. Although 3.3 per cent more children were born in 2020 compared to the previous year, this still falls short of the 2016 figure (*HCSO 2021b*).

Several papers have addressed the positive impact of the subsidy on the number of children born. Based on these studies, the HPS may still improve childbearing willingness in the future, but the success of family policy in this respect strongly depends on living standards as well as other moral and ethical norms (*Sági – Lentner 2020; Tatay et al. 2019*).

The average amount of the disbursed subsidy is HUF 2.4 million (HUF 5.2 million for the purchase of new property, HUF 2.4 million for the purchase of used property). 78 per cent of the subsidised amount is linked to new property and 2 per cent to the expansion of existing real estate. Between 2016 and 2019, one in six property purchases (44 per cent of new properties and 12 per cent of used properties) relied on the HPS (*HCSO 2021a; KINCS 2019*).

According to the Magyar Nemzeti Bank's (the Central Bank of Hungary, MNB) November 2020 Housing Market Report, subsidised borrowing has experienced steady growth; however, a decline in the financing of both new and used properties occurred from the second half of 2020. This decline may be attributable to the uncertainty caused by the coronavirus pandemic. According to the data, 77 per cent of applicants for the non-refundable subsidy supplement the subsidy with a loan. Until the end of June 2020, 134,000 people applied for HPS loans totalling HUF 400 billion (*MNB 2020*).

The emergence of HPS caused increased real estate demand, which led to soaring property prices that consumed almost 75 per cent of the subsidy disbursement amounts (*Banai et al. 2019*), thereby further complicating the housing opportunities of young couples (*Elek – Szikra 2018*).

According to the research of *Sági et al.* (*2017*), the social perception of the subsidy is positive, as more than 60 per cent of the respondents believe the subsidy will help them buy a home. This is also confirmed by the research of *KINCS* (*2020a, b*), and *Tóth – Horváthné* (*2018*). Although individual family policy measures may improve young people's propensity to have children, other factors, some of which have a greater effect than housing conditions, also influence childbearing willingness. Some of these factors include overall quality of life, a stable economy, employment and partnership, inflation, unemployment, income factors, health,

religion, ethnicity, moral standards, and the lingering effects of the communist past. This is particularly true for couples who are extremely uncertain about having children. Targeted housing policy decisions have little influence on many of the abovementioned factors (*Kapitány – Spéder 2018; Spéder et al. 2017; Sági – Lentner 2020; Szikra 2016; HCSO 2016*).

4.2. Analysis of the beneficiaries of non-refundable HPS

Among the regions, the West Transdanubia region has the highest net income per capita and the lowest unemployment rate. In terms of GDP per capita specified at a regional level, 44 per cent of GDP is generated by the three examined regions (*HCSO 2018a, 2020a, 2020b*). With the exception of 2020, the number of housing subsidy applications is steadily rising (*Figure 1*). The decline experienced in 2020 is attributable to the uncertainty caused by the pandemic and was not restricted to these regions, but occurred nationwide. This effect appears to be slightly stronger in the western part of the country as pandemic measures partially restricted the movement of Hungarians working in Austria.

Figure 1
Change in the number of HPS applicants by number of children between 2016 and 2020 (N=625)
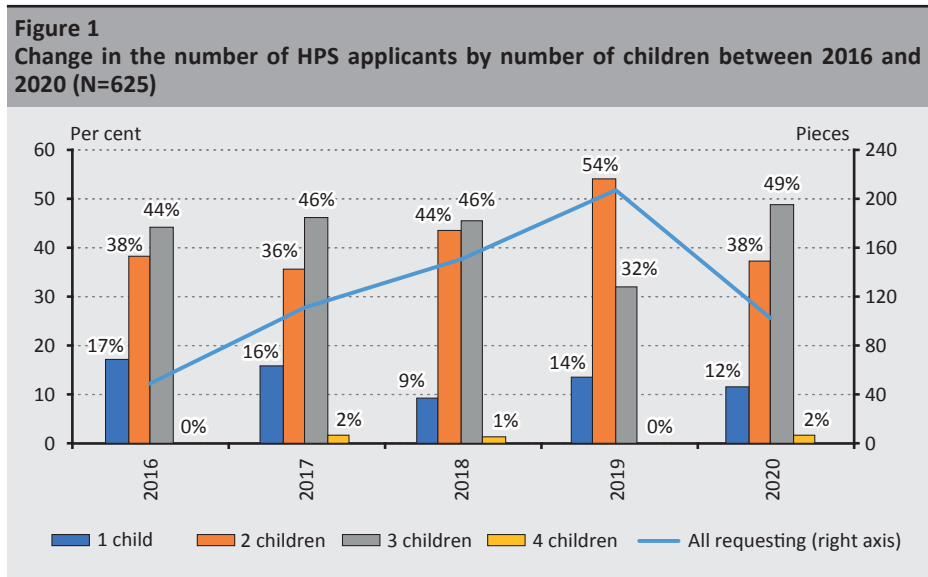
The greatest demand for the housing subsidy occurred in 2019. The factor driving the demand was likely the interest-subsidised loans that became available to two-child families. This indicates that a decrease in interest payable has a favourable impact on the property market. The distorting effects of the state interest subsidy reduce the borrower's exposure to increased interest servicing triggered by potential negative cyclical developments (*Kiss – Vadas 2006*). Of the total number of applicants, 234 families (37 per cent) only used the non-refundable subsidy, while 63 per cent of the applicants supplemented the state subsidy with a loan.

Regarding the number of children, 44 per cent of the applications were submitted under a two-child family model (including existing and anticipated children) (*Table 4*). Families wishing to have three children comprised 43 per cent. The ratio of families with one child was a mere 13 per cent.

Table 4

Distribution of HPS applicants in the period 2016–2020 based on the number of children and the number of anticipated children

	One-child family model		Two-child family model				Three-child family model				
			children								
	total	existing	total	existing	1 antici-pated	2 antici-pated	total	existing	1 antici-pated	2 antici-pated	3 antici-pated
Applicants (number)	**81**	**81**	**277**	**178**	**51**	**48**	**267**	**221**	**26**	**17**	**3**
Without taking a loan (number)	74	74	114	109	5	0	46	40	3	2	1
Also taking subsidised and/or market-based loan (number)	7	7	163	69	46	48	221	181	23	15	2

Of those who took advantage of the subsidy, 32 per cent did so for one child, 49 per cent for two children, and only 19 per cent for three children. Only two per cent of one-child families took on a loan. This is likely due to the low subsidy amount and the lack of interest-subsidised credit (*Horváthné Kökény – Tóth 2017*). Large families represent the highest ratio (57 per cent), which is attributable to the availability of the interest-subsidised loans throughout the programme. Nationally, 36 per cent of families have one child, 22 per cent have two, 6 per cent have three, and 2 per cent have four or more children. Among HPS beneficiaries, the ratio of families with two children is several times higher than the national sample and even higher for families with three children (*HCSO 2012a*). According to the national data of the HCSO, childless (32 per cent) and two-child families (30 per cent) account for the largest ratio of residential mortgage borrowers. These are followed by families with one child (26 per cent). Large families represent the lowest percentage (12 per cent) of borrowers (*HCSO 2018b*), which is the opposite of the distribution by number of children among the HPS beneficiaries.

The government also intends to use the programme to foster the attainment of demographic objectives, i.e. to increase the number of births. HPS applicants can best contribute to this by having children in addition to the ones they have already planned. Only 23 per cent of state subsidy beneficiaries make an advance commitment to having children (*Table 4*), which falls short of the national childbearing willingness rate of 33 per cent (*KINCS 2019*). A total of 68 per cent of those agreeing in advance wish to have two children, while 32 per cent intend to

have three children in the future. Seventy-seven per cent of the applicants apply for the subsidy after bearing children. Those who anticipate having children are considered to have contributed to population growth only if they have committed to having a child they had not previously planned to have before the subsidy, rather than just bringing forward their previously planned childbearing. The highest childbearing willingness (36 per cent) is among the applicants who intend to have up to two children (including the anticipated child). Seventeen per cent of families committed to having three children promise to increase their number of children to three by the statutory deadline. By the end of 2020, 62 per cent of all those anticipating further children had fulfilled their commitment, i.e. they bore a child they had committed to having. Only one applicant who took the subsidy in 2016 was unable to fulfil the childbearing commitment by the deadline date. If a young couple fail to fulfil their commitment to having children, or fulfil it only partially (with the exception of confirmed health reasons), the used subsidy amount must be repaid to the state together with the default interest, plus five times the penalty interest if they committed to having three or more children. This is how the government intends to prevent unfounded commitments to having children, which would only be designed to claim the higher subsidy amounts.

Forty-five per cent of all applicants who committed to having children in the future plan to have two more children (12 per cent plan to have a second and third child, accounting for 2 per cent of all applicants) and 2 per cent commit to having a third child (*Table 5*). The rest of them plan to have one more child.

Table 5		
Ratio of two-child and large families committed to having additional children within all those anticipating children in future		
		Childbearing willingness (N=135)
2-child family model	anticipates 1 child (second child)	35%
	anticipates 2 children (first and second child)	33%
Large family	anticipates 1 child (second child)	18%
	anticipates 2 children (second and third child)	12%
	anticipates 3 children (first, second and third child)	2%
Total number of applicants making advance commitment		
Total number of applicants making advance commitment	anticipating 1 child	53%
	anticipating 2 children	45%
	anticipating 3 children	2%

The positive changes in the subsidy conditions that appeared in 2019 are reflected in the number of applications and in the increase in the number of applicants who supplement the subsidy with a loan (*Table 6*).

Table 6					
Drawdown of HPS by family size and year of application					
	Large family		**Normal-sized family**		**Total (no.)**
	without a loan	with loan	without a loan	with loan	
2016 (no.)	**10**	**13**	**20**	**9**	**52**
New properties	74%		45%		30
Used properties	26%		55%		22
2017 (no.)	**16**	**38**	**50**	**8**	**112**
New properties	41%		76%		66
Used properties	59%		24%		46
2018 (no.)	**12**	**59**	**52**	**28**	**151**
New properties	34%		38%		54
Used properties	66%		63%		97
2019 (no.)	**2**	**64**	**44**	**96**	**206**
New properties	33%		58%		103
Used properties	67%		42%		103
2020 (no.)	**6**	**47**	**22**	**29**	**104**
New properties	51%		41%		48
Used properties	49%		59%		56
Total (no.)	**46**	**221**	**188**	**170**	**625**

The ratio of used properties increased for both family models over the years. In 2019, there was a further increase in demand for used properties among large families, and a moderate decrease among those committed to the two-child family model. We assume these changes are attributable to the fact that since the beginning of 2019, the subsidised loan for new properties has become available to families with two children and, since the middle of the year, for the purchase of used property as well, which inspired large families to consider the subsidy. Overall, 58 per cent of large families and 47 per cent of normal-sized families purchased used property with the aid of the subsidy.

Following the abolition of the HUF 35 million maximum property price limit for used properties, 40 per cent of the properties above this limit are now used properties. Overall, however, the volume of high-value property purchases has

not increased, and the stock of used and new properties exceeding HUF 35 million shows a downward trend compared to the period before and after 2019.

Prior to 2018, subsidy applicants with an existing property could not apply for HPS to purchase used property while simultaneously keeping an existing property. This provision was cancelled in 2018. Subsequently, more than 90 per cent of those who applied for an HPS subsidy with an existing property used the direct HPS to purchase used property; the ratio of these applicants declined to 61 per cent in 2019. Also considering the propensity to have children, we found that only 2 per cent of those who committed to having children in advance used the subsidy to buy another property in addition to their existing one.

Property purchases in the favoured small regions are below 5 per cent in the sample; accordingly, the effect of the subsidies is not reflected in any growth in the sample element numbers. This may be due to the low number of subsidised small regions in the regions under review, while their level of development exceeds the national average.

Forty-eight per cent of those applying for a direct subsidy use the funds to finance new property (a total of HUF 1.5 billion, HUF 5 million/property on average), forty-five per cent to finance the purchase of used property (a total of HUF 485 million, HUF 1.7 million/property on average), and 7 per cent to finance expansion work on existing real estate (a total of HUF 67 million, HUF 1.5 million/property on average) (*Figure 2*). The distribution by child in the case of new property purchases is 15 per cent (HUF 26 million in total, HUF 0.6 million/property), 48 per cent (HUF 377 million in total, HUF 2.6 million/property) and 37 per cent (HUF 1 billion in total, HUF 10 million/property), respectively. In the case of purchasing used property, these figures are 13, 35 and 52 per cent, respectively. Three quarters of the subsidies are disbursed for investment in new property. Half of the disbursed subsidies is concentrated at 18 per cent of the eligible applicants (14 per cent without those committing to having children in advance), due to the fact that these applicants are large families and thus receive a non-refundable state subsidy of HUF 10 million for the purchase of new property. Families with two children, who comprise 23 per cent of all applicants purchasing new property, receive less than 20 per cent of the disbursements, even though they represent a large number of new property purchase transactions. The reason for this is that the state provides a subsidy of HUF 2.6 million to help with the purchase in their case.

Figure 2
Number of applicants for direct HPS and their share in the disbursed subsidy amount by number of children and property type (N=625)
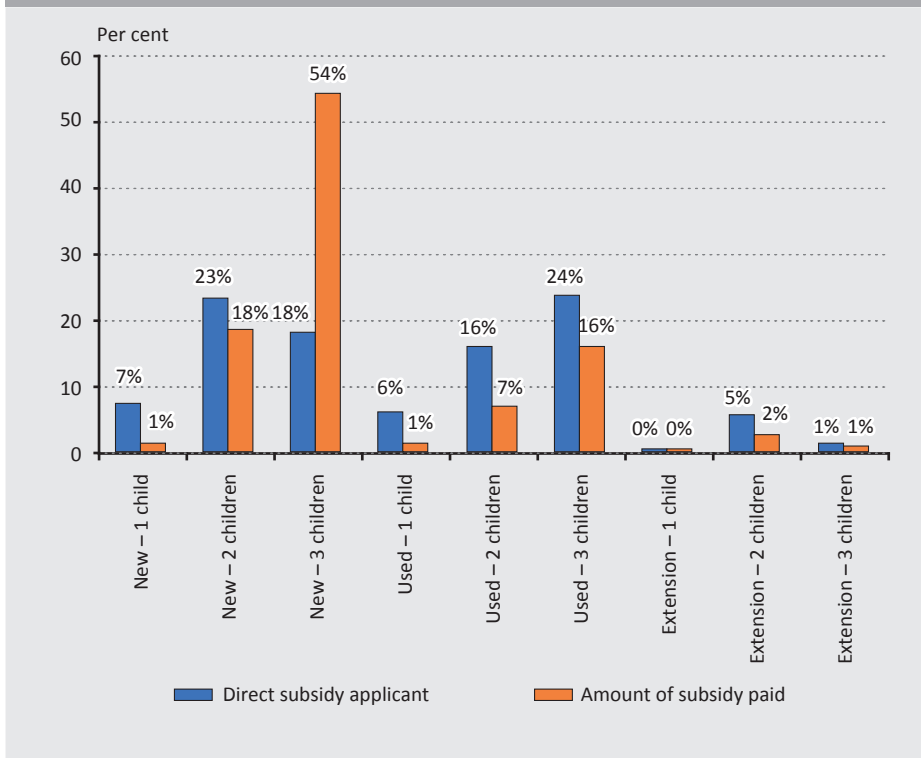
Per cent

Those making advance commitments to having children (anticipators) receive 24 per cent of the subsidies (HUF 495 million). From this group, 55 per cent buy new property and 39 per cent buy used property, while 6 per cent use the funds to expand their existing house with additions. Fifty-seven per cent of the anticipators with 2 children (including the anticipated child) and 52 per cent of anticipators with three children (including the anticipated child) use the subsidy to purchase new property. The distribution of both family models is almost identical among those investing in new property and making an advance commitment to having children. However, there is a significant difference in disbursed subsidy amounts, to the benefit of large families. The amount of the subsidy realised by those who become large families via an advance commitment is 48 per cent of the amount disbursed to all anticipators. In the case of families with two children, the figure is 30 per cent. The number of families becoming families with three children did not increase in excess of the families becoming two-child families as a result of the advance commitment, despite the high incentive of the HUF 10 million subsidy applicable

to new properties. Fourteen per cent of large family applicants use the subsidy to buy a new property and already have three children at the time of the application.

4.3 Classification of applicants by income and property price depending on family size

We obtained income data for 391 households. After eliminating the outliers, we analysed 371 families. A higher proportion of the borrowers (57 per cent) were large families. Seventy-two per cent of normal-sized families realise their first-time home-buying objectives below a property price of HUF 35 million (*Figure 3*). Eleven per cent of two-child families and 5 per cent of large families (including the anticipated child), purchase a property with a value that exceeds HUF 50 million.

Figure 3
Value of property purchased with subsidy, by family size (N=371)
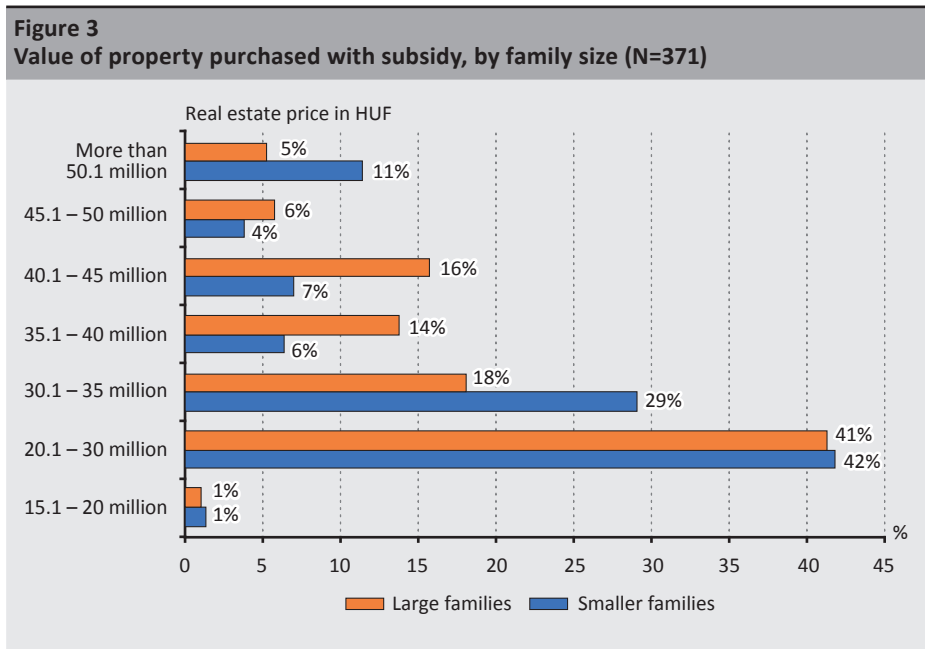
Normal-sized families usually buy new property with a smaller floor area (*Table 7*). The same applies to 60 per cent of large families who tend to buy slightly larger used properties because the family is larger.

