

2

FINANCIAL AND ECONOMIC REVIEW

June 2015
Vol. 14. Issue 2.

Labor's Share in Hungary

J. Michael Orszag – Peter R. Orszag

Show me how you pay and I will tell you who you are – Socio-demographic determinants of payment habits

Tamás Ilyés – Lóránt Varga

Analysis methodology of interbank reference rates – International trends and the results of the first Hungarian annual statistical analysis for 2014

Dániel Horváth – Eszter Makay

The macroeconomic impacts of demographic changes in Hungary in the context of the European Union

Emese Kreiszné Hudák – Péter Varga – Viktor Várpalotai

Topology of the foreign currency/forint swap market

Ádám Banai – András Kollarik – András Szabó-Solticzky

Financial and Economic Review

Scientific journal of the Magyar Nemzeti Bank

Chairman of the Editorial Board:

ÁDÁM BALOG

Editorial Board:

TIBOR BÁNFI, ÁKOS BOD PÉTER, ÉVA HEGEDŰS, ZSOLT KATONA, GYÖRGY KOCSISZKY,
LEVENTE KOVÁCS, CSABA LENTNER, KOPPÁNY NAGY, GÁBOR P. KISS, DÁNIEL PALOTAI,
ANETT PANDURICS, MIHÁLY PATAI, TAMÁS SCHENK, RÓBERT SZEGEDI

Editor-in-Chief: GÁBOR P. KISS
Editor-in-Charge: SZABOLCS PÁSZTOR
Editor: HELGA PENCZ
Proofreader: KENDALL LOGAN
Copy Editor: ESZTER LÁNG

Publisher: Magyar Nemzeti Bank
Publisher in Charge: ESZTER HERGÁR
H-1054 Budapest, Szabadság tér 9.
www.hitelintezetiszemle.hu
ISSN 2415–9271 (Print)
ISSN 2415–928X (Online)

Cover design: MARIANNA IZSÓNÉ BIGAI
© Copyright: Magyar Nemzeti Bank

The papers in this issue contain the opinion of the authors which is not necessarily in line with that of the Magyar Nemzeti Bank.

2

FINANCIAL AND
ECONOMIC REVIEW

June 2015
Vol. 14. Issue 2.

FINANCIAL AND ECONOMIC REVIEW

The address of the Editorial Office: H-1054 Budapest, Szabadság tér 9.

Phone: (36) 06-1-428-2600

Fax: (36) 06-1-429-8000

Homepage: www.hitelintezetiszemle.hu

E-mail: szemle@hitelintezetiszemle.hu

Editorial Staff:

Gábor P. Kiss Editor-in-Chief, E-mail: kissg@mnbb.hu

Szabolcs Pásztor Editor-in-Charge, E-mail: pasztorsz@mnbb.hu

Helga Pencz Editor, E-mail: penczh@mnbb.hu

Published regularly in every three months.

HU ISSN 2415–9271 (Print)

HU ISSN 2415–928X (Online)

Page setting and printing:
Prospektus – SPL consortium
H-8200 Veszprém, Tartu u. 6.

Contents

Vol. 14. Issue 2., June 2015

STUDIES

- J. Michael Orszag – Peter R. Orszag:**
Labor's Share in Hungary 5
- Támás Ilyés – Lóránt Varga:** Show me how you pay and I will tell you
who you are – Socio-demographic determinants of payment habits 25
- Dániel Horváth – Eszter Makay:**
Analysis methodology of interbank reference rates –
International trends and the results of the first Hungarian
annual statistical analysis for 2014 62
- Emese Kreiszné Hudák – Péter Varga – Viktor Várpalotai:**
The macroeconomic impacts of demographic changes in Hungary
in the context of the European Union 89
- Ádám Banai – András Kollarik – András Szabó-Solticzky:**
Topology of the foreign currency/forint swap market. 128

ESSAY AND REVIEW

- József Golovics:** Bounded rationality and altruism:
behaviourism in economics 158
- Támás Rózsás:** The leaven of growth 173

DISCUSSION

- József Banyár:** Response to the comment of András Simonovits. 175

BOOK REVIEW

- György Dávid Csikós:** Why and how we cheat?
(Dan Ariely: The (Honest) Truth About Dishonesty
(How we lie to everyone – especially ourselves) 179

Zsolt Kovalszky: The Death of Money (Jim Rickards: The Death of Money – The coming collapse of the international monetary system)	182
Attila Méhes: The economic curse of great powers – Is US dominance threatened? (Glenn Hubbard – Tim Kane: Balance – The economics of great powers from ancient Rome to modern America)	184
Róbert Rékási: Is China a real world power? (David Shambaugh: China Goes Global – Partial Power)	186
Tamás Rózsás: Invisible predators (Michael Lewis: Flash Boys – A Wall Street Revolt)	189
Zoltán Siklósi-Dutkay: Situations at the time of political changes (Adam Burakowski – Aleksander Gubrynowicz – Pawel Ukielski: 1989 – The Final Days of the Communist Regime in East-Central Europe)	191
Zsigmond Pálvölgyi: Money should stay the means, not the end (Andrea Tornielli – Giacomo Galeazzi: Pope Francis: This Economy Kills)	194
Norbert Szijártó: Thoughts about the euro-area crisis (Lorenzo Bini Smaghi: Austerity – European democracies against the wall)	197

Labor's Share in Hungary

J. Michael Orszag – Peter R. Orszag

This paper examines labor's share of income in Hungary. We find that the trend in labor's share is substantially influenced by the treatment of self-employment; self-employment has declined significantly because of both shifts across sectors and reductions within sectors. Hungary's labor share has been roughly constant when labor compensation excludes the self-employed. The labor share with an imputation for the self-employed has declined, but data quality concerns and ambiguities surrounding the appropriate imputation make it difficult to reach definitive quantitative conclusions about the extent of the decline. Policymakers and researchers should be cautious in interpreting the apparent shifts in Hungary's labor share.

Journal of Economic Literature (JEL) Classification: E01, E25, J30

Keywords: national income accounting, factor income, income distribution, employees

1. Introduction

The first of Kaldor's stylized facts of economic growth is that the shares of income attributable to labor and capital are roughly constant over time (*Kaldor 1961*). That stylized fact, however, has come under increased scrutiny over the past decade or so, with debate over whether and why the capital share has risen and the labor share declined. Professor Kaldor was born (with the name Kaldor Miklós) in Budapest, and the share of income attributable to different factors has important macroeconomic consequences, so it seems particularly appropriate to examine labor's share in Hungary in a publication associated with the nation's central bank.

The *OECD (2012)* has recently noted that labor's share has declined in Hungary, with a larger fall in the overall labor share in Hungary than in the United States and the decline in Hungary's business-sector labor share exceeding every other of the 26 countries examined except Finland. As we discuss, however, the extent of any decline in the labor share is not entirely clear, because of ambiguities regarding how the self-employed should be treated as well as uncertainties in the underlying data.