Table 7

Distribution of property investments by family size, property type, and useful floor area

Property floor area	Normal-sized family			Large family		
	New property	Used property	Distribution of properties owned by normal-sized families by floor area	New property	Used property	Distribution of properties owned by large families by floor area
under 60 m²	16%	4%	10%	3%	5%	4%
61–70 m²	5%	4%	4%	12%	4%	7%
71–80 m²	15%	30%	22%	24%	15%	18%
81–90 m²	11%	23%	17%	14%	16%	15%
91–100 m²	15%	12%	13%	35%	15%	22%
101–110 m²	4%	9%	6%	4%	7%	6%
111–120 m²	5%	4%	4%	0%	8%	5%
121–140 m²	4%	3%	3%	3%	9%	7%
above 141 m²	27%	12%	19%	6%	21%	16%
Total investment in new and used property relative to family size						
Property investments	52%	48%		37%	63%	

Nationwide, 32 per cent of privately owned properties have a floor area below 60 m². Due to the statutory requirements, the property size cannot be below 60 m² in the case of HPS applicants. Forty-three per cent of the total Hungarian population lives in properties 60–100 m² in size. The ratio of properties exceeding this size is almost 35 per cent among HPS applicants, while it is 25 per cent nationally. The data show that the HPS increased the floor area of the property purchased (*HCSO 2012b*).

When dividing the family income into five income groups with an identical number of elements, we found that among those with loans, the ratio of large families (57 per cent) exceeds that of normal-sized families. This is because in income band 3 and above, their ratio exceeds (and to the largest degree in income band 4) that of the normal-sized families (*Table 8*).

Table 8

Distribution of those who took a loan in addition to HPS, by income category, family size and childbearing willingness

Family income band	Normal-sized family			Large family		
	Normal-sized family applicants as percentage of all applicants	Families committing to having children as percentage of normal-sized family applicants	Families committing to having children in advance as percentage of anticipators	Large family applicants as percentage of all applicants	Families committing to having children as percentage of large family applicants	Families committing to having children in advance as percentage of anticipators
Band 1: HUF 0–418,000	53%	64%	81%	47%	17%	19%
Band 2: HUF 419,000–487,000	53%	63%	83%	47%	14%	17%
Band 3: HUF 488,000–607,000	39%	68%	61%	61%	27%	39%
Band 4: HUF 608,000–760,000	27%	50%	50%	73%	19%	50%
Band 5: HUF 761,000–	43%	38%	67%	57%	14%	33%
Total applicants with a loan	**43%**	**57%**	**70%**	**57%**	**18%**	**30%**

Those committed to the two-child family model aim to buy a home with more moderate family income. One reason for this is the higher net income available through the tax allowance for larger families, as well as the family allowance and child-care/infant-care benefit, which are included in the family income. Eighty-two per cent of three-child families already had their children when they submitted their applications. The same applies to 43 per cent of two-child families. Those making an advance commitment to having children usually belong to the lower income groups, and 62 per cent of these purchase cheaper property, i.e. HUF 35 million with a useful floor area below 80 m^2. This suggests that the subsidy makes it possible for those from lower income groups to buy their own home.

The government gives priority support to families with three children for the purchase of new homes. However, the households surveyed in the western region are dominated by households with two children or those who become two-child families by having an additional child, generally by acquiring new property. Contrary to our expectations, large families (with a child anticipated in the future) tend to buy used property. A smaller proportion agreed to have an additional child in order to become large families, and the number of people who have another two children in addition to an existing child is low.

Seventy-eight per cent of applicants declared that they did not own a residential property when they applied for the subsidy. Fourteen per cent did, but sold it to improve the family's housing conditions by using the subsidies (*Table 9*).

Only 8 per cent of the applicants (77 per cent of these are large families) kept their previous home and bought an additional property using the subsidies. These families belong to the top three income brackets. Few of these families were able to draw the direct subsidy of HUF 10 million, since merely 24 per cent of the property transactions were for new property, and of these, not all buyers were large families.

Table 9

Distribution of applicants by family size and income band according to whether a subsidised property transaction occurred in addition to an existing property

Family income band	No existing property, or it is sold and reinvested			Existing property retained		
	Normal-sized family	Large family	Distribution of applicants without existing property as percentage of all applicants	Normal-sized family	Large family	Distribution of applicants retaining their existing property as percentage of all applicants
Band 1: HUF 0–418,000	53%	47%	100%	0%	0%	0%
Band 2: HUF 419,000–487,000	53%	47%	100%	0%	0%	0%
Band 3: HUF 488,000–607,000	39%	61%	99%	0%	100%	1%
Band 4: HUF 608,000–760,000	27%	73%	84%	25%	75%	16%
Band 5: HUF 761,000–	48%	52%	77%	24%	76%	23%
Total applicants with a loan	**45%**	**55%**	**92%**	**23%**	**77%**	**8%**

Based on applicant family income and the market value of the property purchased using the subsidy, we created seven distinct groups using cluster analysis. The three largest groups concentrate 83 per cent of the elements in the analysed sample. Based on the variance values and the distance between the clusters, the seven-cluster solution also shows the highest similarity within the group.

Our analysis aimed to discover which social groups the subsidy provides essential assistance for in achieving housing objectives, and at what income level and property value it encourages the purchase of a second home.

Figure 4
Grouping of subsidy applicants by family income and property price
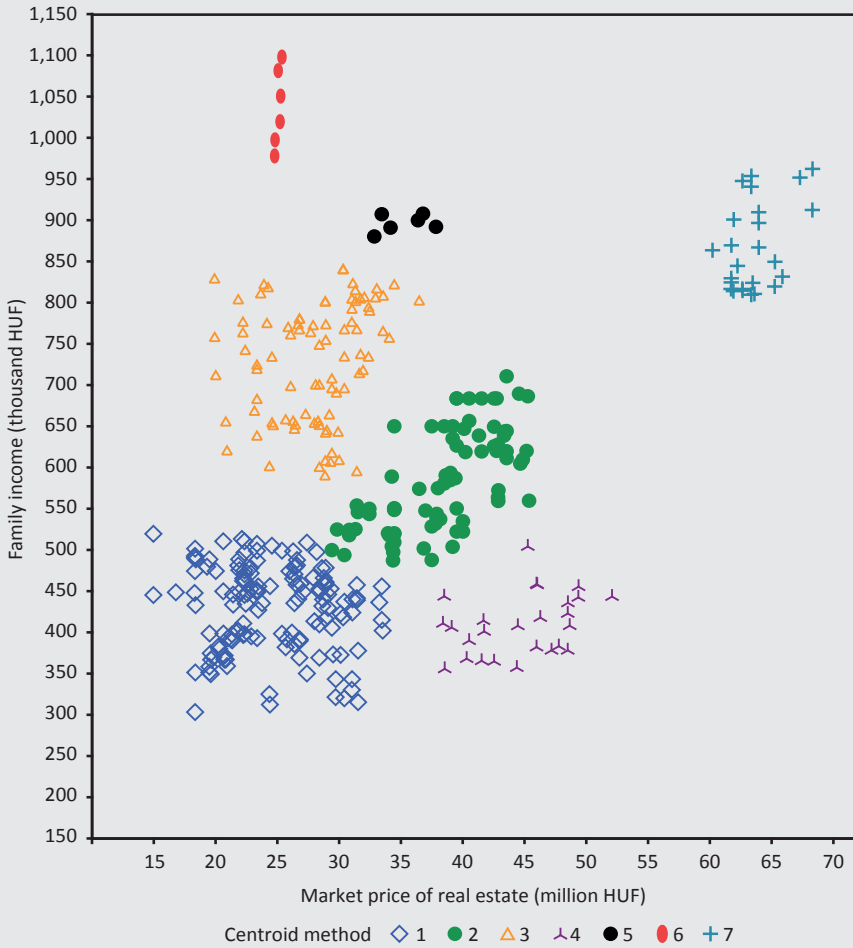
Note: The analysed data were edited in SPSS

Group 1 has the highest population with a share of 38 per cent (*Table 10*). This group also owns the cheapest properties, with an average price of HUF 26 million (*Figure 4*), and has the lowest income (HUF 429,000). Accordingly, this group relies on the subsidy to buy a first property. Group 1 has the highest number of families with two children (52 per cent). Similar to Group 4, Group 1 also has high childbearing willingness (42 per cent), which may have been partly induced by the acquisition of property due to the low-income level (*Table 10*).

Table 10					
Share of the individual groups and their composition based on family size, advance commitment to having children and existing property					
	Number of group members (units)	**Share of the group**	**Distribution by family model relative to the group**	**Childbearing willingness within the group**	**Has an existing property and retains it (units)**
Group 1	**142**			**42%**	**0**
Large family	68	**38%**	48%	18%	0
Normal-size family	74		52%	64%	0
Group 2	**79**			**38%**	**9**
Large family	56	**21%**	71%	23%	9
Normal-sized family	23		29%	74%	0
Group 3	**87**			**18%**	**15**
Large family	57	**23%**	66%	7%	10
Normal-sized family	30		34%	40%	5
Group 4	**26**			**54%**	**0**
Large family	14	**7%**	54%	36%	0
Normal-sized family	12		46%	75%	0
Group 5	**6**			**0%**	**6**
Large family	4	**2%**	67%	0%	4
Normal-sized family	2		33%	0%	2
Group 6	**6**			**33%**	**0**
Large family	3	**2**	50%	33%	0
Normal-sized family	3		50%	33%	0
Group 7	**25**			**36%**	**0**
Large family	10	**7%**	40%	40%	0
Normal-sized family	15		60%	33%	0

It is evident that families with lower incomes are more likely to commit to having additional children. Over 70 per cent of the households used the subsidy to purchase a used property (*Table 11*). This also contributes to the fact that this moderate-income group benefits the least from the direct state subsidy of HUF 10 million

(15 per cent), since the share of new property is minimal for family houses and only 41 per cent for flats. More than half of the new property purchases (54 per cent) are made in villages (*Table 11*) due to the lower real estate prices. This group is in great need of the subsidy, as even with the subsidy they can only afford the most modest of homes. The amount of direct non-refundable state subsidy per capita is HUF 3.1 million, which is the second lowest value compared to the other groups.

Table 11							
Groups by property characteristics							
	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**	**Group 7**
Distribution by type of property (house/flat) (units, per cent)							
House (units)	60	69	43	25	5	0	21
New houses	15%	38%	33%	64%	0%	0%	71%
Used houses	85%	62%	67%	36%	100%	0%	29%
Flats (units)	82	10	44	1	1	6	41
New flats	41%	60%	73%	100%	0%	50%	100%
Used flats	59%	40%	27%	0%	100%	50%	0%
Distribution by settlement type and property type and quality (per cent, units)							
VILLAGE	49%	18%	62%	50%	50%	50%	12%
used (units)	47	4	28	9	3	2	3
new (units)	23	10	16	4	0	1	0
TOWN	51%	82%	38%	50%	50%	50%	88%
used (units)	52	43	13	0	3	1	3
new (units)	20	22	20	13	0	2	19
Distribution by useful floor area (per cent)							
below 60 m²	9%	8%	7%	0%	0%	0	0%
61–70 m²	8%	1%	10%	0%	0%	0	0%
71–80 m²	30%	1%	26%	0%	17%	6	0%
81–90 m²	26%	11%	11%	0%	0%	0	12%
91–100 m²	18%	15%	26%	12%	50%	0	4%
101–110 m²	3%	18%	2%	12%	0%	0	0%
111–120 m²	2%	10%	3%	15%	0%	0	0%
121–140 m²	0%	10%	5%	19%	0%	0	8%
above 141 m²	4%	25%	8%	42%	33%	0	76%

Group 2 has a share of 21 per cent and is the group with the third highest population (*Table 10*). This group has the highest proportion of large families (71 per cent). With an average monthly family income of HUF 580,000, applicants in this group buy property at around HUF 40 million as their first property (*Figure 4*). These typically belong to the categories over 90–110 m², but the distribution of larger properties

is also even (*Table 11*). Eleven per cent of families in this group have an existing residential property (*Table 10*). They have the third highest childbearing willingness (following Groups 4 and 1). Fifty-four per cent of applicants opted for used houses in urban areas (*Table 11*). As in Groups 3 and 4, the ratio of those with two loans is high (53 per cent) here as well. On average, they agree to a market-based loan of HUF 14 million, in addition to the subsidised loan, which is the highest loan value of all groups. Twenty per cent of the group members are able to take advantage of the HUF 10 million direct subsidy, as they typically look for used houses in urban areas. In this group, the amount of direct non-refundable state subsidy per capita is HUF 3.5 million. This is the third lowest value when compared to the other groups.

Families in this group are considered to be in the mid-range both in terms of income and property, and they undertake higher indebtedness for a house in an urban area (their income situations permit this). Thirty-eight per cent of applicants buy new houses (*Table 11*), while in Group 4, 36 per cent of families purchase used homes. The main difference between the two groups is that Group 2 buys smaller houses and flats in urban areas under higher income conditions and higher indebtedness, while those in Group 4 purchase new and bigger property in rural areas. These groups clearly reflect the additional costs incurred in towns compared to villages.

Twenty-three per cent of applicants belong to Group 3 (*Table 10*). Large families comprise 66 per cent of this group, which is the second most populous group for large families. Families in this group have higher income than those in the mid-range and buy cheaper 90–100 m^2 houses and 60–80 m^2 flats (*Table 11*). Fifty-two per cent of the applicants in this group also take out market-based loans – in addition to the subsidised loans – with an average amount of HUF 7.5 million.

Group 3 has the highest share of rural properties (62 per cent), resulting in a decrease in the ratio of new properties (*Table 11*). The families moving to villages are motivated to buy used property, while newly built flats are the more popular choice in urban areas. Seventeen per cent of the applicants in this group own or have owned real estate and do not use the subsidy to buy their very first home (*Table 10*). With a stable livelihood, this group has the highest number of applicants (33 per cent) and receive the highest direct subsidy of HUF 10 million. However, in return, many (18 per cent) tend not to commit to having additional children. The amount of the direct non-refundable state subsidy per capita in this group is HUF 4.7 million, which is the highest amount compared to the other categories even though Group 3 does not have the lowest income.

Group 4 includes 7 per cent of the applicant families (*Table 10*), who – under low-income level conditions – buy properties of above average value at HUF 46 million, which is high compared to their income level (*Figure 4*). Half of those in Group 4 make an advance commitment to having children (54 per cent), which is the highest

commitment to childbearing among all groups. This may be positively influenced by the difference between income and the value of the property to be purchased. The average indebtedness over the amount of the subsidised loan is HUF 8.3 million. Forty-six per cent of the families in this group hold two loans.

Almost all applicants in Group 4 buy a family house, and all those with two children buy new property (*Table 11*). As is the case with Group 7, families in Group 4 also tend to buy new property. Due to their income position, almost half of the applicants (46 per cent) opt to move to a village to secure a spacious home for the family. The properties purchased are over 90 m², but a good number of the applicants (35 per cent) own properties with floor space over 151 m² (*Table 11*). Only 19 per cent of this group are able to draw the highest subsidy amount of HUF 10 million. The amount of the direct non-refundable state subsidy per capita in Group 4 is HUF 3.8 million, which is the third highest value compared to the other groups.

With Group 4, it may be assumed that the commitment in advance to having children was partly motivated by the acquisition of property, as higher childbearing willingness is accompanied by low income and high-value property. However, despite the high number of large families, only a few were able to take advantage of the HUF 10 million subsidy. In our view, these families would have not been able to buy a higher value property without the subsidy – they did not own a property before, as the mortgage burden of property is significant even with the high property price. This group reflects the highest tendency to make an advance commitment to having children. Nevertheless, this group does not receive the highest subsidy amount, even though their income situation would justify it.

Group 5 includes only a few families, merely 2 per cent of borrowers (*Table 10*). Each member of this group, which mostly comprises large families (67 per cent), belong to the highest income category. They usually purchase used houses with useful floor areas of 90–100 m² or over 141 m² (*Table 11*) as second properties (*Table 11*) (only one applicant replaced their home with a higher quality home) at an average price of HUF 37 million (*Figure 4*).

People in this group already owned a home at the time of application, which they retained despite purchasing the subsidised property (*Table 10*). In addition to the direct subsidy, they also make full use of the subsidised loan. Families with two children (50 per cent) were not yet eligible for the subsidised loan at the time of the application, and thus they took a market-based loan. None of the members in this group commits to having additional children. In this group, the amount of direct non-refundable state subsidy per capita is HUF 1.9 million, which is the lowest compared to the other groups. Families in Group 5 maximise the use of the subsidy, and with minimal additional debt they increase their living standards with

the additional property, all without committing to having more children. Due to the existing property they already owned, these families would have not been able to benefit from this allowance in 2016 and 2017.