*J. Michael Orszag, Ph.D., is the head of research at Towers Watson. E-mail: mikeorszag@gmail.com.
Peter R. Orszag, Ph.D., is vice chairman of corporate and investment banking at Citigroup, Inc.
E-mail: orszagp@gmail.com.*

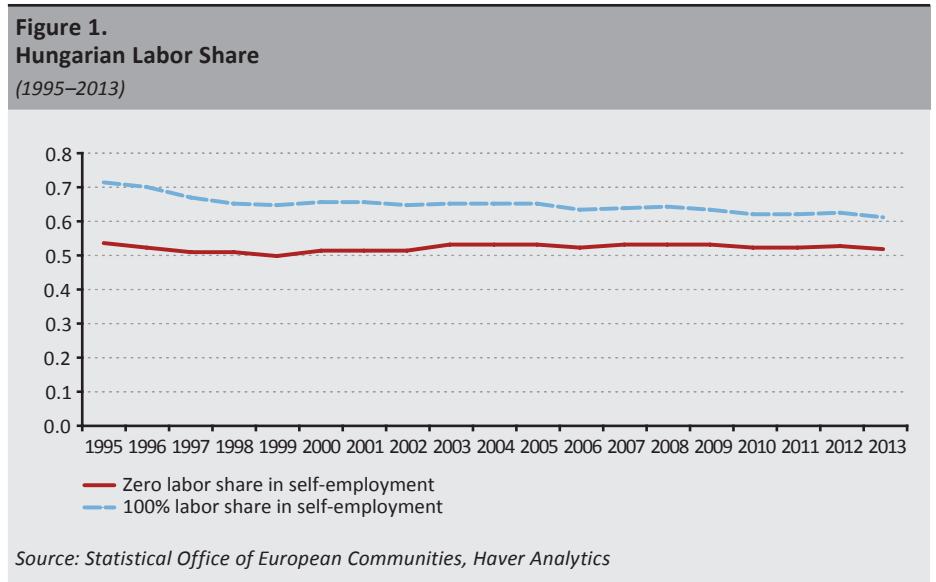
The authors thank Peter Tillman for outstanding research assistance.

At the same time, a decline in labor’s share in Hungary would not be particularly surprising: labor share has been declining in some of the fastest growing economies in the world over the past decade.

As a capsule summary of the self-employment issue, *Figure 1* shows the labor share of gross value added in Hungary under two extreme assumptions: that the labor share among the self-employed is either zero (mixed income is attributed entirely to capital) or 100 percent (mixed income is attributed entirely to labor). Under the former assumption, there is a 1.5 percentage point decline in the overall labor share; under the latter, the share declines by a sizeable 10.5 percentage points. Conclusions about whether the overall share is roughly steady or falling sharply thus depend sensitively on what intermediate assumption is used to attribute the share of self-employment income that represents labor compensation.

In this article, we discuss the broader international literature about labor’s share, examine trends within Hungary while assessing issues of both data quality and mixed income, and analyze the role of changes within and across sectors of the Hungarian economy. Our conclusions are:

- (a) labor’s share measured only using employees and not the self-employed has remained roughly constant over time;
- (b) labor’s share including the self-employed has indeed likely declined, but sufficient concern surrounds data quality and the self-employment imputation that the quantitative extent of any such decline is unclear;



- (c) self-employment has declined markedly, both because of shifts across sectors and reductions in self-employment rates within each sector;
- (d) labor's share in industry has declined noticeably;
- (e) net capital income has risen as a share of national income; for gross capital income, the share excluding real estate has increased notably.

2. Background on labor's share

In 1995, Professor Larry Katz of Harvard, a leading labor economist, summarized the view at the time that, "It is remarkable how constant labor's share has been over the last 150 years. This is one of the strongest regularities of advanced economies" (*Bradsher 1995*). This view, reflected in Kaldor's first stylized fact, was also the basis on which the Cobb-Douglas production function was introduced (*Cobb–Douglas 1928*).

However it has become increasingly clear that labor's share in recent decades has deviated from this pattern, leading to much discussion and debate. According to OECD data, the median labor share in member countries fell from approximately 70 percent in 1980 to roughly 64 percent in 2012. During that period the measured labor share in the United States fell by 5.9 percentage points, in Germany by 7.3 percentage points, and in France by 11.1 percentage points.

2.1. Causes of decline in measured labor share

An IMF paper (*Jaumotte–Tytell 2007*) found that labor globalization and technological change were about equally responsible for the decline in labor shares in Anglo-Saxon countries (U.S., U.K., Canada, and Australia), but that technology was the more important factor in continental Europe and Japan. Other contributing factors include the weakening of labor unions and privatization.

The *OECD (2012:110)* estimated that total factor productivity growth and capital deepening may be responsible for "as much as 80% of the average within-industry decline of the labour share in OECD countries between 1990 and 2007." Advances in technology have promoted automation and thus greater substitution between capital and labor. Globalization is estimated to account for another 10 percent of the fall.

In his book *Capital in the Twenty-First Century*, *Thomas Piketty (2014)* sparked a debate about outsized returns on capital, an issue tightly linked to labor share. This debate has involved questions ranging from whether the decline in labor share is temporary or permanent; whether it reflects a broader pattern associated with technological change; and whether it reflects growing elite power and rent-seeking behavior.

It could well be that the decline in labor share which has been witnessed is a transient phenomenon connected with the adjustment mechanism to new technology associated with the internet revolution and the fact it facilitates globalization; the effective global labor supply has expanded more dramatically than the effective global capital supply over the past two decades. At least conceptually the Marxist concepts that arose during the industrial revolution were based on observations about the low returns to labor, something which itself may have been a transient adjustment phenomenon connected with the rapid speed of change at that time. We simply do not have enough data or experience yet with the recent labor share declines to know whether or when the share will recover. Nor can we be clear precisely how the next major technological wave of robotics will affect factor shares.

It is also noteworthy that while a declining labor share has been highlighted in many circles as a problem, international experience suggests it may also be a symptom of necessary investment and changes in economic activity. Nothing illustrates these points better than the case of China. The decline in labor's share in China has been particularly significant since the 1990s amid one of the fastest growth rates in observed economic history. Labor's share in China is now under 40 percent, much lower than Hungary. Some of the change in China involves sectoral composition. Manufacturing has a much lower labor share than agriculture, and a movement of workers into manufacturing has thus driven labor's share lower. In addition, increasing investment and capitalization of production has reduced labor's share.

The basic point is that although developed economies will have higher labor shares than developing countries, the process of growth requires investment and sectoral reallocation, which leads to a decline in labor share for some time. *Guerrero (2012)* also notes that low labor shares are seen in economies with high dependence on natural resources. The process of investment in natural resource extraction is beneficial for economic growth yet it can result in a decline in labor share because of the investment required.

2.2. Measurement issues: role of housing and depreciation

In addition, several methodological issues arise when interpreting changes in labor's share. For example, a paper by *Benjamin Bridgman (2014)* finds that although gross labor share in the United States has fallen to an historical low, the net labor share (excluding depreciation and taxes on production) has remained within its historical range. Specifically, gross labor share fell by 9 percent between 1975 and 2011 while net labor share fell by 6 percent. Depreciation is primarily responsible for this difference.

The role of housing and land raises other issues. A recent Brookings paper by *Matthew Rognlie (2015)* of MIT raises an important issue regarding the conventional

wisdom that capital's share has increased at the expense of labor. Rognlie finds that the long-term increase in the net capital share in large advanced economies stems entirely from housing. For sectors other than housing in G7 countries, the capital share fell from 1948 until the 1970s and has only partially recovered since. The role of housing has increased dramatically over this period, contributing 10 percentage points to net capital income today compared to 3 percentage points in 1950.

2.3. Data quality

The quality of data required to compute labor's share is a significant issue in many countries. These data issues led *Karabarbounis and Neiman (2014)* to focus assessment only on corporate income, as it is more reliable than measures that include self-employment income. In addition to the issue of appropriate imputation of capital income to the self-employed, the actual level of self-employment income itself is notoriously unreliable in most countries due to under-reporting of income. In Hungary, *Benedek and Lelkes (2011)* find particularly low reporting of income of the self-employed, creating a high degree of uncertainty over what has happened to the self-employed income at the heart of many of the issues we are examining.

More fundamentally, the OECD and Eurostat data on labor's share that is the subject of much analysis and policy debate is quite unusual when looked at the granular level. When we looked at the relevant data for Eastern European countries at the sectoral level, there were some significant puzzles. In Slovenia for instance, the sectoral labor share of agriculture, forestry and fishing was not just over 100 percent every year since 1995, but exceeded 200 percent in most years, with a peak of 269.9 percent in 2009. Not to be outdone, in Romania this measure of labor share reached a peak of 660 percent in agriculture in 2010. These figures may have economic explanations in some cases (such as large subsidies for agriculture), but the use of unreliable survey data also plays a role.