At 2 per cent, Group 6 consists of the smallest portion of applicants (*Table 10*). Within this group, the distribution by family size is even, with 33 per cent committing to having additional children. All families utilised the maximum amount of the direct state subsidy and drew down the subsidised loan, without supplementing it with additional market-based loans. The properties purchased by this group include flats below HUF 30 million, with a useful floor area of 70–80 m^2 (*Table 11*). The applicants declared that they had not previously owned a property, although they have the highest disposable family income in the examined sample (*Table 10*). Indeed, in their case, income of HUF 1 million (*Figure 4*) is accompanied by properties of the lowest value, all of which are flats (*Table 11*). In this group, the amount of direct non-refundable state subsidy per capita is HUF 4.6 million, which is the second highest value compared to the individual categories.

We believe this property could be more of a second home purchase, for which the available state subsidy offered a good opportunity, thereby increasing the already stable living conditions of these families. Their favourable financial circumstances, the use of the subsidy elements, and the lack of other loans indicate that they did not necessarily need the subsidy to finance the property transaction. However, without the subsidy, these households might not have embarked on a property investment. This group well reflects the property incentive effect of the subsidy, but it is unlikely to generate additional childbearing.

Seven per cent of families belong to Group 7 (*Table 10*). They buy large properties that cost over HUF 65 million and are in a high-income bracket (HUF 867,000 on average) (*Figure 4*). Applicants who already owned property sold it and used the proceeds to purchase new property. The ratio of large families is the lowest in this group (40 per cent), while childbearing willingness is 36 per cent. All but one of the applicants were already eligible for subsidised loans, which they used to the maximum extent. In this group, the amount of direct non-refundable state subsidy per capita is HUF 3.7 million, which is the fourth highest value compared to the other groups. The extension of the subsidised loan to families with two children created a very favourable opportunity for the members of this group. This is evidenced by the fact that all but one of the two-child families embarked on the property purchase trail after the subsidised loan became available. This significantly reduced their exposure to market-based loans, and thereby their debt servicing. This group of purchased properties includes larger flats (80 m^2), while 48 per cent of the family houses have a useful floor area over 171 m^2 (*Table 11*). Sixteen per cent of the applicants were eligible for the highest non-refundable state subsidy of HUF 10 million, which was not accompanied by an advance commitment to

having children as a positive effect. This group contains the highest number of urban inhabitants (88 per cent) and the number of those purchasing new property is high as well (*Table 11*).

Based on our analysis, we named and characterised the individual groups of applicants as follows (*Figure 4*):

1) *Needy small families buying used flats* – lowest income – cheapest property price – no high commitment to having children

2) *Buyers of urban used houses, large families* – medium income – medium property price – high advance commitment to having children

3) *Upper-middle class large families – benefiting from the HUF 10 million subsidy* – medium to high income – more modest property – low propensity to have additional children

4) *Buyers of new houses in villages* – lower income – high property prices – highest advance commitment to having children

5) *House buyers for investment, in addition to an existing property* – high income – medium property price – without committing to having additional children

6) *Investment property buyers* – high income – low property price – without committing to having additional children

7) *Small families living in new, luxury urban flats* – high income – highest property price – without committing to having additional children

5. Summary and conclusions

Our study, conducted for the western and central regions of Hungary using an anonymous credit institution database, found that 44 per cent of those applying for a subsidy chose the two-child family model, and 43 per cent the large family model. Childbearing willingness is 23 per cent, i.e. slightly lower than the national rate of 33 per cent, but there is no significant difference in the number of children committed to in advance, nor the preferred family size. In the regions surveyed, 68 per cent of those who made an advance commitment to having children opted for the two-child family model. Childbearing willingness is of great importance, since there is a possibility of agreeing to have more children than originally planned, thereby supporting the realisation of the government's demographic objectives. More than half of those committing to giving birth to a child in the future agree to have one more child. The number of those committing to three children is minimal, at only 2 per cent.

Seventeen per cent of those buying a new property and making an advance commitment to having children would like to become a large family, while 38 per cent aim for a two-child family. Those committing to having children – opting for the large family or two-child family model – tend to buy new and used property from the subsidy in an almost in equal share, i.e. half and half. This implies that the high subsidy – HUF 10 million – has not been a significant incentive for families to become large families or to invest in a new property. The childbearing willingness was supported to a greater degree by the existence of the subsidy. This finding is supported by the fact that at the national level the rate of childbearing willingness is almost the same among those opting for new and used property. The government's demographic objectives are least supported by the large families (14 per cent) that do not commit to having additional children and use the subsidy for buying new property.

The absence of an income cap for subsidy drawdowns encouraged 8 per cent of the applicants to buy a second property. The number of these applicants could be reduced by the reintroduction and comprehensive application (extending it to new properties) of the restrictions on property ownership in excess of 50 per cent, which had been enforced until 2019. In this regard, we agree with the proposal of *Banai et al.* (*2019*) and suggest it would be advisable to revise the eligibility criteria in this respect.

We identified seven distinct groups based on property values and family income. The analysis shows that Group 1 combines the lowest income and property price, under high childbearing willingness. A high quality, new property is unaffordable for families in this group. Consequently, we considered families in this group to be most in need of a subsidy to purchase a home. Group 1 benefits from a small share of the disbursed subsidies, despite the fact that, on a social basis, families grouped here need the most support. The availability of the HUF 10 million subsidy does not generally improve the situation for families in Group 1 because the benefits extended for smaller family sizes and used property purchases are limited.

The childbearing willingness is higher in the lower income groups (1, 2 and 4). These groups are also more likely to draw smaller subsidies, move to the agglomeration or villages, and show a higher interest in family houses. Group 3 received the highest state subsidy despite their medium to high income level. We identified three groups (5, 6 and 7) for whom the state subsidy is not a matter of necessity, but often only a means for purchasing an additional property to add to their existing one, which places them in an even more advantageous position compared to other applicants.

However, an undisputed advantage of the subsidy scheme is the support for families and the purchase of used property. Support for large families has been a priority in all previous housing support schemes, but it has never been of this magnitude

before. Accordingly, in the future we aim to analyse how many of the applicants who made an advance commitment to having children have indeed been encouraged to have additional children.

Given the economic stimulus and employment creation effect of the subsidy and the strong interest in it, efforts should be made to ensure its long-term sustainability since it contributes to the predictability of housing investment for families. To this end, consideration should be given to harmonising the subsidy amounts depending on the number of children, with the exclusion of the possibility of the accumulation of properties, and introducing an income cap. Providing housing subsidies to ensure that housing policy objectives meet the expectations related to higher birth rates is not enough. A stable and favourable macroeconomic environment must be continued to provide. Accordingly, we clearly confirm previous research findings that emphasise the predictability and purposefulness of family policy support.

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Thoughts on the Dilemma of When to Introduce the Euro in Hungary*

Péter Gottfried

In its EU accession treaty, Hungary committed to introducing the euro without a legally binding deadline. The question is therefore not whether the country will introduce the common currency, but when it will do so, and what factors play a role in the decision. Developments in recent years have confirmed that the euro system is able to weather a crisis, but also highlight that the euro does not in itself guarantee sustainable convergence. In addition to accession, members' rights and obligations have also changed considerably, and these changes have not been completed. There are examples for successful economic policies without the euro and also for frustrated growth with the euro. Only one area has been identified where the advantages of membership are indisputable: yield spreads. In today's international environment, this is much less important than in the past, but it is impossible to know how long this situation will last. Accordingly, the Hungarian strategy should target sustainable convergence, rather than the introduction of the euro. If the country can substantially reverse the increase in the government deficit and debt and keep them low, it would be worth waiting until the development paths related to the euro are outlined more clearly, while continuing with convergence. If this is not possible, the option to join the euro area as soon as possible should be preferred, which offers greater security but less room for autonomous manoeuvre.

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Keywords: EU, euro area, EMU, euro, European integration

1. Introduction

In its Treaty of Accession to the European Union,[1] Hungary undertook to strive to establish the conditions for introducing the euro and initiate its use when the time is right. This commitment will mark its 20th anniversary in 2022, as the accession talks ended in 2002.

[1] Promulgated by Act XXX of 2004, entered into force on 1 May 2004. The negotiations were concluded at the Intergovernmental Conference tied to a meeting of the European Council in Copenhagen in December 2002.

The legal situation is straightforward. In recent years, the Hungarian public has passively acknowledged the timing of joining the euro area. Opinion polls show[2] that the Hungarian public has a generally positive attitude towards introducing the euro at some point. The government also assumes that it will happen if the conditions are right. Nevertheless, the exact conditions and parameters that have any relevance to a future decision, including the timeframe in which the Hungarian euro can be expected, seem to be less "settled". The question now is not whether the euro will become the Hungarian currency, but under what conditions and in what timeframe this should be expected.

During the past almost two decades, there were periods when a concrete target date was set. In the first decade, the "obscure object of desire" was determined several times, and in the end, following several necessary postponements, what stuck in people's minds was something like "we are always five years away" from introducing the euro. In the second decade, Hungary's perspective changed. In light of the euro area crisis following the global economic meltdown, introducing the euro started to be seen in a more nuanced manner. Experts and policymakers no longer ask when Hungary will become "worthy" of joining, but whether it is "good for the country", and if so, when Hungary should join.

Until recently, no meaningful debate occurred on the aspect that the single currency cannot in itself be deemed useful or harmful from the perspective of a country already using it or one on the brink of joining the currency club, without analysing competitiveness. Likewise, no major objection was heard from experts to the approach that appropriate competitiveness can be captured as about 85–90 per cent of GDP per capita at purchasing power parity (today this indicator is at approximately 73 per cent). This argument is partly based on the fact that experience has shown that hurriedly joining the currency area due to political pressure sooner or later poses problems, first to the country joining the club, and soon perhaps even to its partners that are already members. Joining the currency bloc is intended to provide extra resources to Hungary and to its partners, rather than cause a headache for anyone. This is probably the reason why Hungary's partners within the euro area are not pushing for those still outside the bloc to join. (Apart from some brief efforts, such as when the Juncker Commission, in its draft budget for 2020–2027, referred to its idea about technical assistance as an "irresistible offer". Of course, it is the responsibility of the aspiring member to provide the necessary conditions and to take the legal initiative, and those in the currency club accept the bid if the conditions are deemed to have been met.)

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[2] See the Eurobarometer survey from October 2019, in which 66 per cent of Hungarian respondents were positive towards the euro: https://www.gesis.org/en/eurobarometer-data-service/survey-series/standard-special-eb/study-overview/eurobarometer-922-za7580-october-2019

Shifting the focus slightly, this paper does not examine when and how Hungary can become able to introduce the euro, but rather merely highlights some considerations in the following areas:

• the extent to which the countries that already use the euro and the system as a whole have met the expectations;

• the possible development paths for the system;

• and the conclusions that can be drawn from this regarding the timing of Hungary's euro accession.

The author raises some future questions that are relevant for Hungary. The past and the present are mentioned only to the extent they are considered important from the perspective of the future when assuming trends. The aim is not to comment on earlier decisions, but to provide input for a solid vision.

2. Change and stability

Much has changed in the past two decades – or three, if one starts counting from the birth of the concept of the euro. These changes are important for at least three reasons.

First: the economic and theoretical framework of the single currency area has changed.[3] One need only recall the unbelievably rapid transformation that has occurred between the economic policy management of the euro area crisis following the 2008–2009 meltdown and today's pandemic crisis management. Of course, the nature of the two crises is different, just as the nature of the vicious sovereign–bank–corporate debt triangle and economic policy priorities have also undeniably changed. Suffice it to mention the statements in which the key figures of the earlier crisis management, the members of the "troika", warned the world about returning to normalcy too early. Let us not forget, today's situation is characterised by quantitative easing, the suspension of deficit and debt rules, and the easing of public support rules. Much has changed in the tone since the times when the recipe of the EU/ECB/IMF bailout packages was to guide distressed countries towards balance through fiscal austerity.[4]

Second: the situation within the euro area has changed. The initial unbridled optimism was tempered by the fact that while the system proved to be resilient to crises, not much has been achieved in terms of the main objective. The downward trend in the share of the EU and the euro area within the global economy and

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[3] This was already discussed in the 1990s; see, for example, *Bordo – Jonung* (*1997*).
[4] Press conference by Christine Lagarde following the meeting of the ECB's Governing Council on 11 March 2021.

world trade has not stopped, and no convergence within the euro area has been accomplished (see, for example, *Bongardt et al. 2013*). Experiences differ, not only in the case of newcomers, but also of the founders. There were failed attempts to eliminate the structural factors that regenerate the balance of trade and balance of payments surpluses and deficits within the euro area and that broaden the gap between the northern and southern parts of the bloc in terms of GDP per capita, rather than narrowing it. The political necessities arising from this lead to forced compromises and contingency solutions; see, for example, the joint borrowing, which was planned to be a one-off. In general, the acceptance and diffusion of responsibility has separated members into groups that are permanently at loggerheads (*Acocella 2020*).

Third: the considerations of EU members not currently using the euro have also changed. Brexit has significantly reduced the ability of this country group to promote their interests. The group already using the euro has ample voting power to decide the overwhelming majority of questions within the European Union, even in issues unrelated to the euro. At the same time, on average the EU-27 performs better in most real economy indicators (growth, employment, balance indicators) than the euro area. In other words, joining the bloc confers no special prestige if it is not warranted by a sensible cost–benefit calculation. This can be based on others' experiences, but the factors involved are so wide-ranging that they should be treated carefully, considering the features of the country concerned.[5]

While there are huge changes, the geopolitical considerations are largely unaffected and stable. Hungary's geopolitical stance and links to alliances were set in stone by the EU and NATO accession. It follows from this that joining the euro area does not bring about change from this perspective.

Undoubtedly, in the given moment, the democratically elected leaders made all the past decisions considered the best, based on the advice from the best possible experts. The only goal here is to contribute to a discussion that serves this purpose under the new conditions. One thing is certain. The success of the euro area is in Hungary's best interest, whether Hungary is outside it or inside it. Despite being a non-euro area member, Hungary's trade and economic integration with the club is among the highest and is higher than in the case of most members within the bloc. Therefore, the country should probably continue to refrain from interfering with the solutions to the current problems, and to hope for success, because Hungary has a vested interest in that. On the other hand, the country should offer and defend its opinion on the issues pertaining to the future. This essay intends to highlight some political, geostrategic, integration policy and economic issues, before drawing conclusions from them.

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[5] Eurostat annual national accounts

3. Where is the euro area now? Political, geostrategic and European policy considerations

The creation of the common currency is perhaps the greatest achievement of European integration so far. Just as European integration itself is a political project implemented with economic instruments, the euro is one, too.

For many centuries, European politics and history were characterised by the search for balance. The decision on European integration, produced by deeply political ideas following the Second World War, was a response to this search for balance: some kind of balance between European powers seemed to emerge for a few decades from time to time, but it was always undermined. These periods of balance were times of peace, while the disruption of and renewed search for balance meant wars in Europe. The "founding fathers" wanted the national powers that formed the basis for the defence industry at that time, such as the coal and steel industry, to be jointly exercised by the participating nations, especially Germany and France. In effect, the establishment of the European Coal and Steel Community was to serve as a check on building capacities that could have been used against each other. (Let us not consider the issue to what extent this idea was inspired by Americans, which would be difficult to clarify today anyway.) In other words, the limited customs union that emerged, the quotas and other economic instruments served a political purpose.

Similarly, the idea of creating the euro was based on political considerations. The fall of the Iron Curtain and the imminent prospect of German reunification and the slightly more distant perspective of uniting Europe once again raised the issue of the European balance of power. In particular, it led to the French concern that the new conditions may lead to German dominance, which would jeopardise the new-found stability, based on the assumption that Germany's presence in the Central and Eastern European region would become more intensive. The French wanted guarantees that this would not upset the balance. The common currency was to serve this purpose and to be a condition that ensures, like a steel hoop on barrel, enduring cohesion under the new conditions, at least in Franco–German relations.

Although it concerned a country that had not introduced the euro, Brexit brought about important changes in European political relations, at several levels and to an extent that cannot be accurately measured yet. The exit of a permanent member of the UN Security Council, a G7 member and a nuclear power dramatically reduces the EU's global power and also affects the power relations within Europe. Beyond the immediate effects, for Hungary the indirect consequences – arising from the fact that the balance between economic philosophies has been undermined – may be even more important. In the face of the continental French and German thinking not wary of greater state engagement restricting, or at least regulating,

competition, the group comprising the Netherlands, Nordic and Baltic countries and the Visegrád Group[6], headed by the UK and favouring free trade relations, as free competition as possible and limited state intervention, was a balancing factor. This balance seems to have been disturbed in the absence of the UK. The so-called New Hanseatic League led by the Netherlands is making some efforts, but the coordination and influence of the German–French–southern group seems to be increasing. At the same time, difficult compromises need to be forged in issues, such as the appropriate ratio of preventing and sharing financial risks or the method and extent of solidarity.

4. The euro is a work in progress

The current structure of the euro area is still a work in progress. Although it has proved to be more resilient to crises than many people had thought, having withstood the debt crisis, and it also seems to be weathering the pandemic crisis well, there is a widespread argument that the structure cannot be sustained for long at its present state of completion. A step needs to be taken, either backwards or forwards. However, neither of these steps are easy (*Erhart 2021*). Taking a step backwards would cause incalculable political and material losses. This is attested by *Mario Draghi's* famous *"Whatever it takes"* speech[7] and the approximately EUR 280 billion spent on various Greek bailout packages so far. It seems that despite the expectations about dissolution of the euro area, the disintegration of the system or an exit by individual members, even temporarily, are politically unrealistic. Therefore, a step needs to be taken forwards to stabilise the structure. But this is also not simple or free of contradictions. Recent years have seen major steps that could assist in crisis management without taking a significant leap in the most critical issue, namely the new ratio of risk prevention and dispersion. While one group, let us call it the north-western school, cites individual responsibility, the other one, let us refer to it as the Mediterranean school, cites solidarity. A large portion of the instruments and institutions have been established that could be created without changing the frontlines. The banking union has been set up, with the exception of common deposit insurance, and the European Stability Mechanism (ESM), and thus also the intricate system of backstops, has received an extended mandate. However, attempts to venture beyond this red line, towards a fiscal union, have always failed. On account of the dilemmas about the future and also because Hungary was directly concerned, it is important to note that the plan to create a separate, albeit not too large, part within the EU-27's budget for euro area

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[6] Visegrád Group or V4 Group: Czechia, Hungary, Poland and Slovakia
[7] Mario Draghi's speech at the Global Investment Conference in London on 26 July 2012.

members, which would have mainly had theoretical significance, failed to succeed. This was replaced by the Reconstruction Fund for the EU-27.[8]

In this respect, special attention should be paid to the European Reconstruction Fund.[9] It is, on the one hand, a significant step as regards debt or a future part of that, as after a long "frugal" resistance, in the end, common bond issues take place (when the Commission appears on the market as a borrower, while the guarantee is provided jointly by the Member States). On the other hand, this operation comes with the condition for Member States and institutions that it is one-off which does not create a precedent for the future. Taking into account that the debate was intense even without the pandemic and that government deficits and sovereign debt increased substantially due to the national pandemic measures precisely where deficit and debt levels were already exceptionally high to begin with, the extraordinary situation was more of a pretext, and it remains to be seen whether common debt issuance can be prevented from becoming a recurring or even permanent instrument.

The aforementioned uncertainty with respect to future development paths poses a separate dilemma for countries, including Hungary. This is because the issue is complicated, in that the groups of "responsibility-takers arguing for risk reduction" and "diffusers arguing for risk sharing" do not overlap with the rich and the poor. Historical experiences and cultural traditions are just as important in countries' positions as development rankings. Ultimately, it comes down to the assessment by countries' current leaders as to what has a greater chance and importance for the country's future. Diffusing or sharing risks and ultimately responsibility in as large a community as possible, which also means that countries are less able to take responsibility for their own fate, but expect to be better off together with the others, or retaining the control over one's own fate to the necessary extent, even if it is more difficult and a greater responsibility. This is a question of deeply rooted world views. Moreover, the decision is difficult, if not impossible, to correct later on. The problem is not that if things do not go well, a euro area member cannot not leave the system at any time. The system is comprised of democratic states that abide by the rule of law. No one will be forced to join or leave the bloc against their own will. However, an exit would entail much heavier losses than what could be expected in the case of Brexit. In other words, a hasty decision can only be corrected at the price of huge losses, if at all, which can only be endured once per one, two or even more generations. So, careful, cool-headed deliberation is in order.

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[8] Among the concepts about the EMU's reform, one should mention the so-called Five Presidents' Report, presented by the heads of the European Council, the European Commission, the European Parliament, the Eurogroup and the ECB in June 2015.
[9] Part of Next Generation EU is the Recovery and Resilience Facility, which provides loans of EUR 360 billion and grants of EUR 312.5 billion, EUR 672.5 billion in total, to Member States.

5. For the assessment – To what extent has the euro met or not met expectations?[10]

European integration and its flagship product, the euro, have contributed to *stability.* Although it has been unable to halt the realignment within the global economy, i.e. the downward trend in Europe's relative importance, it has proven to be more resilient to crises than ever thought. How many times has the euro, or at least the membership of some countries, been declared doomed! It seems that in critical situations the political will has always been stronger, so that the system was able to overcome crises, even if at the price of compromises. But was it able to facilitate convergence within the bloc?

Economic convergence can be assessed from several aspects. The expectation and assumption in the 1992 Maastricht Treaty was that by introducing the euro, members would waive their monetary policy autonomy, in exchange for achieving greater stability and economic growth by eliminating the uncertainties arising from exchange rate movements and reducing borrowing and transaction costs.

In the preliminary phase of euro introduction, there was a special focus on the developments in nominal convergence. The assumption was that the prices of the goods marketed in the euro area would level off, inflation would converge, leaving some room for productivity increase in the converging members, while the rules on fiscal discipline would prevent the decentralised fiscal policies from leading to disorder with spillover effects felt in other members. The fiscal requirements were supplemented with the "no bailout" rule to underline the strictness of fiscal discipline and the inevitability of responsibility.

In itself and in theory, *convergence as expressed in income per capita* is not necessarily a condition for economic integration, but it is perhaps its most important political goal and promise. Increasing welfare was an express aim of the "ever closer union". According to the dominant attitude around the time when the concept of the euro was born, the elimination of exchange rate risks and obstacles diverts capital towards converging countries and regions. However, labour flows shift towards the countries with higher wages. Nevertheless, it should be recalled, partly in light of today's debates, that the risk of divergence was also taken into account, for the off chance that economic resources would concentrate in the regions that were already better supplied with human resources and infrastructure. That is why structural and cohesion policies were and still are vitally important, not only for the beneficiaries of redistribution, but also for the viability of the entire system.

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[10] This section is based on *Virág* (*2020*) and *Acocella* (*2020*).

The trends so far do not show that the introduction of the euro brought about a convergence in income levels (*Franks et al. 2018*). Even within the core, there is a significant difference between the high German incomes and the lower-than-average French wages, and especially Italian incomes, which have stagnated for about two decades. It should be noted that even within the same country, different periods may show variation. A good example for this is the period of slow growth after the introduction of the euro, followed by a rapid rise in the wake of the Hartz reforms. The performance of the countries that joined later is also not compelling evidence for the expected convergence effect. In contrast to the impressive convergence process of the Baltic states, which had a lower level of development to begin with, in Slovakia, Slovenia and Finland GDP per capita measured at purchasing power parity relative to the euro area or the EU-27 decreased rather than increased. Nonetheless, within the EU-27, there is a clear trend of the V4 Group converging rapidly, sometimes even catching up with southern cohesion countries (*Tokarski 2019*).

It is worth mentioning that the analyses have shown that the income convergence of the 12 founding countries slowed down after the introduction of the euro and then stopped altogether, and in fact, some divergence can also be detected. Meanwhile, on average, the countries that joined in 2007 or later continued their convergence, although there are huge differences even within that (*Alcidi 2018*).

The *yield advantage* is straightforward in the countries using the euro. This is not so important in today's low interest rate environment, but this situation is only temporary, and it is difficult to predict how long it will last. Its importance is reflected in the fact that even though the national debt of euro area members has risen significantly, the costs of debt servicing have dropped from over 5 per cent in 1995 to 1.6 per cent today. A similar trend can be seen in Hungary as well. Prior to the pandemic, servicing a debt of around 60 per cent cost over 4 per cent of GDP, whereas in the times of the extraordinary monetary easing, a debt of approximately 80 per cent can be financed at a cost of around 2 per cent of GDP.

In theory, *the convergence of economic structures* is not a necessary condition for successful monetary policy, unlike the flexibility and adjustability of the labour market and goods market. The lack of these explains the recent rising efforts to coordinate and harmonise traditionally Member State policies, such as welfare systems, minimum wage setting and social security systems.

Among the indicators reflecting nominal convergence, the development of *inflation rates* shows that most of the reduction in differences occurred during the preparation for the euro's introduction. Until 2015, there were not very significant but quite persistent differences, and the upper band was consistently occupied by the same members (Ireland, Greece, Spain and Portugal), and these differences

continuously undermined their competitiveness. A separate analysis is needed to determine whether the pandemic influenced this situation. During the 2008–2009 crisis, the convergence of inflation rates did not continue.

In terms of the *convergence of business cycles,* the picture is less clear. Some researchers say that the harmonisation within the euro area is greater than outside the group, but the level does not seem to increase over time. Others have found that although business cycles have become more harmonised, the size of fluctuations has increased. It follows from this that while the harmonisation of the cycles gives more chance for a successful common monetary policy, there are periods where the levels of optimal easing or tightening differ.

There were high hopes about the euro's impact on *trade development and trade diversion*, in other words that some of the trade with those outside the bloc would be diverted to within the euro area. Two things should be noted from a Hungarian perspective. First, the share of the EU and the euro area is so high in Hungarian exports, but also in imports, that increasing it any further is not a sensible objective. (In 2019, 80.9 per cent of Hungarian exports went to the EU (*HCSO 2020*), which is one of the highest proportions among Member States.) Second, interconnectedness in trade is currently experiencing a realignment, irrespective of the introduction of the euro. In 2020, Germany's volume of trade with the Visegrád countries was greater than with China and Russia combined, and almost double the figure with France. Hungarian exports to Germany were half of French exports and surpassed Russia's exports in 2020 (*ECB 2020*).

6. Unplanned changes – Unity in diversity?

It would be interesting to examine the patterns outlined based on the experiences so far that can be useful for the future. Is the oft-cited pattern true that the euro has divided members into two groups: the southerners with recurring balance issues and the westerners with permanent balance of payments and trade surpluses? One might venture to make several statements about this.

First, in Europe, the economic, institutional and socio-cultural dividing lines do not overlap. In fact, there is currently a sort of realignment, diverting some of the traffic within the euro area in a euro area–non-euro area direction, mainly due to a dynamically growing German–V4 connection.

Partly because of this, the worries that introducing the EU later than planned would automatically place countries on the wrong side of a new dividing line in Europe do not seem warranted. A Europe of concentric circles or the emergence of a "core" and a "periphery" along the lines of the euro does not seem realistic, if only because the real structural obstacles to completing convergence are just

as much within the "core" as outside of it. Analysts assess trends differently from several aspects, but they all agree on one thing. All scenarios should be based on the premise that the basis for the European structure is the balance between the large, dominant continental powers, where maintaining the Franco–German cooperation is an axiom, and in the political reality Italy falls almost within the same group, and although the rankings will continue to be contested for a long time, the largest players are followed by the middle of the pack with Spain and Poland. The differences are particularly huge within this core. These attract less attention than the north–south skirmishes, but they are still important. One only needs to mention the differences between Germany, France and Italy.

Of course, all members would wish to tailor the common solutions to their own experiences, traditions, philosophy and institutions, but these are different. Germany and the like-minded Netherlands, Austria, Finland within the euro area, as well as Sweden and Denmark outside the club use a market economy model based on solid public consultation, in which economic growth relies heavily on exports and the openness of the markets. By contrast, the institutional capacities and traditions of Mediterranean members rely less on planning growth strategies. The traditional main tool of addressing challenges in competitiveness is the devaluation of the currency, i.e. adjustment through the exchange rate. Compared to these, the French model is unique in that the state plays a much greater role than in the others, and economic growth is based more on domestic demand than on exports (*Tokarski 2019*). (It may not require such a stretch of imagination to search for the roots of the European strategic autonomy coined by Macron, adapted to the need that Europe, the domestic market for France, should be protected against external competition by environmental, fiscal and employment-based market protection measures, and also against internal competitors with improving competitiveness in goods and services, mainly from the east, on the EU's single internal market.)

7. Attempts at managing the diversities

As already noted, size does matter. Of course, all members are responsible for adherence to the common rules, but the responsibilities of the small, medium-sized and large countries differ as regards the negative consequences for the entire system arising from breaking the rules. What makes the operation of the system difficult is that experience has shown that adherence to the rules and responsibility are not directly correlated. It should be recalled that even if the toolkit for enforcing the fiscal rules that are so important for operating the system has been refined (Two-Pack[11], Six-Pack,[12] Fiscal Compact[13]), these tools have never actually been

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[11] https://ec.europa.eu/commission/presscorner/detail/en/MEMO_13_457
[12] https://ec.europa.eu/commission/presscorner/detail/en/MEMO_13_979
[13] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3A1403_3

used. What should be an even bigger red flag: their use was considered in earnest only once, when the suspension of cohesion funds was foreseen for Hungary, which has not introduced the single currency and exerts no major spillover effects due to its size. In the famous German, France and Spanish cases, there was no political power to impose the sanctions. It remains to be seen how to consistently enforce rules in the case of large and powerful members. Therefore, it is also impossible politically in smaller and poorer countries.

If reforms cannot be enforced with punitive financial measures, the question remains how to encourage members to implement the often not very popular reforms that are expected to entail improved competitiveness and the conditions necessary for long-term, sustainable and balanced growth. This led to the calls for the so-called economic semesters.

As part of the semester, the Council offers recommendations, based on the Commission's proposal, with a qualified majority, to all countries, and implementation is also monitored. However, the practices are controversial here, too. Ever since the Juncker Commission defined itself as a political actor and has been acting like it instead of the good and innocent practice of "exchange of economic policy experiences and advice" used in the OECD, the approval of the recommendations has increasingly become politically contested, where objective expert analyses have been replaced more and more by ideological, unmeasurable debates, for example on the rule of law. Aside from this, another problem is the extent to which institutions without political responsibility can take over the role of elected governments, parliaments and decision-makers. Who can voters hold accountable for decisions that turn out to be wrong? It is difficult to force governments with a political responsibility to implement tough reforms against their own will, with the claim that the Commission's apparatus knows better what the Member State needs than its elected leaders. This is why Member States have implemented only 7 per cent of the "recommendations" in the past ten years.[14]

The attempts were taken to a new level by the agreement in December 2020 on the multi-year budget for 2021–2027 and the Reconstruction Fund of EUR 750 billion. In the case of the latter, the international community was concerned with the possibility of a Hungarian and Polish veto. Yet three other issues, which were just as important and may be crucial for the euro area and European integration as a whole, were also discussed. First, the issue of a separate budget for the euro area was abandoned for some time due to the pandemic and the Reconstruction Fund. The significant step that was urged so much by the French and southern countries as a step towards complementing the euro's structure was not made.

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[14] Report by the European Commission on the implementation of the semester recommendations, 2019. https://op.europa.eu/webpub/eca/special-reports/european-semester-16-2020/en/index.html

But there was a practical measure, which had just as much theoretical significance, although interestingly it was not taken within the framework of the euro area but of the EU-27: a decision was made on common bond issuance and thus the communitarisation of some of the debt. This is a breakthrough in meeting French and southern demands, even if it is claimed that this was a one-off, which does not create a precedent. Third, a special new situation emerged in enforcing reforms, too. The grants and preferential loans that are calculated based on the damage caused by the pandemic, and are therefore mainly geared towards the south, can only be drawn down if the beneficiary member country can present for approval a reform programme subject to phased performance and payment requirements, which, when implemented, is expected to yield structural reforms that, if upheld, will eliminate the need for further external assistance, which makes the claim that this is a one-off programme more credible. Devising, discussing, approving and especially implementing the programme will be an unprecedented institutional and also credibility challenge for all stakeholders. According to the accepted process, the "goodwill" of not only the Commission but also of the 26 other Member States will have to be obtained for the programmes. The question will be whether in a strained market situation, for example the Netherlands delays or even prevents the approval of, say, an Italian programme that would be the key to survival, or the disbursement of an upcoming instalment. Or how will the approval of a Hungarian or Polish programme by Sweden or Finland go? How will this change the decades-old practice that uncomfortable decisions are usually made by Member States without looking each other in the eye and placing the Commission in between them, and can it change it at all? How much tension will be generated by this system? Shall the process be objective and evidence based or turn into an instrument serving political or ideological objectives. These are tough questions, and the answers shall have far-reaching consequences.

8. Conclusions

What conclusions can be drawn from this for Hungary's euro introduction? The answers can be found in three dimensions:

• the further development of the euro area's structure,

• the impact of introducing the euro on Hungary's European policy,

• the cost–benefit calculation of the direct material effects of joining.

The structure of the euro area has *come a long way* since its creation. It has become able to manage a crisis, and the instruments necessary for doing so have been devised. However, the conflicts arising from the different views of the Member States, primarily regarding risk reduction and sharing have continued.

The establishment of a fiscal union would transfer important powers from the Member States to the EU. There seems to be no sufficient political will for this, even if without it the structure remains unfinished.

It has not been proven that the euro area means a kind of *higher quality* and that remaining outside is certainly negative in itself, while joining it definitely entails positive effects. Structural improvements can be made outside, and even those inside can fall behind. It is not only, or not primarily, about the currency; there are winners and losers among the founders and the new members, too.

The border of the euro area does not denote a line between good and poor quality within the EU. It has already been established that the political affiliation was decided with the EU and NATO accession, and no trade diversion effect should be expected. In a wider European policy context, the question is rather what kind of Europe we would like to see in 10, 20 or 50 years, where we would feel comfortable. To put it simply: a "strong Europe based on strong members" or a federal structure where a major part of Member States competencies are exercised through common institutions. From a Hungarian perspective, even without answering this deeply political question, the integrity and level playing field of the internal market seem to be more important than the common currency. Cohesion policy should facilitate convergence, the position of less dominant countries and companies should be protected by competition rules, and the fairness of rule enforcement should not be distorted by institutional, political and/or self-interests.

The experiences so far have shown that other than the lower yields, the advantages are *not automatic,* neither for the founders, nor for those that joined later. There are examples of falling behind and convergence in the case of founders and those that joined later, and the same holds true for those that stayed outside. The real question is the "reformability" of the given country in a political, social and economic sense. There are cases where reform attempts are met with opposition, and also where a country can implement meaningful reforms in a relatively short period, which happened in Germany at the turn of the 2000s and after 2010 or in Latvia before and after 2010. In any case, transition countries have vast experience in this regard.

The consequences affecting the freedom of decision-making should be taken into account, as it is ultimately a question of sovereignty and also an institutional one. On the one hand, euro membership opens up new opportunities for participating in decision-making, since the decisions about the euro are taken by, understandably and rightly, the participants, and only them. This increases countries' influence over the decisions that affect them. As people say, the countries can shape the decisions that impact them rather than merely suffering the consequences. On the other hand, the option is lost to pursue an independent monetary policy that is best aligned with a country's own economic objectives and circumstances according to

its best judgement. The single monetary policy has to take into account northern, southern, eastern and western considerations, all at the same time. This also confirms that the introduction of the single currency should be considered only when it can be assumed with reasonable certainty that there are no more unique aspects, for example related to convergence or lower competitiveness, that would warrant, or even require, autonomy in monetary policy.