Noise in the data is also reflected in dramatic changes over time. In Bulgaria, labor's share in agriculture, forestry and fishing rose from a reasonable-sounding 70.8 percent in 2000 to 167.6 percent in 2014. And there are dramatic shifts in some cases from one year to another. In Lithuania, the labor share in the same sector fell in one year from 106.2 percent to 73.2 percent. In Romania in one year (from 2008 to 2009) the labor share of manufacturing went from 57.4 percent to 36.7 percent.

In addition, when one looks at similar sectors across Eastern European countries, there is more variation in labor's share in economies that one would think are more similar. In Hungary, for instance, manufacturing in 2010 had a labor share of 48.3 percent. In Romania it was just 33.5 percent and Slovenia it was 67.9 percent. Manufacturing is just the beginning of the puzzles. Construction in Romania in 2010 had a labor share of 33.5 percent, yet in Hungary it was 65.3 percent. Our intuition is that the fundamental division of income should not be that different across these

sectors in these different countries. *Karabarbounis and Neiman (2014, Figure 6)* report that a lot of the movement in labor's share in Eastern European countries is within sectors relative to other countries, further reinforcing the point that sectoral data quality is potentially a big issue.

Given the degree to which these data irregularities are pervasive in the published OECD/EUKLEMS data it would be helpful to put much stronger caveats into reports and claims on the decline in labor's share. The apparently smooth and reasonable movements in labor's share at a country level that are reported have substantial compositional issues beneath the surface that could well invalidate the aggregate conclusions or at a very minimum add a high degree of uncertainty to any conclusions reached.

3. Trends in Hungarian labor share

With the caveats above in mind, we begin to examine the labor share in Hungary by presenting the data on gross value added in four categories: compensation to employees, mixed income, net capital income, and depreciation. In these calculations, gross value added and compensation to employees is based on data from the Hungarian Central Statistical Office and consistent with OECD and Eurostat data. Depreciation is measured as the consumption of fixed capital in the national income and product accounts, and mixed income is taken from the Hungarian Central Statistical Office series on mixed income in the household sector. Net capital income is then computed as the residual.

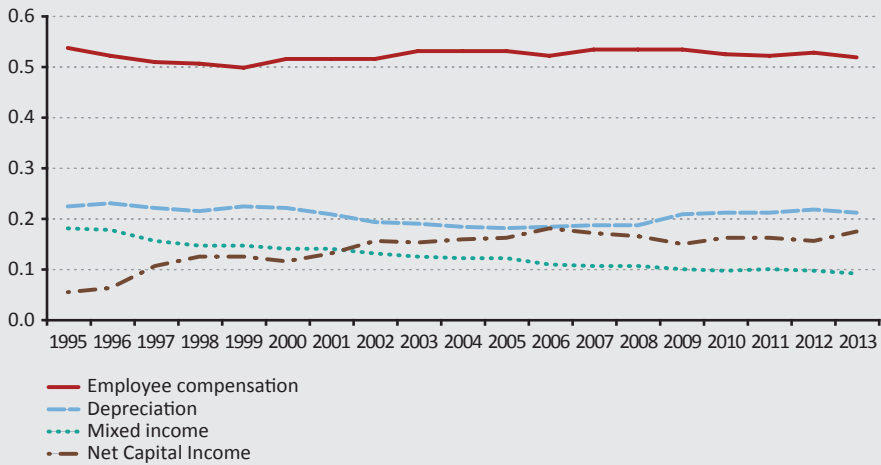
As *Figure 2* shows, the shares of gross value added attributable to compensation of employees and to depreciation have remained roughly constant since 1995. The share attributable to mixed income (that is, self-employment) has declined significantly, and the share attributable to net capital income has risen noticeably.

The pronounced decline in mixed income as a share of gross value added, and the lack of any trend in employee compensation by itself, highlights the issue described in the introduction. In particular, mixed income declined from 18 percent of gross value added in 1995 to 9 percent by 2013. How such self-employment income is treated can therefore substantially affect conclusions about the trend in the overall labor share.

3.1. Self-employment and mixed income

In its calculations, the OECD assumes that mean hourly compensation among the self-employed is equal to mean hourly compensation among employees, and therefore scales the data on employee compensation by the ratio of total hours to employees' hours to arrive at an overall labor compensation figure, which is then compared to gross value added. We update the OECD data using this methodology in *Figure 3*, with the modification that we assume mean annual (instead of hourly)

Figure 2.
Factor Income shares
 (1995–2013)



Source: Statistical Office of European Communities, Haver Analytics; Hungarian Central Statistical Office

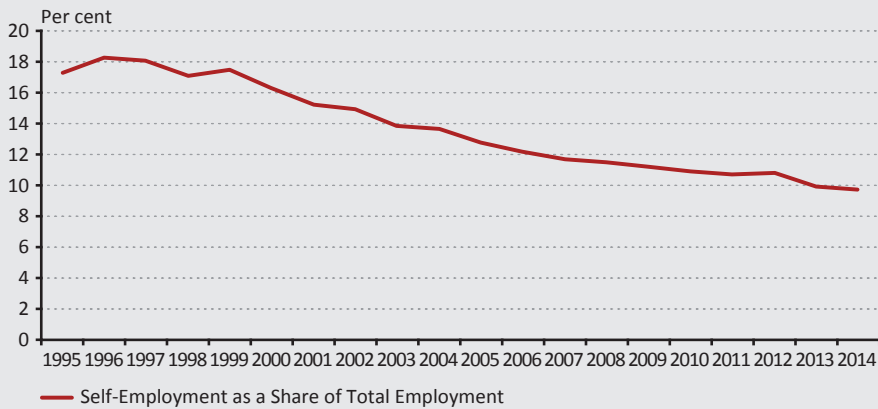
Figure 3.
Labor's Share under OECD Self-Employment Assumption
 (1995–2014)



Source: Statistical Office of European Communities, Haver Analytics

compensation is the same for the employed and self-employed. The results show a noticeable decline in labor's share given the assumption regarding self-employment. The fundamental reason, as shown in *Figure 4*, is that the share of the self-employed in total employment has fallen roughly in half since the mid-1990s.

Figure 4.
Self-Employment as a Share of Total Employment
 (1995–2014)



Note: Figure shows the difference between total employed and number of employees, as share of total employed
 Source: Statistical Office of European Communities, Haver Analytics

This decline in the self-employment rate appears to be caused partially by a decline in agriculture’s share of total employment and a rise in professional and related employment over that period of time. Appendix *Table 1* shows the employment shares by sector by year, and *Table 2* shows the self-employment rate within each sector by year. As the table shows, the share of total employment in agriculture fell from 15 percent in 1995 to 7 percent in 2014. This sector, as shown in *Appendix Table 2*, has a disproportionately high rate of self-employment, in excess of 50 percent. By contrast, employment in the professional, science, technology, and administration sector rose from 3 percent in 1995 to 9 percent in 2014.

There have also been declines within sectors. The self-employment rate fell from 19 percent in trade, travel, and food services to 8 percent; it fell from 14 percent to 8 percent in professional, science, technology, and administration, and from 17 percent to 12 percent in construction. It rose in some other sectors, such as financial insurance. In general, however, self-employment has become less prominent within most sectors.

The shift across sectors (and in particular away from agriculture and towards professional and related services) and the reduction within sectors can each explain about half of the decline in self-employment for Hungary as a whole. For example, weighting the 1995 self-employment rates by 2014 employment shares by sector yields an overall self-employment rate of 13.5 percent; conversely weighting the

2014 self-employment rates by 1995 employment shares yields an overall rate of 13.6 percent. In other words, the shifts of employment between sectors can explain about half of the decline in the self-employment rate for the nation as a whole, and a reduction in self-employment rates within sectors explains the other half.

A paper in Hungarian by *Hárs (2012)* has analyzed in detail the decline in self-employment in Hungary. The paper finds that two factors played an important role in the movement of self-employment over the period since the mid-1990s. The first was the decline in cooperatives primarily in agriculture that accounted for roughly 4 percent of total employment. As members of the self-employed cooperatives aged and retired, this form of self-employment declined. The second is the share of entrepreneurs and partnerships in total employment in Hungary, which declined slightly.

Taxation is also a potentially important issue as tax regimes have a uniquely powerful effect on the supply of self-employed labor. And in the period under question tax rates changed every year and in two cases within the year. Over the relevant period, the income taxes and social security contributions of the self-employed were stable as a share of GDP. Because the proportion of self-employed shrunk over the period, the implication is an implicit rise in the tax burden on the self-employed. So increases in taxation of the self-employed could well have been driving at least part of the movement away from self-employment in Hungary.

As noted earlier, the sensitivity of the results to how self-employment income is treated is not unique to Hungary. *Gollin (2002)* emphasizes the crucial role played by self-employment income in international analyses of income shares. *Marta Guerriero (2012)* looked at labor share in a panel of 89 countries since the 1970s and found that treatment of self-employment income had a material effect on measurements. Guerriero calculated six different measurements of labor share, each with a different approach to self-employed income. In the case of Hungary, these figures ranged from 58 percent to 76 percent.

In the United States the official BLS figures assume, as do the OECD figures for Hungary, that average wages of the self-employed and payroll employees are the same. A recent Brookings paper, however, shows that this assumption implies that the capital share of the self-employed would be negative in the 1980s. Two alternative measures (an “asset basis” measure which assumes that “returns to capital, as captured by its user cost, are the same for the capital used by the payroll-employed and that used by the self-employed”, and an “economy-wide basis” measure that “assumes that the labor share in entrepreneurial income is the same as that for the overall economy”) suggest that the BLS measure overstates the decline in labor share by one-third (*Elsby 2013:12*).

Figure 5 shows that for Hungary, the implicit capital share attributed to the self-employed by the OECD procedure appears much more reasonable than the Brookings results for the United States. In particular, Figure 5 shows the residual between total mixed income and the implicit labor compensation attributed to the self-employed, divided by mixed income. This capital share varies between 25 and 40 percent, which is a more constrained range than for the United States. Figure 5 might be seen as attenuating concerns about how the self-employed are treated in the OECD calculations, but ultimately it does not answer the fundamental challenge: we do not know with certainty how to split income for the self-employed; self-employed income has fallen markedly in Hungary; and substantial potential therefore exists for misinterpretation of aggregate income shares depending on how self-employment income is treated. As we have noted above, for many countries in the world, the various ways of handling the self-employed do not substantially affect the trend, whereas for Hungary it is crucial.

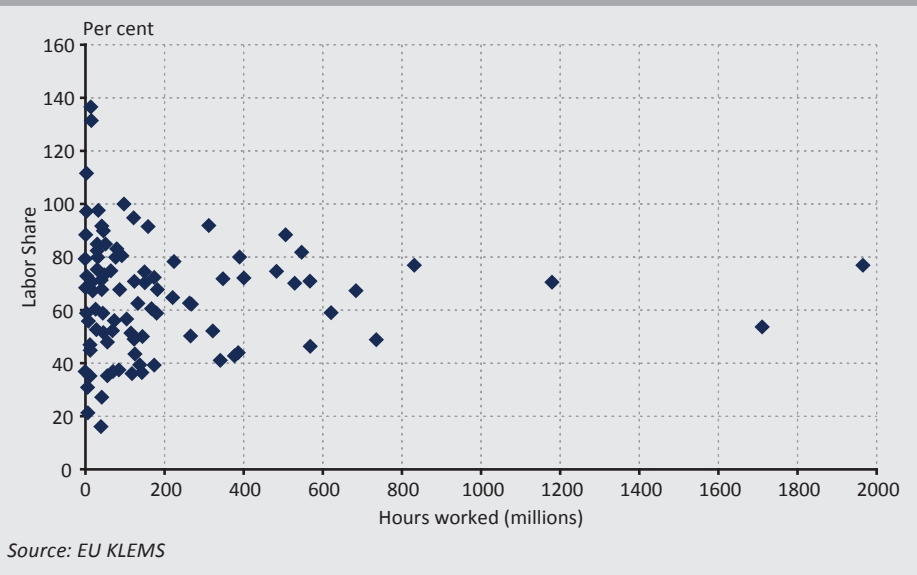
Figure 5.
Implicit Capital Income Share for Self-Employed
 (1995–2013)



Source: Statistical Office of European Communities, Haver Analytics

This concern is only underscored by examining the traditional methodology for the self-employed at the detailed sectoral level. Figure 6 shows a scatter plot of sectoral total hours worked and the attributed labor share in that sector for 2007. As the figure shows, several sectors (such as telecommunications equipment and air transport) have labor shares in excess of 100 percent, many others have labor shares close to 100 percent, and several sectors (such as real estate activities) have labor shares below 30 percent. These patterns do not seem plausible, highlighting

Figure 6.
Sectoral Labor Shares by Hours Worked
 (2007)



concerns about both the underlying data and the methodology used to construct the labor share.

The bottom line is that the treatment of self-employment income affects the level, but not necessarily the trend, in the labor share if self-employment itself were relatively stable. Indeed, in most analyses of declining labor share such as *Karabarbounis and Neiman (2014)*, the treatment of self-employment seems to affect the level of the share, but it does not noticeably impact the trend. Hungary, though, is considerably different.

3.2. Role of housing

Hungary has one of the highest rates of home ownership in the world (*Wikipedia 2015*). And the FHB housing index for Hungary (a measure of residential real estate prices developed by FHB Bank) rose by roughly a factor of four between 1999 and 2008, which for comparison is more than double the rate of increase in house prices in the overheated U.S. market during that period. However, some aspects of the Hungarian housing stock – such as expenditures as a percentage of disposable income – are below EU averages.

We lack complete data on net housing capital income in Hungary, and must therefore rely on approximations involving gross rather than net housing capital income. That is, we do not have data on the allocation of depreciation between

housing and non-housing capital, so we examine gross capital income rather than net capital income across these two components. One could potentially approximate depreciation on housing by imposing an assumption that all housing is owned by households and that households own no other fixed capital, and then proxying depreciation of the housing stock by the consumption of fixed capital by households. We prefer simply to examine gross capital shares here, however.

We separate gross capital income into two components: real estate and non-real estate. For real estate gross capital income, we subtract employee compensation from gross value added in real estate. *Figure 7* shows that, unlike for the United States and other industrialized economies, the capital share excluding real estate for Hungary appears to have risen significantly, and real estate capital income as a share of gross value added has risen modestly. This is somewhat puzzling given the relatively high rental yields on Hungarian property at the moment and the rapid rise in Hungarian property prices (*Global Property Guide 2015*). But yields in the late 1990s in Hungary were yet higher, at over 10 percent.