The lessons and *conclusions are not straightforward.*

Further research should be conducted to see how realistic the assumption is that the *convergence process of a converging country* requires adjustment through the exchange rate, because otherwise it would experience other negative consequences, for instance a deterioration in its trade balance or a growth or employment sacrifice. Or precisely the opposite, a fixed exchange rate is necessary to provide *normative* pressure in *competitiveness* that is vital for structural changes and increasing value added. It is interesting to see the experiences of Bulgaria and the Baltic countries with the "currency board", i.e. an exchange rate pegged to the euro.

It has been established that a structural change can mean success outside, and countries can fall behind within the club if they fail to adjust to the challenges. Euro membership may be a huge advantage to the vulnerable in a great turmoil. Experience shows that normally the very strong and the competitive can acquire surplus resources due to the euro, while vulnerability can often lead to losses.

It all depends on *value choices, self-confidence* and the perception of various risks. This paper advocates the following "stance".

The introduction of the euro should not be considered the fixed point to which Hungary's vision should be aligned. Instead, the country's vision should be developed, and the country should examine how the introduction of the euro fits into that. This paper argues that what we will see is that a liveable, good country requires preparation for the changes that adjust the factors of success. This calls for fine-tuning human resources, the physical infrastructure and the structure of the economy as a whole to meet the technological and other challenges. This is what will make countries competitive. Hungary should assess the horizon at which it can achieve this. Meanwhile, it should be borne in mind that the shocks experienced by the world in 2008–2009 and now, during the pandemic, will not go away. Realistically, no crisis-free periods longer than 10–15 years can be expected. In times of crises, a safety net tried and tested in crisis management and yield reduction may be needed. People should also be aware that the introduction of the euro not only means a safety net but also the narrowing of the nation's room for manoeuvre. The question is whether the country believes that it can implement the necessary changes better and faster alone, rather than as part of a system

with numerous participants. Furthermore, time is of the essence. If the external vulnerabilities can be reduced rapidly, the chance of success while staying outside is greater, but if not, it is better to choose the "common roof" that provides greater security. In simple terms, if the country thinks that debt levels can be significantly and steadily reduced while implementing the structural reforms necessary for boosting competitiveness, introduction of the euro should be postponed until the current uncertainties have cleared up. But if this does not seem to be realistic, an accession date as soon as possible should be set, and it should be viewed as a compass that guides the country into a safe haven in due course. Although this latter option seems to be easier, the author argues that in the long run, the more arduous, first way is safer.

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What Happened in the Neighbour? The Past Decade of Romania's Economic Convergence*

Katalin Kis

While further enhancing Hungary's convergence strategy, one should take a look at the convergence process of other countries in the Central and Eastern European (CEE) region, as well as the underlying reasons, the achievements, the issues encountered, the structure of growth and the development of balance indicators. The economic convergence in Romania is a good example of the benefits and drawbacks in this process. In the decade prior to the coronavirus crisis, Romania exhibited one of the most rapid convergence in the CEE region in terms of level of development. Starting from 51.6 per cent in 2010, the country reached 69.4 per cent of the European Union's level of development by 2019, coming close to Slovakia. In the years leading up to the Covid-19 crisis, Romania was among the top performers in economic growth in GDP terms. This growth was based on the significant expansion of disposable real incomes, the dynamic rise in household consumption, growing investment due to the stable investment climate and the government's housing market programme as well as a major improvement in productivity, partly related to the ICT sector. Nevertheless, improving productivity often conceals overheating, and after 2015, wages increased more than productivity. In addition, the deterioration in the current account deficit, together with the increasing deficit and government debt related to the coronavirus crisis, all point towards a negative trend in balance developments. The fact that Romania was able to converge in terms of GDP per capita as measured at purchasing power parity was due to dynamic growth, a substantial population decline and statistical effects.

1. Economic convergence in Romania – GDP per capita and what lies behind it

In the decade prior to the coronavirus crisis, Romania exhibited one of the most rapid economic convergences in the CEE region. Thanks to this fast growth, the country's level of development rose from 29.6 to 51.6 per cent of the EU average between 2002 and 2008. However, in the years prior to the global financial crisis, the period of rapid growth led to a build-up of imbalances and an overheating of the economy. Therefore, as the impact of the 2008–2009 economic meltdown started to be felt, real economic convergence was interrupted in Romania, too. The crisis

forced the country to make significant consolidation efforts, which entailed the signing of a standby arrangement with the International Monetary Fund and the introduction of reforms. After 2011, the Romanian economy was once again on track for growth, before changing gears in 2013 to become one of the top performers in European convergence. The level of development increased by 17.2 percentage points in the past decade, and by 2019 it came close to Slovakia, at 69.4 per cent of the European Union's level of development (*Figure 1*).

Figure 1
Evolution of relative development in relation to the EU

Note: Based on purchasing power parity data at current prices
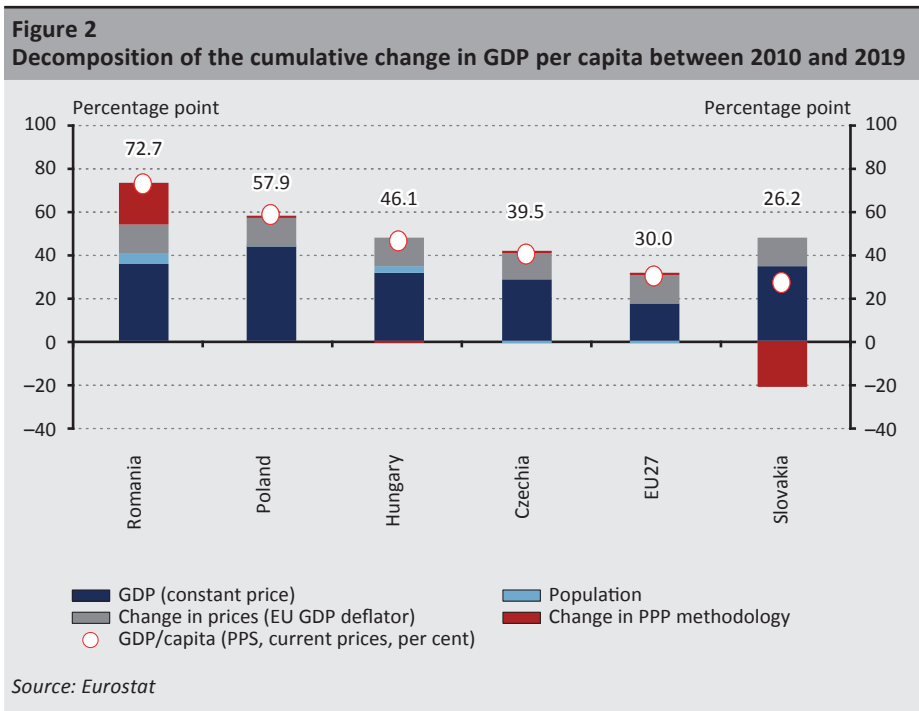Source: Eurostat
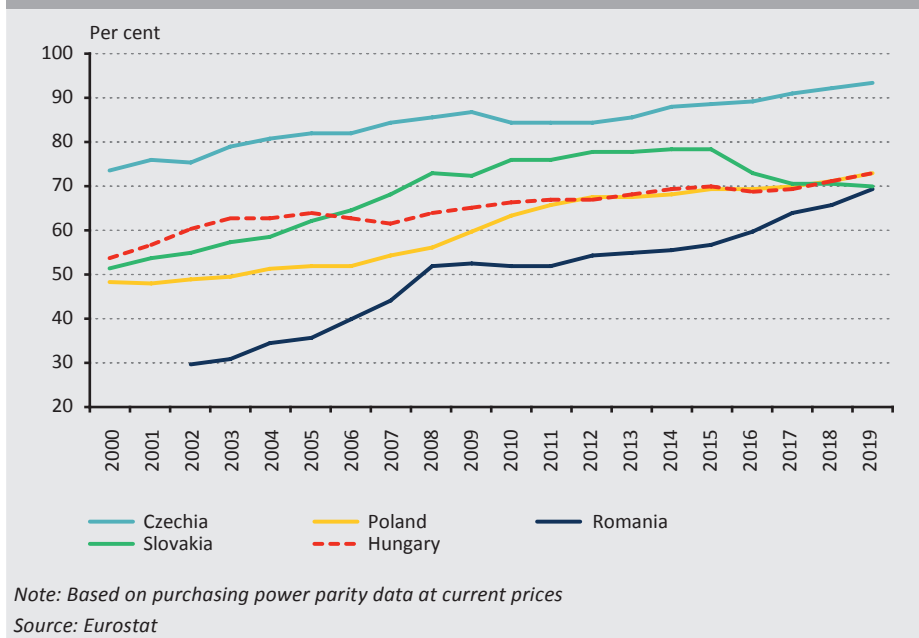
GDP per capita at purchasing power parity grew by almost 50 per cent in Hungary between 2010 and 2019, while the same figure was almost 75 per cent in Romania. Romania's convergence progressed at a faster pace than economic growth, due to dynamic growth, a substantial population decline and statistical effects (*Figure 2*).

In the past decade, one of the largest population declines in the European Union was registered in Romania. The population of Romania diminished by around 5 per cent, whereas the same figure was 2.5 per cent in Hungary. Approximately 75 per cent of this decline is attributable to emigration. In 2019, 18.4 per cent of Romanian citizens were living abroad, typically employed in lower-skilled jobs as migrant workers in Italy, Spain, Germany or the United Kingdom (*OECD 2019*). The connection maintained by the workforce abroad to the home country is crucial, and the question is whether the economic growth and increasing welfare can entice Romanians to return home from abroad. According to an *OECD* (*2019*) survey, in 2015–2017 the

employment rate of the low-skilled and moderately skilled Romanians returning was higher than those who had not emigrated, while the reintegration of graduates was less successful. The former could be explained by the younger age structure of the emigrating population, while the latter is probably attributable to the differences between the economies of the host country and Romania. It remains to be seen whether the growing productivity of the Romanian economy and the rise of the ICT sector[1], which now produces greater value added, will contribute to the reintegration of higher-skilled Romanians into the domestic labour market.

In Romania, *the increase in GDP per capita was greatly influenced* in recent years *by a major statistical factor, namely the 'adjustment' of purchasing power parity.* The time series development of GDP per capita data measured at current prices and purchasing power parity (PPP) is shaped by real GDP and population shifts as well as by changes in relative prices and the methodology. The PPP methodology had a varying effect on the countries of the CEE region: in Slovakia, for example, it pushed down GDP per capita considerably, while lifting it significantly in Romania in the past decade. Accordingly, when assessing real economic convergence, this should also be borne in mind, as it is uncertain to what extent the change in the PPP methodology reflects an actual shift in welfare, since it may simply show the difficulties in capturing the value added of the ICT sector that has expanded considerably in recent years.
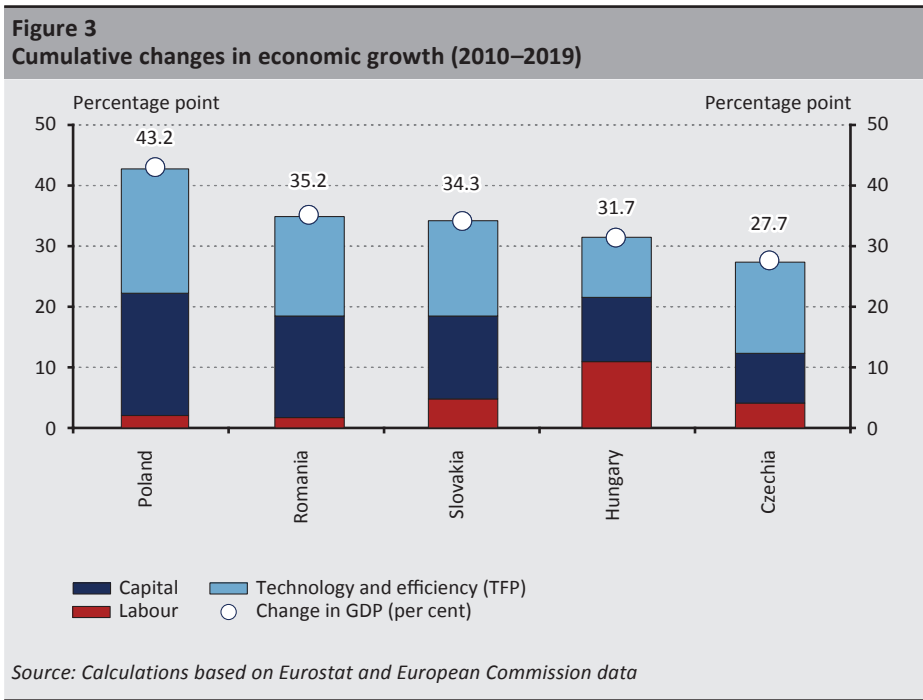
Figure 2
Decomposition of the cumulative change in GDP per capita between 2010 and 2019

Source: Eurostat

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[1] Information and communications technology

The biggest factor in Romania's convergence has been the dynamic expansion in GDP. In the years preceding the coronavirus crisis, economic growth in Romania was *exceptional* both in Europe and in the CEE region, *putting Romania among the top performers in GDP terms.* GDP in Romania grew by over 35 per cent between 2010 and 2019. This growth was based on the significant expansion of disposable real incomes, leading to a dynamic rise in household consumption, growing investment due to the stable investment climate and the government's housing market programme as well as a major improvement in productivity, therefore the focus of the paper will now be shifted to take a closer look at these.

2. The structure of Romania's growth

In 2010–2019, the rise in Romania's GDP *was dominated by capital deepening and increased productivity* (*Figure 3*). On average in the past 10 years, the investment rate was at 24.5 per cent, slightly higher than in Hungary (21.8 per cent), although in recent years Hungary has been able to overtake its peers in the region again thanks to an investment-driven growth model. A breakdown by sector shows that the investment activity of Romanian households contributed substantially to growth. In Romania, the demand side of the housing market has been supported by government-guaranteed preferential loan products since 2009. In that year, the *First Home* programme was introduced, mainly focused on providing preferential loans to those purchasing their first home. The loans were granted with an own contribution of 5 per cent and a 50 per cent state guarantee, allowing the beneficiaries to access loans at below-market rates. Until the end of 2018, the state guaranteed over 264,000 loan contracts, totalling RON 23 billion (HUF 1,700 billion). In 2019, an amended housing loan programme was launched called *New Home,* mainly aiming to enable beneficiaries to purchase larger homes. On the supply side, labour force migration has been a serious problem in the Romanian construction industry in recent years, therefore the government increased the minimum wage for construction workers in January 2019, and it also introduced tax breaks in the sector.
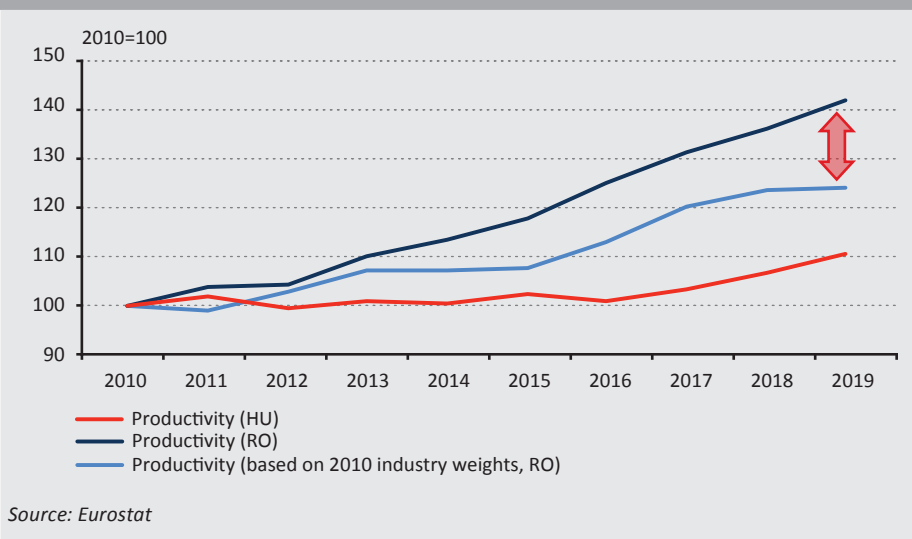
Figure 3
Cumulative changes in economic growth (2010–2019)

Source: Calculations based on Eurostat and European Commission data

The growth in capital-intensive industrial sectors was also driven by FDI. In recent years, Romanian FDI has been stable, similar to Hungary's, at around 40 per cent of GDP. In 2019, EU countries accounted for 87.5 per cent of Romanian investments. The country has a stronger southern orientation than Hungary, and besides German, Austrian and Dutch investors, a large portion of FDI comes from France, Greece and Cyprus. In the Romanian car industry, the largest players are the French Renault and the German-owned (or indirectly US-owned) Ford, while car industry suppliers are mostly German and American firms. Italian textile enterprises were among the first to move their production to the country to take advantage of cheap Romanian labour, while Austrian companies played an important role in Romanian privatisation even before EU accession (*Adarov et al. 2021*).

From a geopolitical perspective, Romania's *value is raised by its mineral deposits,* and it is *strategically situated* between the Balkans and the Black Sea. Hungary's eastern neighbour has boasted substantial oil and gas production in the recent decade, even by EU standards, and the sector is largely dominated by foreign multinationals. The potential economic advantages of the close cooperation with NATO and the United States were already seen in the past decade. These were mainly related to the military modernisation of Romania, investments in military facilities and the revival of the defence industry. The US is the largest FDI investor

in the country outside the EU, although defence developments, important from a geopolitical perspective, are not dominated by this form of financing (*Adarov et al. 2021*).

After 2015, *Romania's labour productivity increased considerably by regional comparison,* and by 2019 it had surpassed Hungary and Slovakia. Nevertheless, *half of the productivity advantage* relative to Hungary is *attributable to the composition effect* (*Figure 4*). Overall, Romania's manufacturing output has lower value added than in Hungary. In manufacturing, both countries are dominated by the production of transport equipment. In technologically advanced industries, such as pharmaceuticals, electronics and battery production, Hungary is more specialised. The relative underdevelopment of manufacturing is offset by the services sector. The share of Romania's services sector within economic output has increased by over 10 percentage points in the past ten years, and the economic restructuring was also felt in rising productivity. In Hungary, this restructuring was performed earlier, therefore around half of Romania's advantage in improved productivity comes from the composition effect (*Figure 4*). All in all, the productivity of Romanian services is higher than in Hungary. Approximately 65 per cent of Hungarian workers are employed in the services sector, while only 48 per cent work there in Romania.