As another perspective on the role of housing, *Figure 8* plots real estate value added (including employee compensation) as a share of total gross value added. As it shows, this ratio has not risen markedly, providing an additional though still

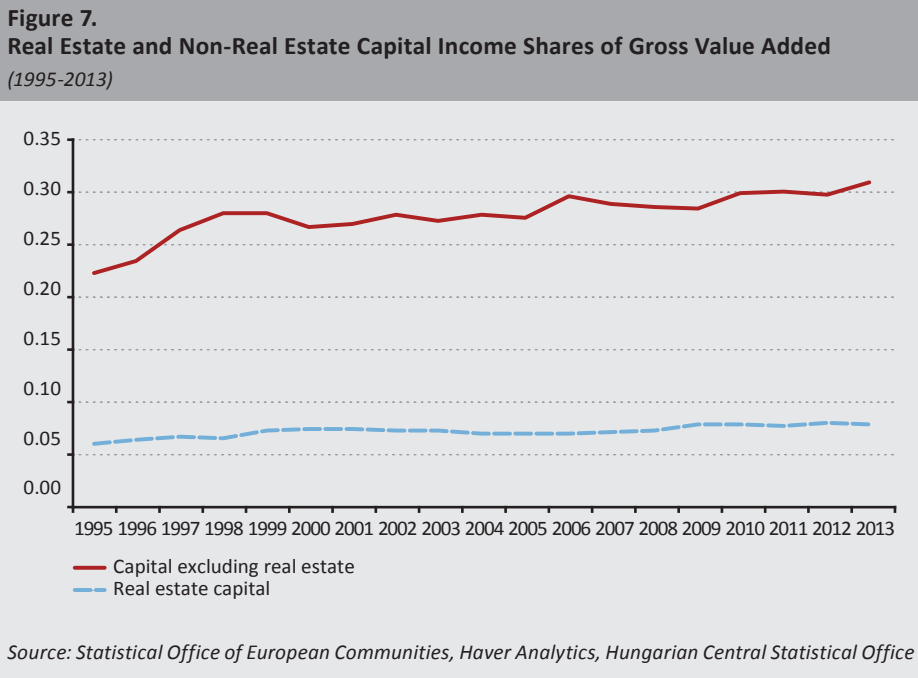
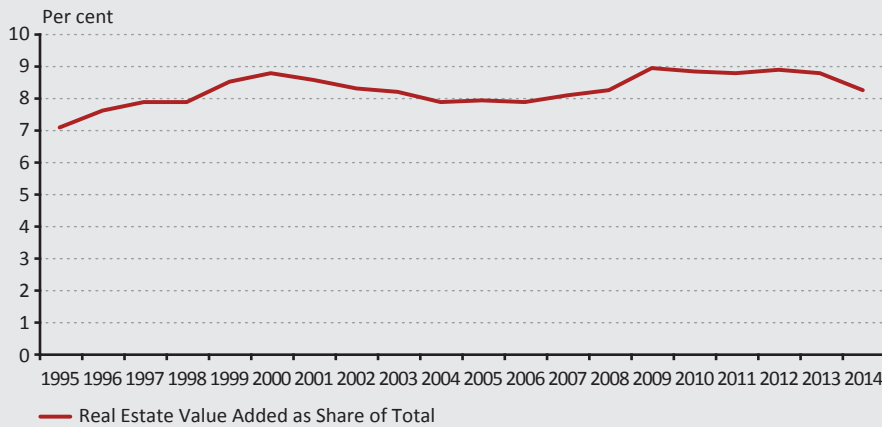


Figure 8.
Real Estate Value Added as Share of Total
 (1995–2014)



Source: Statistical Office of European Communities, Haver Analytics

imperfect check on the conclusion that housing has not played as dominant a role in income shares in Hungary as in many advanced economies, including the United States.

3.3. Trends in Labor's Share by Sector

Comparable data at the major sectoral level is unavailable for both self-employment and value added. One could proxy self-employment by using household income data by economic activity, but rather than adopting that approach, in this section we examine sectoral shifts in the ratio of employee compensation (that is, with no self-employment imputation) to value added. *Appendix Table 3* shows the share of gross value added attributable to each major sector, and *Appendix Table 4* shows trends within each sector in labor's share, measured only using employee compensation.

As *Appendix Table 3* shows, the shares of value added by sector have been relatively stable. The share attributable to agriculture has declined, from 8 percent of total value added to 4 percent, and the share attributable to professional, scientific, and technical activities has risen from 6 percent to 9 percent. These shifts mirror those of the employment shares by sector. Other than those changes, the distribution of value added across sectors has remained roughly the same since the mid-1990s.

Appendix Table 4 shows the ratio of employee compensation to gross value added by sector. This has fallen substantially in industry, from 59 percent to 46 percent, and somewhat less dramatically in construction, from 55 percent to 48 percent. It

has risen substantially in professional, scientific, and technical services, and also in information and communications and in financial insurance.

The between-sector and within-sector shifts, overall, have produced a ratio of employee compensation to gross value added that has not changed much over time. Applying the 2014 compensation ratios to 1995 value-added weights yields an aggregate share of 52 percent, for example, not that different from the observed ratio of 54 percent in 1995.

4. Conclusions

In this article, we reviewed the broader international literature about labor's share, examined trends within Hungary while assessing issues of both data quality and mixed income, and analyzed the role of changes within and across sectors of the Hungarian economy. Our conclusions are:

- (a) labor's share measured only using employees and not the self-employed has remained relatively constant over time;
- (b) labor's share including the self-employed has indeed likely declined, but sufficient concern surrounds data quality and the self-employment imputation that the quantitative extent of any such decline is unclear;
- (c) self-employment has declined markedly, both because of shifts across sectors and reductions in self-employment rates within each sector;
- (d) labor's share in industry has declined noticeably;
- (e) net capital income has risen as a share of national income; for gross capital income, the share excluding real estate has increased notably.
- (f) The dependence of results on the self-employed is problematic because of the myriad ways of classifying their labor income, the changes in tax regimes over the period as well as the deficiencies in underlying data. Other aspects of the data including details of the sectoral movements and the capital imputation raise further questions.

At the same time, any decline in labor's share in Hungary is not that remarkable when looked at in the context of other countries during the same period. Poland's decline in manufacturing labor share was more rapid for instance. Hungary's level of labor share is neither the lowest among comparable countries nor has it declined the most rapidly, even under the potentially flawed ways in which the data are measured internationally.

Factor shares remain an important topic for analysis and policy, but care is warranted in interpreting the apparent shifts in Hungarian labor share. The sensitivity of the Hungarian results to self-employment assumptions is particularly noteworthy.

References

- Benedek, D. – Lelkes, O. (2011): The Distributional Implications of Income Under-Reporting in Hungary. *Fiscal Studies*, Vol. 32, Issue 4, December 2011, pp. 539–560.
- Bradsher, K. (1995): Productivity is All, But It Doesn't Pay Well. *New York Times*, June 25, 1995.
- Bridgman, B. (2014): Is Labor's Loss Capital's Gain? Gross versus Net Labor Shares. *Bureau of Economic Analysis*, October 2014.
- Cobb, C. – Douglas, P. H. (1928): A Theory of Production. *The American Economic Review*, Vol. 18, No. 1, pp. 139-165. Supplement, Papers and Proceedings of the Fortieth Annual Meeting of the American Economic Association.
- Elsby, M. – Hobijn, B. – Sahin, A. (2013): The Decline of the U.S. Labor Share. *Brookings Papers on Economic Activity*, Vol. 47, Issue 2, Fall 2013, pp. 1-63.
- The FHB Index. <http://www.fhbindex.com>. Downloaded on April 24, 2015.
- Global Property Guide (2015): <http://www.globalpropertyguide.com/Europe/Hungary/rent-yields>. Downloaded on April 24, 2015.
- Gollin, D. (2002): Getting Income Shares Right. *Journal of Political Economy*, Vol. 110, No. 2, pp. 458-474.
- Guerrero, M. (2012): Labor Share of Income around the World: Evidence from a Panel Dataset. University of Manchester, *Institute for Development Policy and Management*, WP No. 32.
- Hárs, Á. (2012): Atipikus foglalkoztatási formák Magyarországon a kilencvenes és kétezres években. *Budapest Working Papers on the Labour Market*, BWP 2012/7; Hungarian Academy of Sciences, Budapest Corvinus University.
- Jaumotte, F. – Tytell, I. (2007): How Has the Globalization of Labor Affected the Labor Income Share in Advanced Countries? *IMF Working Paper*, WP/07/298, December 2007.
- Kaldor, N. (1961): Capital Accumulation and Economic Growth. In: Lutz, F. A. – Hague, D.C. (Eds.): *The Theory of Capital*, St. Martins Press, pp. 177-222.
- Karabarbounis, L. – Neiman, B. (2014): The Global Decline of the Labor Share. *Quarterly Journal of Economics*, Vol. 129, No. 1, pp. 61-103.

OECD (2012): Labour Losing to Capital: What Explains the Declining Labour Share? *OECD Employment Outlook*, Chapter 3, pp. 109-161.

Piketty, T. (2014): *Capital in the Twenty-First Century*. Belknap Press, 696 p.

Rognlie, M. (2015): Deciphering the fall and rise in the net capital share. *Brookings Papers on Economic Activity*, Spring 2015.

Wikipedia (2015): List of Countries by home ownership rate. https://en.wikipedia.org/wiki/List_of_countries_by_home_ownership_rate. Downloaded on April 24, 2015.

Appendix

Table 1.
Shares of Total Employment by Year
(1995–2014)

Year	Agriculture, Forestry and Fishing	Industry (ex construction)	Construction	Trade, Travel & Food Service	Information and Communication	Financial Insurance	Professional, science, technology, and administration	Public Administration, education and social work	Art, Recreation & Other Services
1995	15%	26%	5%	22%	2%	2%	3%	21%	4%
1996	15%	25%	5%	22%	2%	2%	3%	20%	4%
1997	15%	26%	5%	22%	2%	2%	3%	20%	4%
1998	14%	27%	6%	22%	2%	2%	4%	20%	4%
1999	14%	26%	6%	22%	2%	2%	4%	20%	4%
2000	12%	26%	6%	23%	2%	2%	4%	20%	4%
2001	11%	26%	6%	23%	2%	2%	5%	19%	4%
2002	11%	26%	6%	23%	2%	2%	5%	20%	4%
2003	9%	25%	7%	23%	2%	2%	5%	21%	4%
2004	9%	24%	7%	23%	2%	2%	6%	21%	4%
2005	8%	24%	7%	24%	2%	2%	6%	21%	4%
2006	8%	24%	7%	24%	2%	2%	6%	21%	4%
2007	8%	23%	7%	24%	2%	2%	6%	21%	4%
2008	7%	24%	7%	24%	2%	2%	7%	20%	4%
2009	7%	23%	7%	24%	2%	2%	7%	21%	4%
2010	7%	23%	7%	24%	2%	2%	7%	22%	4%
2011	7%	23%	7%	24%	3%	2%	7%	21%	4%
2012	7%	22%	6%	25%	3%	2%	8%	21%	4%
2013	7%	21%	6%	24%	3%	2%	9%	22%	4%
2014	7%	21%	6%	24%	3%	2%	9%	23%	4%

Source: Statistical Office of European Communities, Haver Analytics

Table 2.
Self-Employment Rates by Sector
 (1995–2014)

Year	Agriculture, Forestry and Fishing	Industry (ex construction)	Construction	Trade, Travel & Food Service	Information and Communication	Financial Insurance	Professional, science, technology, and administration	Public Administration, education and social work	Art, Recreation & Other Services
1995	61%	5%	17%	19%	4%	4%	14%	1%	27%
1996	63%	5%	18%	19%	5%	5%	18%	1%	28%
1997	64%	5%	19%	18%	5%	6%	18%	1%	27%
1998	64%	5%	19%	17%	6%	8%	19%	1%	26%
1999	65%	5%	20%	17%	6%	11%	17%	2%	28%
2000	66%	4%	20%	15%	5%	11%	15%	2%	26%
2001	64%	4%	20%	14%	5%	10%	15%	2%	28%
2002	64%	4%	19%	14%	8%	12%	16%	1%	25%
2003	61%	4%	18%	14%	8%	13%	17%	1%	26%
2004	61%	4%	18%	14%	7%	13%	15%	2%	27%
2005	60%	4%	16%	12%	10%	14%	13%	2%	25%
2006	60%	4%	16%	12%	8%	13%	12%	2%	23%
2007	58%	3%	17%	11%	7%	13%	11%	1%	24%
2008	58%	3%	15%	11%	7%	14%	13%	2%	22%
2009	57%	3%	15%	11%	7%	15%	11%	2%	26%
2010	57%	3%	16%	10%	7%	15%	9%	2%	24%
2011	56%	3%	17%	10%	7%	16%	8%	2%	24%
2012	58%	3%	16%	10%	6%	16%	7%	2%	24%
2013	59%	3%	12%	8%	6%	15%	9%	1%	20%
2014	59%	2%	12%	8%	7%	15%	8%	1%	20%

Source: Statistical Office of European Communities, Haver Analytics

Table 3.
Shares of Total Value Added by Sector
(1995–2014)

Year	Agriculture, Forestry and Fishing	Industry (ex construction)	Construction	Wholesale and retail trade, Transport, Accommodation & Food	Information and communication	Financial Insurance activities	Professional, scientific and tech activities	Public admin, education, social work	Arts, entertainment & recreation; other service activities	Real Estate
1995	8%	25%	5%	18%	3%	4%	6%	19%	4%	7%
1996	8%	25%	5%	17%	4%	5%	6%	18%	4%	8%
1997	7%	27%	5%	18%	4%	4%	6%	17%	3%	8%
1998	7%	28%	5%	18%	5%	4%	6%	17%	3%	8%
1999	6%	27%	5%	17%	5%	3%	7%	17%	3%	8%
2000	6%	27%	5%	18%	5%	4%	7%	17%	3%	9%
2001	6%	26%	5%	18%	5%	4%	7%	17%	3%	9%
2002	5%	25%	6%	18%	5%	4%	8%	18%	3%	8%
2003	5%	25%	5%	17%	5%	4%	8%	19%	3%	8%
2004	5%	26%	5%	17%	5%	4%	8%	19%	3%	8%
2005	4%	26%	5%	17%	5%	5%	8%	19%	3%	8%
2006	4%	26%	5%	18%	5%	5%	8%	18%	3%	8%
2007	4%	26%	5%	19%	5%	4%	8%	18%	3%	8%
2008	4%	25%	5%	19%	5%	4%	8%	18%	3%	8%
2009	4%	25%	5%	18%	6%	5%	9%	18%	3%	9%
2010	4%	26%	4%	18%	5%	5%	9%	18%	3%	9%
2011	5%	26%	4%	18%	5%	5%	9%	17%	3%	9%
2012	5%	27%	4%	18%	5%	4%	9%	17%	3%	9%
2013	4%	26%	4%	19%	5%	4%	9%	17%	3%	9%
2014	4%	26%	4%	18%	5%	4%	9%	18%	3%	8%

Source: Statistical Office of European Communities, Haver Analytics

Table 4.
Employee Compensation as Share of Gross Value Added by Sector
 (1995-2014)

Year	Agriculture, Forestry and Fishing	Industry (ex construction)	Construction	Wholesale and retail trade, Transport, Accommodation & Food	Information and communication	Financial Insurance activities	Professional, scientific and tech activities	Public admin, education, social work	Arts, entertainment & recreation; other service activities	Real Estate
1995	28%	59%	55%	60%	45%	47%	50%	69%	57%	16%
1996	26%	58%	55%	62%	39%	41%	49%	68%	59%	16%
1997	29%	53%	47%	61%	40%	52%	49%	69%	56%	15%
1998	28%	50%	49%	60%	36%	52%	52%	70%	61%	17%
1999	28%	50%	44%	60%	34%	60%	47%	70%	54%	14%
2000	29%	53%	46%	62%	41%	51%	49%	71%	54%	15%
2001	29%	52%	44%	60%	48%	50%	47%	73%	53%	14%
2002	31%	52%	41%	59%	43%	48%	44%	76%	57%	13%
2003	30%	50%	45%	63%	42%	46%	49%	78%	60%	12%
2004	25%	49%	47%	66%	41%	46%	52%	78%	64%	12%
2005	28%	48%	48%	65%	43%	44%	55%	78%	61%	12%
2006	28%	46%	52%	63%	42%	46%	52%	78%	62%	12%
2007	29%	48%	54%	63%	44%	54%	57%	77%	62%	13%
2008	29%	49%	51%	63%	43%	57%	55%	76%	58%	13%
2009	33%	48%	52%	67%	44%	51%	56%	74%	60%	12%
2010	32%	46%	55%	66%	45%	51%	58%	73%	59%	12%
2011	26%	47%	56%	65%	46%	48%	58%	72%	60%	12%
2012	29%	47%	59%	66%	47%	52%	60%	71%	60%	11%
2013	30%	47%	54%	62%	48%	57%	58%	72%	58%	10%
2014	29%	46%	48%	61%	53%	55%	60%	73%	56%	11%