Figure 4
Evolution of productivity in Hungary and Romania

Source: Eurostat

Following a rapid improvement, the productivity of the ICT sector has far outstripped the EU average. The demand driving the enormous growth in the sector was the result of companies' intermediate consumption (*Figure 5*). After 2010, Romanian firms purchased much more products and services from the ICT sector than the businesses in the V4 countries[2]. Romania's ICT sector is based on programming. The proportion of people studying and graduating in ICT fields has jumped in recent years, while employment levels in the sector were up by more than 50 per cent in the past ten years. Furthermore, the strength of Romania's services sector lies in architecture and engineering, management consulting as well as advertisement and market research.
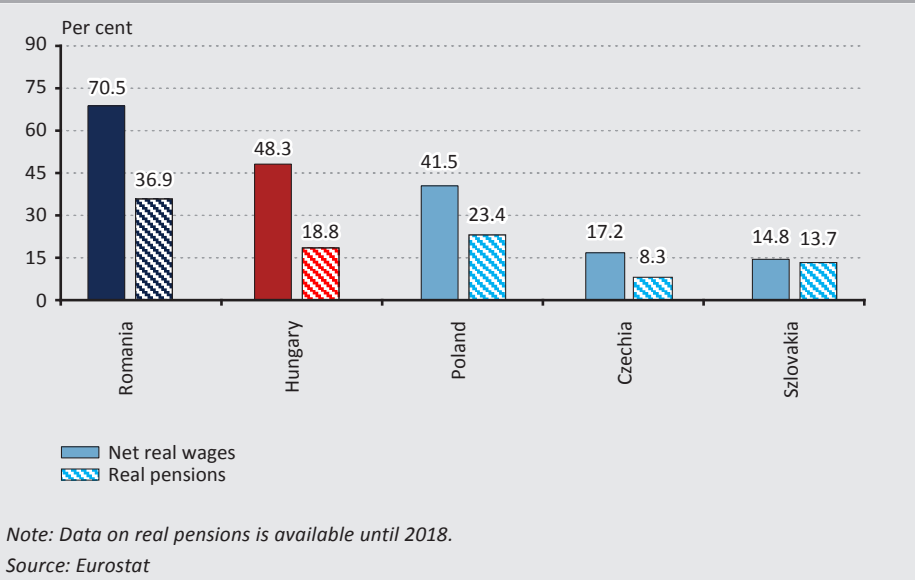
Figure 5
Share of the ICT sector in intermediate consumption
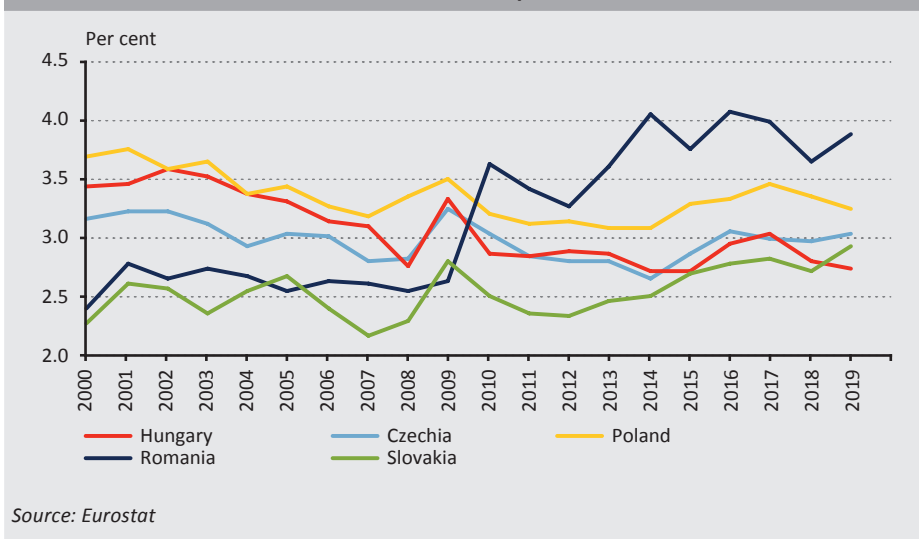
Source: Eurostat

Nevertheless, improving productivity often *conceals overheating,* and after 2015 *wages in Romania increased more than productivity.* Between 2010 and 2019, net real wages in Romania soared by almost 71 per cent, due to the minimum wage-raising cycle launched in 2016 and major state wage adjustments (*Figure 6*). Romania's participation and employment rates have also gone up in the past decade, although they still fall short of the region's average.
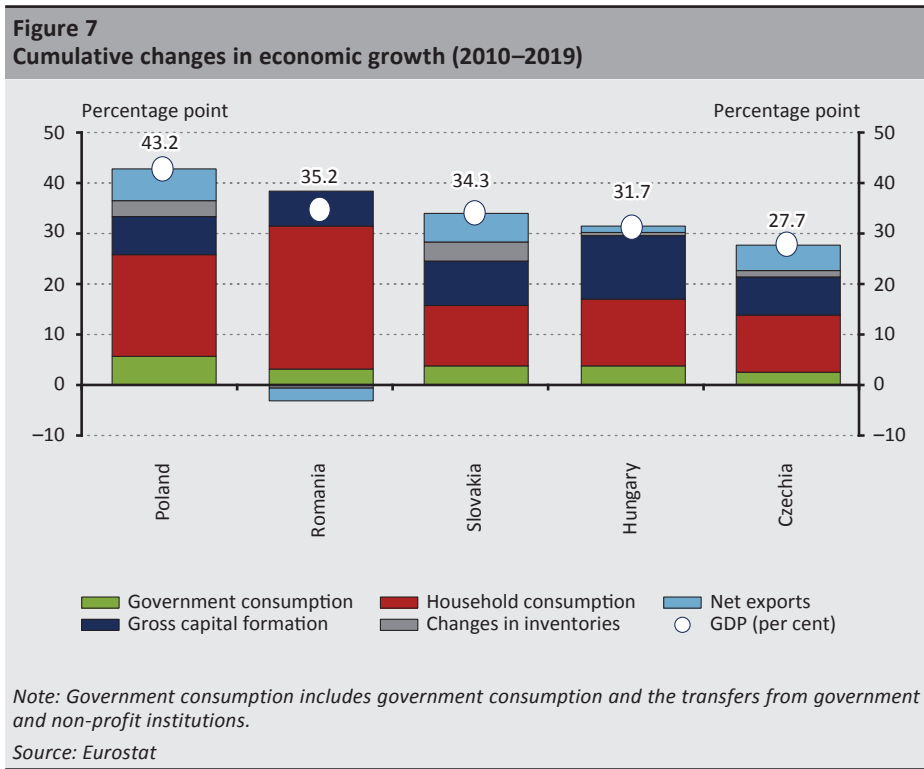
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[2] Czechia, Hungary, Poland and Slovakia

Figure 6
Cumulative increase in net real wages and pensions in the region, 2010–2019, in the national currency

Per cent

	Romania	Hungary	Poland	Czechia	Szlovakia
Net real wages	70.5	48.3	41.5	17.2	14.8
Real pensions	36.9	18.8	23.4	8.3	13.7

Net real wages
Real pensions

Note: Data on real pensions is available until 2018.
Source: Eurostat

As a result of the large wage hikes, household disposable income has increased quickly by international comparison. The expansion in incomes was also influenced by remittances, as the share of Romanian emigrants is high. The proportion of remittances relative to GDP was the highest in Romania in the CEE region, coming in at around 2.9 per cent of GDP in 2013–2019.

In line with the great expansion in incomes, the main driver behind Romania's economic growth was the uptick in household consumption, supported by a high propensity to consume (*Figure 7*)*.* The consumption growth of 1–5 per cent in 2011–2014 had increased to 10.9 per cent by 2017, before returning to 4 per cent in 2019. The consumption rate has been extremely high recently, standing at around 63 per cent of GDP in 2019, compared to Hungary's 49 per cent. Within consumption, an especially large proportion (far outstripping the EU average) is attributable to Romanian households consuming food and communication services, which could suggest some statistical bias.

Figure 7
Cumulative changes in economic growth (2010–2019)

Note: Government consumption includes government consumption and the transfers from government and non-profit institutions.
Source: Eurostat

3. The price of rapid growth – The build-up of imbalances

In addition to the growth in wages that exceeded the growth in productivity, the deterioration in the current account deficit, together with the increasing deficit and government debt, even before the coronavirus crisis, all point towards *a negative trend in balance developments.* Around 10 years ago, the global financial crisis hit the Romanian economy in quite a vulnerable state. GDP shrank by 5.5 per cent in 2009. To manage the crisis, Romania signed an approximately EUR 20 billion standby arrangement with the International Monetary Fund in March 2009. Many measures were taken to ensure the disbursement of the loan, mainly affecting the expenditure side of the budget. Owing to the austerity measures aimed at restoring balance, the ESA deficit of the budget declined steadily until 2015. However, the Romanian government pursued an expansionary policy before the coronavirus crisis, and the rising spending on pensions and the massive pay rise in the public sector all contributed to a swelling of the budget deficit. In terms of government debt, Romania's was the lowest in 2010 (at 30 per cent of GDP), and it increased only marginally until 2019. In 2020, Romania's deficit and debt grew due to the combined effect of the measures decided on prior to the crisis, automatic fiscal

stabilisers and the steps taken in the wake of the coronavirus crisis. Their rise was checked by the fact that pensions were increased by only 14 per cent, instead of the promised 40 per cent, and the previously decided doubling of the child allowance was not implemented either.

The economic growth in Romania in recent years, which was spectacular by European standards, was mainly *supported by the dynamic rise in household consumption, which entailed an overheating of the economy and was coupled with increased external vulnerability of the country.* In Romania, the current account balance has been deteriorating since 2015 (*Figure 8*). The current account deficit relative to GDP rose from around 0 per cent in 2014 to 4.9 per cent in 2019, making it the highest in the CEE region, which is primarily due to the import-intensive nature of consumption (*IMF 2019*). Gross savings have recently diminished considerably, which suggests that consumption growth increasingly surpasses income growth. In the CEE region, the transfer balance typically supports the economy's external balance position. In Romania, the transfer balance was improved by the utilisation of EU transfers as well as remittances from those working permanently abroad. The deficit of the income balance is low in the country by regional standards, which may be explained by the low return on equity of foreign-owned companies. Net external debt diminished from 24 per cent of GDP to under 7 per cent by 2019, although the extent of the contraction fell short of that in Hungary on account of the large current account deficit.

Figure 8
External balance developments in the CEE region

Source: Eurostat
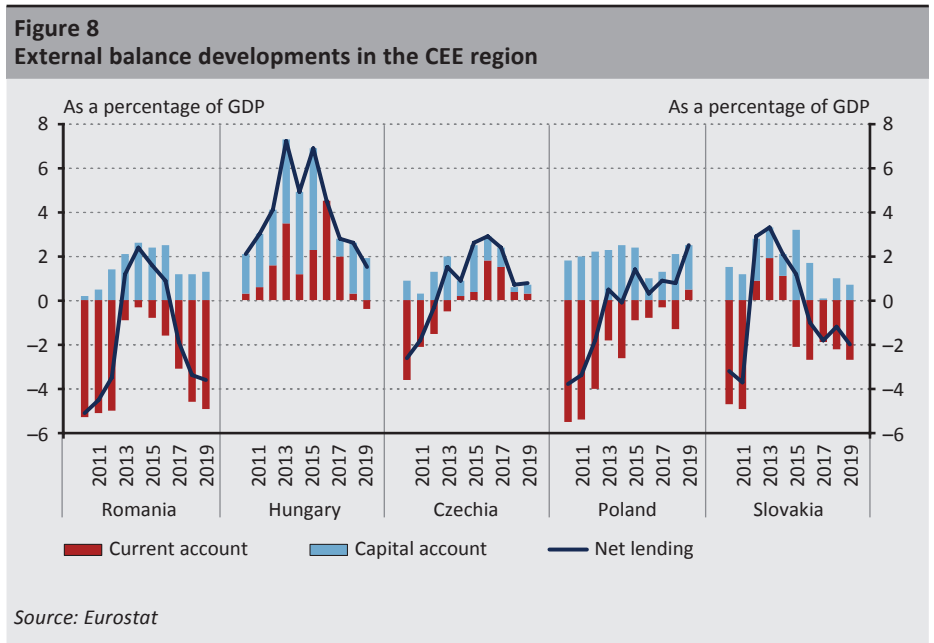
All in all, *Romania's economic convergence progressed at a fast pace* in the past decade, which, *however, led to a deterioration of balance indicators.* Convergence was faster than economic growth, due to dynamic growth, a substantial population decline and also statistical effects. The main driver behind Romania's economic growth was the uptick in household consumption, supported by large wage increases and a high propensity to consume, however, this resulted in a huge deterioration in the current account balance. Productivity increased considerably by regional comparison. The IT sector expanded significantly, and the associated demand was mainly generated by companies' intermediate consumption. This could be the key to the productivity of the Romanian corporate sector. However, half of the productivity advantage comes from the composition effect, and some of the productivity increase is due to an overheating of the economy.

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The Role of Gold in the Digital Age*

Ádám Banai – Pál Péter Kolozsi – Sándor Ladányi

This article follows the change and evolution of the role of gold in the modern economy. It points out the current resurgence of its reserve asset function and the reasons for this, including, in particular, the centuries-old trust in it and its credit-risk-free nature at a time when the FinTech revolution is challenging both the legitimacy of the forms of money we know at present, and the role of the state.

1. Introduction

One of the most important megatrends of our time is technological development, digitalisation. Given the disruptive nature of these changes, it is no exaggeration to say that we are entering a new age, the "digital age", where it is not simply a matter of taking more and more advantage of technology, but of our everyday lives being so pervaded by digital tools that almost all of our lives are being transformed.

The shift from the physical to the virtual particularly affects finance, as this is the sector where the technological leap has been one of the fastest and most radical. While progress is happening at a dizzying speed — we can transfer money from one account to another in seconds, business solutions based on blockchain technology, incomprehensible to many, are becoming more widespread, and we can trade with people tens of thousands of kilometres away from us by using our mobile phones — we are still left with an oddball. A financial instrument that with its past and physical characteristics is almost the incarnate denial of the digital age, yet "its star does not fade", it does not lose its appeal and it has not dwindled into oblivion. In fact, it is becoming increasingly popular. This is none other, than gold.

2. The evolving role of gold

Gold owes its historic role to the properties that enabled it to perform money functions extremely well. Initially, as a commodity currency, gold fulfilled the functions of a means of exchange, means of payment, an accumulation instrument and a benchmark of value. It was recognised as money by economic agents because of its durability, its divisibility and the confidence it created in the monetary system due to its limited quantity.

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Gold first served a monetary policy function in the modern sense in the classical gold standard system between 1880 and 1914. During this period, some countries committed to converting their national currencies into gold at a fixed rate. It was essential for the central banks to provide the gold backing needed to maintain the system. The First World War also drastically undermined the existing financial system, and by the end of the war the gold reserves of European countries had been greatly depleted, with a significant proportion going to the United States.

Gold continued to play an important role in the Bretton Woods system established in 1944: the participating countries held their reserves primarily in US dollars, and the United States guaranteed the conversion of dollars into gold at a fixed rate. From the late 1960s onwards, however, tensions increasingly grew with divergent economic developments, the resulting upwards and downwards pressure on exchange rates as well as the imbalances of the balances of payments leading to the collapse of the system in the early 1970s.

With the break-up of the Bretton Woods system in 1971, so-called fiat currencies were introduced. In the fiat system, the stability of the money is no longer ensured by its physical convertibility into a precious metal, but by the legal requirement to accept it, or by the strength of the real economy of the issuing country.

Despite the change in gold's monetary policy function, it is still a priority for central banks, which currently hold 35,395 tonnes of gold accounting for almost 14 per cent of global central bank reserves. The 10 countries with the largest gold reserves hold 67 per cent of the total gold reserves of central banks, i.e. there is a high concentration of gold reserves (*Table 1*).

Table 1			
Top ten countries with the largest gold reserves (June 2021)			
	Country	**Quantity of gold reserves (tonnes)**	**Proportion in reserve (per cent)**
1.	USA	8,134	78
2.	Germany	3,361	75
3.	Italy	2,452	70
4.	France	2,436	65
5.	Russian Federation	2,292	22
6.	China	1,948	3
7.	Switzerland	1,040	6
8.	Japan	846	4
9.	India	695	7
10.	Netherlands	613	68
Source: World Gold Council			

In recent times, as a result of changing central bank, economic and geopolitical developments, the perception of gold reserves and the role of gold as a credit-risk-free asset with no dependence on any issuer have increased. As a consequence of these developments, many central banks, chiefly in developing countries, have increased their gold reserves. Russia and China have increased their gold reserves dramatically: the Russian central bank has increased its gold reserves from 500 tonnes to 2,292 tonnes since the outbreak of the global economic crisis in 2008, while the Chinese central bank has increased its gold reserves from 600 tonnes to 1,948 tonnes over the same period. Gold also plays an important role in the international reserves of the Magyar Nemzeti Bank (the Central Bank of Hungary, MNB): the MNB decided to increase Hungary's gold reserves in 2018 and 2020 based on long-term national and economic strategy considerations, and the gold reserve increased from 3.1 tonnes to 31.5 tonnes and then to 94.5 tonnes. This moved Hungary from the middle to the top third of the international ranking.

3. Evolution of the financial system

In uncertain historical times, gold has always been in the spotlight, but the question is what the beginning of the 21st century is like in this respect, and what it means from the aspect of gold.