Source: Statistical Office of European Communities, Haver Analytics

Show me how you pay and I will tell you who you are – Socio-demographic determinants of payment habits

Tamás Ilyés – Lóránt Varga

This study is intended to assist in understanding the current payment habits of Hungarian households and examine the extent to which these habits are affected by age, education, activity, income or residence. Our research analysed a representative household survey with a sample of 1,000 respondents using various statistical tools. The percentage of households holding bank accounts and bank cards is high and has not changed since 2010, while households' use of cash has moderately declined in recent years. The socio-demographic variables under review have a limited impact on the use of cash-based payment methods. Accordingly, in terms of both number and value, a similar proportion of households pay their bills via postal cash payments, irrespective of age and income. The preference for the use of electronic payment methods is largely driven by education level. While the use of electronic payment methods generally increases in line with income, cash usage is still strongly over-represented among one fourth of households with higher-than-average income levels. Age, activity and residence also exert a significant impact on the adoption of electronic payment methods, but the payment habits of users of different electronic payment instruments do not generally show differences on the basis of these features.

Journal of Economic Literature (JEL) Classification: C38, D12, D14, E42

Keywords: retail payments, payment habits, household behaviour, electronic payment methods, financial integration

1. Introduction

International and Hungarian literature have unanimously found that the increased use of electronic payment methods benefits the functioning of the economy. In particular, it supports economic growth and may save significant social costs (*Turján et al. 2011*). It is far less clear, however, what it is that determines the rate at which electronic payment methods are used in an economy and hence, it is difficult

Tamás Ilyés is an analyst at the Magyar Nemzeti Bank. E-mail: ilyest@mnbb.hu.

Lóránt Varga is head of department at the Magyar Nemzeti Bank. E-mail: vargalor@mnbb.hu.

The authors wish to thank Kristóf Takács for his help in formulating the questionnaire used for the purposes of this research and interpreting the results, and Eszter Király for her help in processing the responses.

to decide how to encourage the use of non-cash payment methods. The latter question is particularly pressing in the case of households, given that this sector is typically characterised by a high rate of cash usage. Therefore, in order to identify possible policy measures for improving the efficiency of payment transactions, it is important to grasp and properly understand households' payment habits and their determinants. This study is meant to contribute to shedding light on and gaining an insight into this topic.

In laying the groundwork for our research, we conducted a broad-based representative survey among Hungarian households. The detailed analysis of the survey results in this article is intended to answer the following questions: To what extent do Hungarian households use electronic payment methods? What are the characteristics of households with no bank accounts or bank cards? How does the use of certain payment methods correlate to specific socio-demographic features of households? How do these factors influence the choice of a specific payment method in a payment situation? How can we divide Hungarian households into segments based on payment habits?

In recent years, a number of analyses and surveys in Hungary have focused on the payment habits of households. The most recent studies reflect data pertaining to 2011–2012 (*Takács 2011; Turján et al. 2011; Divéki–Listár 2012*); however, several significant changes have since been adopted in regulations affecting payment transactions and the costs of payment services (for instance, the introduction of the financial transaction duty and the option of free cash withdrawal twice a month). Moreover, numerous news items have been published in the media recently envisaging a possible change in households' payments habits based on certain shifts in the data of official payment statistics¹ (for example, changes in the number of bank accounts or payment cards). However, official payment statistics do not necessarily provide a suitable basis for drawing such conclusions. For example, they do not contain data about whether the cancellation of certain bank accounts affected the primary payment accounts of the household concerned (in which case the cancellation eliminated the household's access to electronic payment transactions altogether), or the decline in the number of bank accounts mostly affected special or supplementary accounts that had been scarcely – or never – used for the execution of payment transactions. The results of our survey, by comparing them to similar data collections from the past, enable us to answer these questions as well. Consequently, our analysis may offer some conclusions about how households' payment habits have changed – if at all – since the adoption of the new regulations.

¹ <http://www.mnb.hu/Statisztika/statisztikai-adatok-informaciok/adatok-idosorok/xiii-penzforgalmi-adatok/penzforgalmi-adatok/penzforgalmi-tablakeszlet>

Our article is structured as follows: In the second chapter we present the survey underlying the research. In the third chapter we describe the current payment habits of Hungarian households, while the fourth chapter is dedicated to a detailed analysis of the motives behind the observed payment habits, and the socio-demographic reasons and other correlations identified. At the end of the article we sum up the most important findings of our research.

2. Research methodology

This analysis is based on data gained from an anonymous questionnaire-based survey covering a sample of 1,000 persons. The questionnaire-based survey on payment habits is a generally accepted methodology in the international literature. Several recent publications rely on questionnaire-based surveys to analyse payment habits (*Crujisen–Plooij 2015; Goczek–Witkowski 2015*).

The Magyar Nemzeti Bank (MNB) conducted its own questionnaire-based survey in the summer of 2014. The survey covers ages above 18 of the Hungarian population, including representative samples by gender, age group, region, settlement type and education. The questionnaire was designed to gather both quantitative and qualitative information. Each questionnaire provides data on the basic socio-demographic characteristics of respondents (age, education, labour market status, income, residence), their access to the electronic payment infrastructure (number of bank accounts and payment cards), number and value of daily and monthly payment transactions by main transaction type (cash withdrawal, cash payment, card payment, credit transfer, direct debit, bill payment with postal cheques (yellow and white cheques),² payment with vouchers and other instruments). Where appropriate, respondents were also asked about the reasons for not having a bank account or payment card.

The number and value of payment transactions are based on self-assessment; however, we verified the reliability of monthly transaction data – the core information serving as a basis for our analysis – with various methods. We compared the aggregate monthly transaction data of the questionnaire to the comprehensive, national payment data collected by the MNB on the one hand, and, on the other hand, to the transaction data of the respondents on the specific day (i.e. the day on which the questionnaire was completed). Same-day data are also based on self-assessment; yet, we can assume that respondents recalled the number and value of the payment transactions they performed on the day of the questionnaire with a reasonable degree of certainty. The deviations in numbers or proportions

² For the sake of simplicity, in this study the two most frequently used cash- and paper-based postal bill payment instruments – postal inpayment money orders (commonly known in Hungary as “yellow cheques”) and postal deposit payment orders (commonly known in Hungary as “white cheques”) – are both referred to as postal cheques.

identified on the basis of the comparisons were not significant; thus we may agree with the assumption that the monthly payment transaction data reported by the respondents are sufficiently accurate.

In order to obtain answers to the research questions listed in the introduction, we examined monthly payment transaction data in various breakdowns (aggregated, broken down by groups derived from socio-demographic characteristics, based on indicators measuring the choices between different payment methods) and using different statistical methods (comparison of group means, estimation of linear regressions and cluster analysis).

3. Descriptive statistics of household payment habits

First, by presenting the consolidated data from the replies to the questionnaire, we provide a view of the general payment habits of the entire sector of Hungarian households. Comparing this information to the similar results of previous studies we can also determine whether the payment habits of households have changed in recent years, and more specifically, since the adoption of new regulations affecting payment transactions and the pricing of payment services, such as the introduction of the payment transaction duty in 2013 or the bimonthly free cash withdrawals in 2014.