Few now doubt that the digital age will bring about a transformation of society, and in particular the economy and the financial system as a whole, and even money itself will be transformed. Money is in many ways a constant, yet it has evolved considerably over the last centuries. The social functions fulfilled by money have been relatively stable, but the world has progressed from ancient coins, through Chinese paper money in the 9th century, Arab cheques (Sakks) and medieval northern Italian banking, to modern money. In the current financial system, the bulk of the money in circulation is not created by central banks but by commercial banks in the lending process. Digital development has also brought about a significant change in this respect, as the FinTech revolution is challenging both the legitimacy of the previously known forms of money and the role of the state.

What are the dangers of the digitalisation of money? The most striking implication is that the role of cash in transactions has declined significantly in many developed countries over the past decade (in Sweden, only about a tenth of the population currently say they are cash users), and looking ahead, the trend is likely to continue as the appeal of cash for the new generation of digital-age citizens may continue to decline. At first glance, the decline of cash may seem to be a "formality", but in

fact it affects the very foundations of the financial system: the existence of cash is a fundamental condition for the safe functioning of the two-tier banking system, since scriptural money is in fact a private banking obligation on cash, the means of payment guaranteed by the state. In addition to prudent lending by banks and deposit insurance guarantees, the safety of account money is based on trust in cash.

We have arrived at the basis of any well-functioning financial system, which is broad social trust — confidence that money will be widely accepted, that payment transactions can be carried out, that the financial system will ensure financial and price stability, and that the value of money will be stable. It is no exaggeration to say that the simplest and most complicated question in finance is what money is. There are many possible answers to this question, but what all definitions have in common is that without social trust, there is no money — that is, while digitalisation has brought significant changes to the financial system, without trust, the money of the digital age cannot work either. Digital currencies include a wide range of substantially different currencies: commercial bank deposits, central bank deposits, virtual currencies as well as cryptocurrencies brought to life by the digital revolution which face perhaps the biggest challenge in terms of trust, as they proclaim that institutional trust can be replaced by trust in a decentralised system and a technological solution.

Trust can also be a key concept in the relationship between gold and the digital age. Throughout history, it has also typically been the backing behind money — the means of "escape" in the event money becomes useless — that has strengthened social confidence in money, and gold, which is valuable and very scarce, played this role for a long time. It was an important milestone in the evolution of money, when money broke away from gold (this was the "demonetisation of gold"), and now the question is what can become the "collateral" of the digital age, assuming that the backed nature of money is preserved. There are several possibilities, but if we accept that data and energy are the key resources of the digital economy, it follows that the range of possible collateral can certainly be extended to include these two factors.

However, besides the appreciation of other factors and collaterals, the overall confidence in gold remains high due to its historical and cultural role, making gold a very tangible point of reference even in the digital age of virtuality. Digitalisation brings a new world in technical terms, but it does not affect the characteristics that give gold its value, the most important of which, trust, is linked to the human mind, faith, psyche, the "collective memory" of humanity.

4. Gold in the digital age

Can the digital age end the special role of gold; will the "golden age" draw to a close? The relevance of this question is well illustrated by Fed Chair *Jerome Powell*'s statement earlier this year that "bitcoin could be a substitute for gold rather than for the dollar". If this is the case, then gold may indeed be relegated to the background, especially since bitcoin, often proclaimed "digital gold", is only one of the representatives of the cryptocurrency family, as other coins with smaller and larger capitalisation have also appeared in the financial world in droves over the past few years. Therefore it's worth taking a look at how gold compares to its digital rivals.

A key question is whether these two types of assets really mean the same thing to users. What are the features that link these assets and what are the factors that separate them? If cryptoassets were to be described in one word, perhaps the best word would be "freedom". They are not regulated. They have not been created by a government of a country or a multilateral organisation. It is easy and fast to trade with them across borders. Of course, these are somewhat overshadowed by the fact that there is no supervisory or consumer protection authority to protect against abuse. And the asset class itself is incredibly speculative; you can suddenly get rich with these assets in their current form, or just as suddenly lose everything. In addition to freedom, this dream-like potential success may be attractive to investors, while several factors hamper the development of social trust: the effectiveness of cryptotechnology is questionable, abuses are substantial and frequent, the role of the black market is significant, and there is no actor with a vested interest in stability. Gold, on the other hand, is more associated with trust and stability of value — and for good reason.

It is perhaps already apparent from the above that the potential target audiences for the two instruments, although similar in many of their needs, are different overall. Similarly to cryptoassets, gold is also out of control of countries, authorities and governments, but its acceptance at the state level is significant. Just think of it as one of the most important reserve assets for central banks. Although there are many regulated markets, gold can also be obtained anonymously in various forms. In this sense, it offers similar freedom to cryptoassets, although overall trading is significantly more cumbersome and expensive than in the case of its digital competitor.

It is also worth considering how gold and bitcoin react to business cycles. If we try to place cryptocurrencies in the traditional investment valuation framework, the value of a crypto-network (and thus a cryptocurrency) is determined by the number of transactions and the number of expected future transactions. It is easy to see that the higher the number of transactions and expected transactions, the more valuable the given network. The number of financial transactions is positively correlated with the business cycle, and therefore cryptocurrencies can be considered as pro-cyclical ("risk-on") assets, as opposed to the defensive ("safe haven") gold, so by this logic the two assets react differently to changes in business cycles and risk appetite. However, what the two instruments may have in common is that neither of them is issued by a specific entity, so there is no need to be afraid of credit risk.

As discussed above, gold has served as a means of payment for thousands of years and is therefore deeply embedded in the human psyche, and its function as a store of value is also largely due to its prominent role in the collective consciousness. By contrast, in just over a decade bitcoin has proven to have a very limited capacity to perform payment functions (bitcoin can process 7 transactions per second, while Visa has a maximum capacity of 65,000 transactions per second). The question is whether such a short time and relatively limited diffusion have been enough for the majority of society to endow bitcoin with a feature as a store of value similar to gold? Over time, decentralised, anonymous market operation can become a barrier to the development of full social trust. From time to time, the bitcoin market has been subject to serious allegations of market manipulation. There are no such problems with the gold market, so from this point of view it can be considered a more stable, safe and regulated market. This raises further questions about bitcoin's gold ambitions, as how can an asset act as a store of value if its exchange rate is subject to heavy manipulative attacks?

The short but volatile history of bitcoin makes it difficult to integrate into traditional portfolio allocation decisions (see *Figure 1*). Professional institutional investors take a number of quantitative factors into account when constructing their portfolios. The market capitalisation and liquidity of bitcoin is not sufficient for most institutional investors, which could significantly hinder its propagation. Beyond, but still related to, the liquidity constraints, bitcoin's volatility is extremely high (bitcoin's average annual volatility since its launch in 2010 has been about ten times that of gold), which most institutions with strict investment policies cannot tolerate.

Figure 1
Volatility of bitcoin and the S&P 500 stock market index

Per cent

Per cent
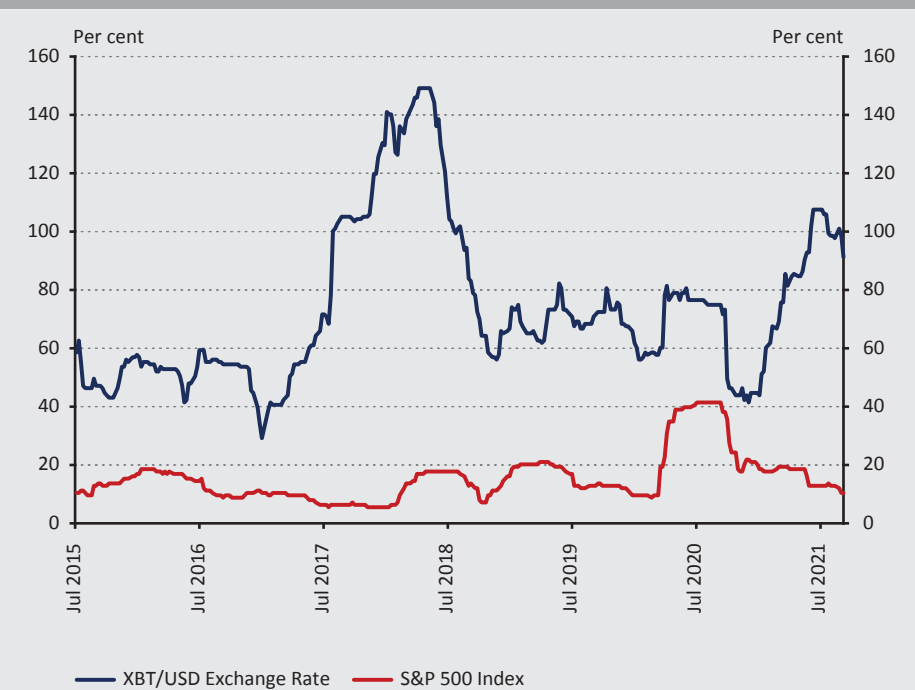
Source: Bloomberg, MNB calculation (annualised standard deviation of weekly returns over a six-month moving window)

The high volatility is also partly due to the unclear position of regulators. In the US, the cryptocurrency family has come under the spotlight primarily due to concerns about money laundering, terrorist financing and tax evasion. The growing concern of the US government and regulators is driven by the hacking attack on the Colonial Pipeline and the extortion case in bitcoin. The story of the fuel company is not unique, as cybercriminals are known to have a predilection for demanding ransom in bitcoin in software extortions. This phenomenon has led to some companies setting aside funds in bitcoin to pay potential future ransoms in preparation for cyber attacks.

In addition to the United States, China and Europe are becoming increasingly active regulators regarding cryptocurrencies. In China, bitcoin has been targeted mainly because of capital restrictions and increased state control, and the digital currency project of the People's Bank of China (PBoC) has also created a strong conflict of interest. As a result, the PBoC called upon Chinese state banks to block transactions in cryptocurrencies. In Europe, the European Central Bank (ECB) compared the

development of bitcoin's exchange rate to previous financial bubbles in its latest Financial Stability Report, calling the cryptocurrency itself risky and speculative. Beyond financial stability concerns, the ECB has also drawn attention to the huge carbon footprint of bitcoin mining and potential illegal use of the cryptocurrency.

5. Conclusion

The digital age is upon us, especially in finance, but gold is "hanging in". After all, the financial system is based on trust, and gold remains synonymous with security despite all the technological advances. While its price may be volatile, millennia of experience tell us that whatever extreme event we face, gold will have value. Understandably, the decade-long history of cryptocurrencies, considered by many to be the main challenger to gold, does not allow for this kind of confidence, and, what's more, there are growing signs that they will be synonymous with risk for some time to come.

The fact that central banks continue to believe in gold, mainly because of its long-term positive properties, is an indication of its continued importance. Gold is one of the most important reserve assets as a line of defence against severe crises, acting as a fallback asset in times of heightened risk aversion and crisis situations, increasing a country's resilience to market turbulence. By holding a physical gold reserve, the central bank does not face credit risk even in a crisis; it has a diversifying role and helps to reduce the concentration of the reserve by spreading the financial risk thereof. Due to the aforementioned legacy of confidence, by holding physical gold the central bank is able to boost confidence in the country both domestically and abroad, especially as the role of gold as a store of value could increase if fears of a sustained rise in global inflation intensify.

The lessons of economic history so far suggest that gold may also play an important role in the revolutionary transformation of money, and the ongoing evolution of the financial system is likely to increase the importance of gold in central bank reserve management. The added value of thousands of years of tradition and crisis resilience has been proven many times in history for gold, which can remain highly relevant as a modern investment instrument, especially in times of inflation.

Even though it is one of the most traditional tools, gold is not immune to progress. Over the past decades, many developments have been made to address the biggest problem with gold: its availability. For a relatively long time, ETFs and certificates have allowed even small investors to benefit from the advantages and returns offered by gold. And digital technology has brought new advances in this. There are also cryptocurrencies on the market that are backed by 100 per cent gold, allowing

quick access for anyone even in small amounts. The new technologies have thus provided gold with another opportunity to strengthen its prominent role even more widely, rather than ending the "golden age".

All the evidence suggests that gold is not lost in the digital age. At most, it will be transformed.

Meeting Point of Great Powers: Southeast Asia*

Levente Horváth – Alexandra Zoltai

David Shambaugh, author of the book *Where Great Powers Meet*, is a Gaston Sigur Professor of Asian Studies, Political Science & International Affairs and Director of the China Policy Program of the Elliott School of International Affairs (George Washington University, Washington DC) as well as a Senior Fellow at the Brookings Institution. In 2015, he was chosen as the second most influential China expert in the United States, but he is an acknowledged expert in China as well. His main fields of research are: internal affairs, external relations, military as well as security and Asian international relations of China. In addition, he was an advisor to the US government as well as various private foundations and companies. His book published in 2013 entitled *China Goes Global* was chosen by *The Economist* as one of the best books of the year.

In his work, David Shambaugh seeks answers to questions such as: What toolkits do Beijing and Washington have in the region? What historical heritages do the two great powers carry in connection with the region? What is the attitude of the ten countries of the Association of Southeast Asian Nations (ASEAN) to the United States and China, and how can they thrive between the two great powers? According to the basic thesis of the book, Southeast Asia is of extreme importance in itself as well, but this region is also a microcosm of the global great power rivalry between America and China. As for the structure of the book, the author first discusses the contest between the USA and China and then examines what leeway Beijing and Washington have in the region, what historical footprint they left in the

Association of Southeast Asian Nations (ASEAN) and in its ten member countries, and also what policy these countries are pursuing in connection with the two great powers. Finally, he tries to find out what is expected in the region in the future in relation to the rivalry of the two great powers. According to Shambaugh, the extensive competition between the United States and China is one of the main determinants of international relations and is expected to remain such for a very long time. Therefore, developments in the Southeast Asian region may have global consequences as well.

In the first chapter, the author establishes that in today's complex field of international relations there is one single factor sweeping everything aside and rising to the surface: the overall competition between the United States and the People's Republic of China. He presents the outset and the current situation of the rivalry between the two great powers and then discusses the ensuing increasingly popular conclusion that there is a new cold war going on in our world. He explains that although the latest rivalry between great powers is similar to the cold war era to some extent, it is also different in many respects. In the author's opinion, the greatest difference is that China – unlike the Soviet Union – has become organically interlinked with the international institutional system. According to experts' unanimous opinion, the competition between China and the USA is becoming increasingly intensive in the Southeast Asian region, and they also agree that this contest may even be influenced by the ten ASEAN member states. Nevertheless, the author calls attention to the fact that other regional, so-called 'middle powers' – such as Japan, India, Australia and the European Union, and, to a lesser degree, Russia as well – also play a key role in the Southeast Asian strategic game of chess. The author then presents Southeast Asia itself, describing it as an extremely dynamic region. He notes that the region is comprised of eleven nation-states, ten of which are ASEAN members, and with its total population of 636 million people, Southeast Asia is one of the most populous areas in the world. He emphasises that the large population is coupled with a diversity of religions as well, and this diversity determines almost everything in Southeast Asia. In the author's opinion, this is the reason why it is so difficult for ASEAN countries to act together in order to reach common goals. Finally, the author of the book outlines when and how the powers of the world appeared in the region and what impact it had on Southeast Asia.

The next comprehensive part is constituted by the second and third chapters. They analyse the presence of the United States in Southeast Asia. The second chapter provides details of the American heritage of Southeast Asia, i.e. of the historical role of United States and of the relations with the Southeast Asian region under the individual US presidents. The third chapter takes us to the present, describing the current role of America in Southeast Asia. The author also considers this important to discuss, because in his opinion the presence of the United States in the region

is clearly undervalued or even deemed self-evident by many observers. On the whole, Shambaugh believes that the presence and impact of the USA in Southeast Asia is extensive and significant in various categories, even if it is less perceptible compared, for example, to the presence of China. He highlights three areas where the USA still plays a defining role: trade, security and *soft power*. He considers the part taken by US diplomacy to be the weakest area.

The next main part of the book discusses the presence of China in Southeast Asia, as previously in connection with the United States. The fourth chapter examines how relations changed over China's thousand-year history and during World War II, and what the attitude of Chinese leaders to the region was like. The fifth chapter already gets down to China's current role in Southeast Asia. As he did for the United States, the author of the book discusses the levels where China is present. He defines the Chinese presence in four relationship dimensions: diplomacy, relations between people, trade and security. However, he stresses that the degree of Beijing's influence is not the same in the four different dimensions, but varies across categories and countries as well. He notes that China's economic and trade impact is the largest of the four dimensions, and this is the most dynamically growing one. He places society-level relations between people to the second place, followed by diplomacy and then security.

In the sixth chapter, the author of the book examines how much leeway ASEAN has between the two great powers, as he stresses that none of the countries in the region are under the sole influence of China or the United States. He thinks that the most important common feature of the ten member states is the ambivalence they show towards both great powers, and that they do not really trust any of them. He also outlines the advantages and disadvantages for ASEAN that may originate from relations with China and the United States. First, the author examines the region as a whole, and then discusses the individual countries separately as well: he briefly presents Thailand, Myanmar, Laos, Cambodia, Vietnam, Malaysia, Brunei, Singapore, Indonesia and the Philippines, before analysing their relations with the United States and China.

In the final seventh chapter, the author searches for an answer to the question of what the outcome of the competition between China and the United States in Southeast Asia may be: polarisation or coexistence while competing? Certain comparative advantages and disadvantages can be pointed out in the case of both great powers in connection with their interactions with the individual Southeast Asian countries, as both have strengths and weaknesses. Shambaugh notes that since 2017 a very significant collective shift towards China has been observed, but he adds that although the position and influence of China in the region has increased considerably, this should not be overvalued. The author's opinion on

China's diplomatic and political influence in the region is that at present it exceeds that of the United States, and its military potential and presence are also increasing steadily in parallel with that. In addition, the 'Belt and Road' Initiative and the ensuing regional infrastructure construction provides a particular comparative advantage for China. The United States is striving to be present in various areas of the life of Southeast Asian countries these days as well, i.e. we can really speak about a multi-dimensional actor. Nevertheless, continuing the train of thoughts, the author calls attention to the fact that raw military power remains the greatest strength and most important means of the United States. The United States is still by far the most important factor in supporting the security of Southeast Asian military forces. In addition, everyday life in Southeast Asia is almost completely interwoven by the cultural attraction of the United States: it is present in the media, in films, in various sports, in higher education, technology and investments. To sum it up: it is far greater than China's cultural impact on the region.

While China is attempting to widen and deepen its presence in all Southeast Asian countries with intensive work, in the author's opinion the United States' attitude in this area is rather negligent. This is what Shambaugh derives the all-pervasive and currently prevailing narrative, which is generally known in connection with the region, from: China is an 'unavoidable' dominant power, while the importance of the United States is decreasing and declining inevitably. Nevertheless, using an empirical approach, this book concludes that this narrative is not precise and does not completely conform to the facts. According to its conclusion, the United States continues to have deep roots and has much more comprehensive power in the Southeast Asian region than China. At the same time, it also acknowledges as an unquestionable fact that the American influence is declining, and according to David Shambaugh China may eventually conquer Southeast Asia if the United States fails to pay enough attention.

Overcoming Financial Exclusion – a Critical Look*

Ferenc Tóth

Samuel Kirwan:
Financial inclusion
Agenda Publishing Limited, 2021, p176
ISBN 978-1-78821-118-5

Samuel Kirwan's book is published as part of the *"The Economy: Key Ideas"* series, which aims to introduce undergraduate students to new and established, and possibly controversial, basic concepts, theories and models that economists use to understand and explain how the economy works.

The author is a fellow in the Department of Sociology at the University of Warwick. His main area of research is the sociology of everyday indebtedness. One of his flagship projects examines how households live with and manage their various debts, with a particular focus on the growing problem of "priority" debts, namely tax and rent arrears, understanding debt relief orders and other insolvency measures, and analysing how debt shapes family and social relationships. Prior to this, the author worked as a research fellow at the University of Bristol on the "New Sites for Legal Consciousness" project, and researched the work and experiences of advisers at the Citizens Advice Service.

To promote financial inclusion – the subject of this book – and to overcome financial exclusion, governments have been working for decades in both developed and developing countries, and have devised various strategies with the practical aim of making basic financial services available to all, whether individuals or businesses, at affordable prices. According to the *World Bank*, in 2017, around 1.7 billion adults worldwide did not have a bank account, and at least 200 million small businesses in low- and middle-income countries were unable to access credit.[1] This significantly hampers the economic development of poor communities. Financial inclusion has now become the dominant and relatively uncontroversial framework for addressing poverty and development opportunities in both developing and developed countries.

[1] World Development Report 2021, p. 103

Drawing on a series of illustrative case studies, *Kirwan* analyses the involvement of the poor in finance, focusing on the different types of policies implemented for this purpose, the reasons for their success and failure in developed and developing countries, and the potential social impact and effectiveness of such economic and financial interventions. The book also explores a much broader range of issues related to financial inclusion: it digs into the causes of poverty by class and gender, and the consequences of income and wealth inequalities. It gives a glimpse into the role of government policy in tackling inequality and notes that in practice it costs more to be poor, for example financial services are more expensive for the poor than for the rich.

The author's aim is to introduce the concept of financial inclusion and at the same time to question it to some extent from a social science perspective. The book is highly critical of the concept of financial inclusion and the areas of intervention. Existing power structures can deepen and exacerbate forms of inequality, despite their well-intentioned action to reduce financial exclusion, rooted in the real needs of individuals and with significant potential to improve lives. The author aims to provide a complete picture of financial inclusion by focusing on more than a single institutional area, a specific concept or an intervention. The guiding questions of the book are less concerned with the successes of financial inclusion, and instead focus on the distinct and common characteristics of the various initiatives and programmes that are grouped under this term.

The chapter entitled *"What is financial inclusion?"* provides an insight into the theoretical issues of financial inclusion. The chapter describes the key definitions of the term financial inclusion, the differences in their application across different geographical and institutional contexts, their relationship with related terms, and the key institutions and other actors constituting the area of financial integration (e.g. *Accion, the Alliance for Financial Inclusion, the Bill and Melinda Gates Foundation, the Grameen Bank, the World Bank*). After setting this institutional and conceptual scene, it presents five different stories of financial inclusion, i.e. different accounts of how financial inclusion has been implemented and approached on each continent. Each story serves as a basis for exploring different manners of financial inclusion and specific manifestations of financial inclusion.

The chapter on *Financial inclusion as a tool of poverty eradication* focuses on microcredit and microfinance and examines how the provision of small loans, particularly to women in rural communities through group lending structures, has become one of the solutions to rural poverty problems in the Global South. It explores the experience of microcredits in Bangladesh and India, detailing how microcredits have transformed existing power structures and how they have been used alongside other forms of debt. In this context, it indicates that the

now widely known financial institution involved in financial inclusion, Grameen Bank in Bangladesh, has been the target of severe criticism since the early 2010s, including the apparent accusation that microcredits are a "death trap" for the poor in Bangladesh.

The chapter *Financial inclusion as the production of new markets: the case of reverse redlining* describes how, in the United States, certain ethnic groups were – in the past – discriminated against when selling or renting housing in certain areas of the country. The previous exclusion of vulnerable consumers has been coupled with continued socio-economic marginalisation. The author highlights how processes of financial inclusion, by eradicating some forms of historical discrimination, can perpetuate this discrimination through adverse financial conditions for the excluded groups. Through the concept of financial feminisation, it explores how women's financial inclusion is often a double-edged sword bringing not only new opportunities, but also new responsibilities and risks. Kirwan highlights the potentially harmful effects of financial inclusion strategies such as the proliferation of subprime mortgages in the US.

The chapter *Financial inclusion as financial subjectivity: the case of financial capability in the UK* deals with the fact that the problem of financial exclusion and inclusion in the UK has intertwined with the issues of financial capabilities and their development as well as financial education programmes. It finds that in the Global North, financial inclusion has focused on changing individual habits and knowledge. It outlines the changing contours of this idealised financial subjectivity, highlighting the tensions between asset-based wealth and a system of financial capability focused on debt avoidance and saving. Policy debates should focus more on the unequal risk-sharing and gender inequalities created by financial services, and consider alternative approaches and potential interventions beyond existing infrastructures. It suggests that marginalised communities should be better equipped not just to adapt to financial life, but to play a critical and active role in shaping the foundations of the financial system.

The chapter entitled *Financial inclusion as policy project: the case of conditional cash transfers* examines conditional cash transfer schemes in Latin America, which provide welfare payments to low-income families. To receive financial support, the family must meet certain conditions. These schemes aim to reach the poorest people directly, promote human capital accumulation, reduce poverty and income inequality and eliminate the intergenerational transmission of poverty. The author explores how financial inclusion can be a political project to transform the behaviour and habits of the given population over time. It addresses a key question that is rarely asked in discussions on financial inclusion, namely the meaning of money.

If money is presented as the answer to the people's problems, how does this fit in with current financial practices?

In the chapter *Financial inclusion as transformations in financial practice: the case of mobile money*, the author describes the practice of the development and use of mobile money in Kenya and in sub-Saharan Africa, where mobile money and the "airtime" transactions it generates have become a form of social interaction following the etiquette of mobile phone use. Mobile money has become a way of smoothing the distribution of money between networks, mitigating the worst effects of disasters and saving money on education. In contrast to the other chapters, the direction of the financial inclusion process in this setting was not driven by government or financial institutions (although these also played a significant role), but rather by the creative need for which consumers used new technology to meet a specific financial need. The chapter looks at how financial inclusion is used to measure the changes created by mobile money, but in a way that does not grasp the fundamental shifts in financial practices and relationships that it enables. In Kenya and sub-Saharan Africa, the success of mobile money as a tool for financial inclusion is measured primarily by the extraordinary increase in the use of formal banking mechanisms it has enabled, rather than the broader changes made possible by society.

The concluding chapter of the book summarises the various critical themes explored in these stories of financial inclusion. It stresses that financial inclusion is an undeniably powerful and influential term, bringing together diverse groups of actors and shaping policy and practice on a wide scale. While its dominance is most noticeable in the reflections on development, its roots lie partly in the social policies of the Global North, where issues of financial inclusion and exclusion have been explored over a longer period of social change. According to *Kirwan*, the objectives of poverty alleviation and social progress can best be achieved by giving people the tools to adapt to difficult financial situations. Rather than simply treating the poor as passive subjects who need more money, this approach recognises the complexity of their financial practices. This uses the ability to be creative and flexible, allowing them to improve their own lives. It raises the main challenges of the concept of financial inclusion and a series of questions that need to be asked when financial inclusion is seen as a solution to social problems. The chapter concludes by setting out an agenda for critical financial inclusion. It acknowledges and supports valuable work in the field of financial inclusion, while moving the assessment of success away from the false binaries of exclusion/inclusion and formal/informal financial services, and give marginalised groups a meaningful role in defining the role of finance in their lives, raising awareness of the importance of involving them in shaping the process of financial change.

Although this book was originally intended for university students, it is also a valuable resource for researchers who wish to understand the socio-economic dimensions of the subject in more depth. This book serves as an introduction to the concept of financial inclusion for readers interested in social science. I also recommend it to all socially sensitive readers for its practical examples.

Humane Economics – from Adam Smith to Vernon Smith*

Balázs Sárvári

The Hungarian edition received an impetuous title: 'The humanisation of economics'. Moreover, this combination of words certainly seems to be an oxymoron for many, also catching our attention easily. Humanising economics. On the one hand, readers could expect the book to eventually shed light on a new path, following which the authors and the reader together will make economics humane. On the other hand, many may approach the book reluctantly, saying that economics is more precise and methodological than humane, and it should not even be made humane. In contrast to these attitudes, in the book the authors show that economics is already essentially and originally humane. One could also say that it is not this branch of science that they want to humanise, but the picture we have formed of it. They undertake all of this by tracing economics back to its roots in many respects, in an approach, which is deeply humane. One of the authors, Vernon L. Smith, received the Nobel Prize in Economic sciences in 2002 for his study of alternative market mechanisms. He is a professor of economics and finance at Chapman University, California. In addition, he is a founding member of the University's Economic Science Institute and its Smith Institute for Political Economy and Philosophy as well as a Distinguished Fellow of the American Economic Association. The other author, Bart J. Wilson, is a professor of economics and law at Chapman University. He is

a founding member of the Economic Science Institute as well as a founding member and Director of the Smith Institute for Political Economy and Philosophy.

If the market is considered to be the location where people make economic decisions, the neoclassical approach performs well in the analysis of these impersonal relations. However, if these relations are embedded in personal interactions, the resulting picture is much different. This is the starting point (Chapter 1) of the fascinatingly complex book by Vernon L. Smith and Bart J. Wilson. With the title (Humanomics) they also want to stress 'the very human problem of simultaneously living in these two worlds, the personal social and the impersonal economic' (p. 2). In their argumentation they return to the thoughts of Adam Smith, where the personality of people, or more exactly their emotions, sentiments, passions and affections (Chapter 2 separates these aspects of human life with inspiring precision) as well as fellow feeling and a sense of propriety still played a greater role.

The importance of these concepts was highlighted by the fact that the neoclassical approach was typically unable to predict the outcomes of two-person interactive games. The models of ultimatum and trust games were created in the 1980s, and laboratory experiments using them were conducted in the following decade. The studies focused on cooperation between actors and found cooperation of a degree that was incompatible with the pursuit of self-interest of the neoclassical approach. The answer of Adam Smith is that human decisions are driven by self-love and not by the pursuit of self-interest. The book is the restoration and proof of this thought.

The interpretation of the meaning of words is an abstract level, and therefore it is justified to project Smith's answer to the practical level of economics as well (Chapter 3). The book's authors address criticism to contemporary economics and cognitive psychologists, who in their opinion, 'maintain the positivist tradition, having merged it with Benthamite utilitarianism' (p. 36). The result of this is that when discussing the preferences they almost only deal with the choice. Meanwhile, they lose sight of the decision-maker's taste, behaviour and conduct – all of the reasons and contexts that may have played a determining role in the decision. It was exactly the importance of context that was explored by laboratory experiments carried out in the 1990s. In these experiments, the participating persons 'regularly make choices that would result in lower cash payoffs for themselves when another available alternative would have made them materially better off' (p. 38).

This paradox of preferences posed a challenge to researchers. One of the directions of looking for an answer was the separation of individual and social preferences. The other direction, Smith's answer, 'eschews outcomes and their utility, including social preferences, and begins with actions as signals of rule-following conduct' (p. 41). If we approach the individual's decision from the direction of compliance,

i.e. context, the elements determining the individual's social relations become more important. For example, these elements include his/her ability to tell right from wrong, or what the individual is incited to do by sympathy or resentment. The authors consider this approach to be an independent model, the axioms of which are contained in Smith's work *The Theory of Moral Sentiments*. Model value is an important element in the book, because the authors highlight the positivist slogan typical of economics as well: 'It takes a model to beat a model' (p. 60). Accordingly, they not only criticise the neoclassical framework, they also offer another model or axiom system in its stead.

This concluding thought of Chapter 4 must necessarily be followed by a presentation of the axioms themselves and the related principles (Chapter 5), occasionally complemented with formalised proofs. Of course, we are not in a position here to describe all of these in detail, but the concept is made perceptible if one reads the 2nd axiom and the 6th principle, one after the other. The 2nd axiom reads: 'Human beings judge the sentiments and passions of each other' (p. 71). The 6th principle reads: 'The circumstances or context of an action acquires importance because it enables human beings to read intentions and find meaning in each other's actions' (p. 78). For our interpretation it is important to underline that morality for Smith is not an exogenous element (stemming, e.g. from beliefs), but means the rules that are followed by people and that can be observed through decisions. These rules are remembered by people as they more and more often opt for actions for which they may expect to be praised, and less and less often for those for which they may be blamed. Reading the book, it becomes clear that by proceeding in this manner the authors can give real answers to the decisions observed in the laboratory experiments.

The authors continue their argumentation with conclusions regarding the prediction of context-specific actions (Chapter 6). This is a more readable approach to the formal structure of Smith's model. One of its steps is that they separate beneficence and justice, which also means direct preparation for the interpretation of the decisions observed in the experiment. Following that, the formalised language returns (Chapter 7). By introducing new concepts, they verify that the system stems from human sentiments and not from conscious human sense. A good example for this is their wording that 'positive reciprocity arises from a sense of gratitude, negative reciprocity from feelings of resentment' (p. 100).

Following that, the text is a description of game theory modelling and the concrete experimental observations. First, the authors deal with trust games (Chapter 8) and then with ultimatum games (Chapter 9). They present games during which the participants 'routinely and deliberately depart from playing payoff dominant strategies' (p. 111). Before looking for the reasons, they reject the idea of avoiding an analysis of the problem in detail by citing the concept of altruism or the preference

called social. Namely, in their opinion this is not about unselfishness (for example), but human sympathy and self-control is expressed in these decisions. The games described present human decisions and the explanatory power of Smith's model in an exciting form. Among other things, the authors demonstrate that participants are typified by their first decisions, as they determine their susceptibility to sympathy to a great degree.

Relying on the observations, the authors construct new trust games (Chapter 10). During that, in one of the most interesting subchapters, they provide a detailed comparison of the traditional model and the one resting on Smithian foundations. In addition, they also demonstrate that what is written in *The Theory of Moral Sentiments* predicts the observations of trust games and many other experimental observations as well – and prediction capability is an extremely strong feature of a model. In light of all this, the authors go even further and propose a revision of the formal structure of the traditional game theory (Chapter 11). Within the context of the mathematical formalisation of human behaviour, they present where the traditional game theory model failed and what amendments allow the elimination of these failures as well as how the Smithian model can be applied during these steps.

One of the main attributes of this model is that it takes the various narratives into account, and therefore this is the main subject of Chapter 12. Context became very important when the results of the experiments went against the utility maximisation approach. Context became the element through which researchers attempted to capture what may divert decisions in these simple situations from what works in the case of much more complex market decisions. On one side, there is traditional economics, where the main emphasis is on the payoffs and the steps in the game theory. On the other side, there is Smith's approach, where the story, human relations and narrative memories are also determinants. In order to illustrate that, the authors share a narrativised trust game as well with the reader. In the closing chapter (Chapter 13), they give an answer to the classic Smithian dilemma. They link his two main works to one another, and with that they take up the position that the volumes should be considered as continuation or complement, and not as two completely different approaches.

This book is recommended to everyone for whom humanomics (or humane economics) is not an oxymoron, or for those who are at least open to becoming acquainted with this side of science as well.

INSTRUCTION FOR AUTHORS

Manuscripts should be submitted in accordance with the following rules:

- The length of the manuscripts should be limited to 40,000 characters (including spaces) but a ± 25–50 per cent deviation is accepted. Manuscripts should be written in Hungarian and/or English.

- 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.

- Journal of Economic Literature (JEL) classification numbers and keywords should be given (three at least).

- Manuscripts should be written in clear, concise and grammatically correct Hungarian and/or English. Chapters and subchapters should be bold.

- Manuscripts should contain the list of references with the first and surname of the authors (in case of non-Hungarians the initials of the first name is required), the year of publication, the exact title of the book, the publisher, the place of publication. In case of papers, the exact title of the journal, the year, the volume, and the pages should be indicated. References in the text should contain the surname and the year. When citing the exact page should be indicated.

- Tables and figures are to be numbered continuously (chapters and subchapters should not contain restarted the numbering). Every table and figure should have a title and the units of quantitative values are to be indicated. Tables are to be made in Word, while figures must be edited in Excel. Notes and sources are to be put directly at the bottom of the tables, figures.

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- Manuscripts are to be sent to the Editorial Office of the FER only. Papers are peer-reviewed by two independent and anonymous reviewers.

- Manuscripts should be sent as attachment by e-mail in MS Word file. Figures should be sent in MS Excel file both in Hungarian and English.

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