According to our survey, 75.7% of Hungarian adults hold at least one bank account, and 71.7% of the adult population own at least one payment card. The percentage of those having a bank account without owning a payment card is 4.3%, while the proportion of cardholders without a bank account (e.g. owners of partner cards linked to another person's bank account) is negligible (0.3%). The percentage of respondents having more than one bank accounts or payment cards is 5% and 40%, respectively. The percentage of bank account and payment card ownership is even higher at the level of households. 82.7% of Hungarian households have at least one bank account, and 80.1% of them own at least one payment card. The ratio of households with a bank account, but no payment card is also lower, at 2.9%.

These ratios have not changed compared to the results of previous survey results. Calculated for the corresponding age groups, for instance, households' access to the electronic payment infrastructures has not changed at all since 2010 compared to data shown in *Takács (2011)*.³ This suggests that the negligible decline⁴ observed in the number of household bank accounts and payment cards in recent years is primarily linked to the elimination of some of the presumably less frequently

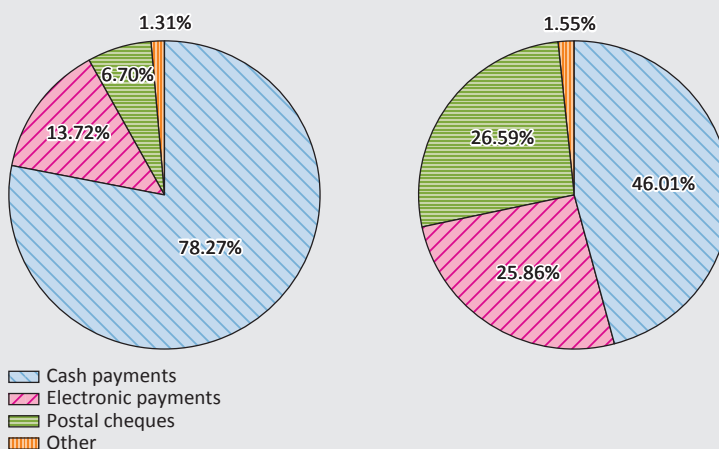
³ Although the age distribution of the survey used by *Takács (2011)* is somewhat different from our sample, practically the same bank account coverage of 90% can be calculated from both samples for ages 18–60.

⁴ <http://www.mnb.hu/Statiztika/statiztikai-adatok-informaciok/adatok-idosorok/xiii-penzforgalmi-adatok/penzforgalmi-adatok/penzforgalmi-tablakeszlet>

used second or third accounts and cards, i.e. the rationalisation of household bank relationships, and as such, it is not detrimental to the electronic payment options of Hungarian households.

Respondents without a bank account or a payment card were also asked about the subjective reasons for not having such instruments. The distribution of the answers was nearly identical in both cases. Of the reasons cited, one stood out: nearly 90% of residents without a bank account or payment card did not think these instruments were necessary. A smaller, but still relatively high percentage of respondents – 25% in relation to bank accounts and 19% in relation to payment cards – explained their reasons with the high maintenance costs. On a positive note, only a relatively small number of respondents indicated a lack of confidence in banks (10–11%) or perceived security risks (3–4%) as a reason. Although due to the different methodologies applied these values are not fully comparable with those of *Divéki–Listár (2012)*, the distribution of the responses is extremely close. Costs and a lack of need for bank accounts or payment cards were cited by slightly more respondents compared to 2012, while the lack of confidence in banks was mentioned slightly less often.

Figure 1.
Distribution of household payment transactions by payment method



Source: MNB Survey 2014 edited

In summarising the responses to the questions pertaining to monthly payment transactions, we identified four payment categories: cash, electronic payment, payment by postal cheques, and other payment methods (*Figure 1*). Among electronic payment methods, we took into account card payments (debit and credit cards), credit transfers and direct debits, while the category of “other” included

payments by pre-paid vouchers (SZÉP card, Erzsébet voucher, etc.) and loyalty cards, where the points earned go towards future purchases.

The data reveal that, based on the number of households' monthly payment transactions, cash payment accounts for a significant part of the transactions: 78% of the respondents chose this option, compared to 14% opting for electronic payment methods. The share of payments by postal cheque is nearly 7%. As regards the value of payment transactions, however, the preference for cash is far less pronounced: 46% of households' payments were executed in cash, while electronic payment methods and postal cheques represented 26% and 27%, respectively. Since postal payment methods always involved cash at the time of the survey, we can conclude overall that cash-based payments account for 85% of the total monthly payment transactions of Hungarian households by number, and 73% in terms of value. Comparison of the distribution of transaction numbers and values reveals that Hungarian households use cash payments more often than any other payment method; at the same time, they tend to pay smaller amounts in cash on average. By contrast, they initiate electronic transactions (or use postal cheques) less frequently, but these transactions involve larger amounts on average.

Table 1.

Statistics of the monthly payment transactions of households

	Proportion of users	Average number/month	Average value/month (Ft)	Average value/transaction (Ft)
Cash withdrawal (conf. int. 95%)	0.81 (0.78 – 0.84)	1.6 (1.5 – 1.7)	67 365 (63 687 – 71 043)	50 001 (46 632 – 53 369)
Cash payment (conf. int. 95%)	0.99 (0.98 – 0.99)	27.2 (25.8 – 28.5)	50 375 (47 136 – 53 615)	2 457 (2 264 – 2 651)
Debit and credit card payment (conf. int. 95%)	0.58 (0.55 – 0.61)	8.3 (7.5 – 9)	34 947 (32 036 – 37 858)	6 223 (5 494 – 6 952)
Credit transfer (conf. int. 95%)	0.24 (0.22 – 0.27)	2.6 (2.3 – 3)	33 083 (29 111 – 37 055)	17 700 (14 777 – 20 622)
Direct debit (conf. int. 95%)	0.27 (0.24 – 0.3)	3.1 (2.8 – 3.4)	38 207 (33 575 – 42 838)	16 131 (12 658 – 19 605)
Postal cheques (conf. int. 95%)	0.69 (0.66 – 0.72)	3.1 (3 – 3.2)	38 451 (36 274 – 40 628)	14 249 (13 229 – 15 268)

Source: MNB Survey 2014 edited

We compared the data above with the results of *Takács (2011)*. We found that the distribution of payment methods by number and value has not changed significantly since 2010, but a slight decline can be observed in cash usage. This is extremely

apparent in the case of payment values: since 2010, the ratio of cash usage has dropped to 46% from 50%. By number, electronic payments rose from 12% to 14%, while based on the amounts paid, they increased to 26% from 20%. Meanwhile, the gap between the number and value of cash payments widened further; in other words, the average value of a single cash transaction continued to decline. These shifts indicate that the payment habits of households did not change substantially in response to the adoption of the regulations affecting payments and the pricing of payment services after 2010, and the proportion of cash-based payments did not increase. This reconfirms the analysis performed by *Ilyés et al. (2014)* on the 2013 data.

Looking at the average characteristics of households' individual payment transactions in more detail, we find that practically all households (99% of users) use cash payments (*Table 1*). In this context, a high percentage of the adult population used cash withdrawals, but at around 80%, their share is far lower than that of those paying in cash. Incomes received in cash may account for some of this difference, while another part of it may be attributed to cash withdrawals by a family member other than the respondent. A relatively high ratio, 70% of the adult population, pay with postal cheques on a regular basis. Of all electronic payment options, card purchases are the most frequently used form of payment; nearly 60% of cardholders regularly make payments with their payment cards. By comparison, the share of credit transfer (24%) and direct debit (27%) in electronic payments is far lower.

In addition to the usage ratio, *Table 1* also indicates the average number of transactions initiated by the users of individual payment transactions, as well as the average monthly amount paid by using the specific payment method, and the average value of individual transactions.⁵ It is clear that the average monthly number of cash payments far exceeds the average monthly number of any other payment methods, while cash payments involve the smallest average value in a single transaction. This is followed by card payments: households pay with cards 8 times per month on average, in the average amount of slightly more than HUF 6,000 per transaction. Households pay via credit transfer, direct debit and postal cheques less often, but these transactions involve higher average values.

4. Socio-demographic factors influencing payment habits

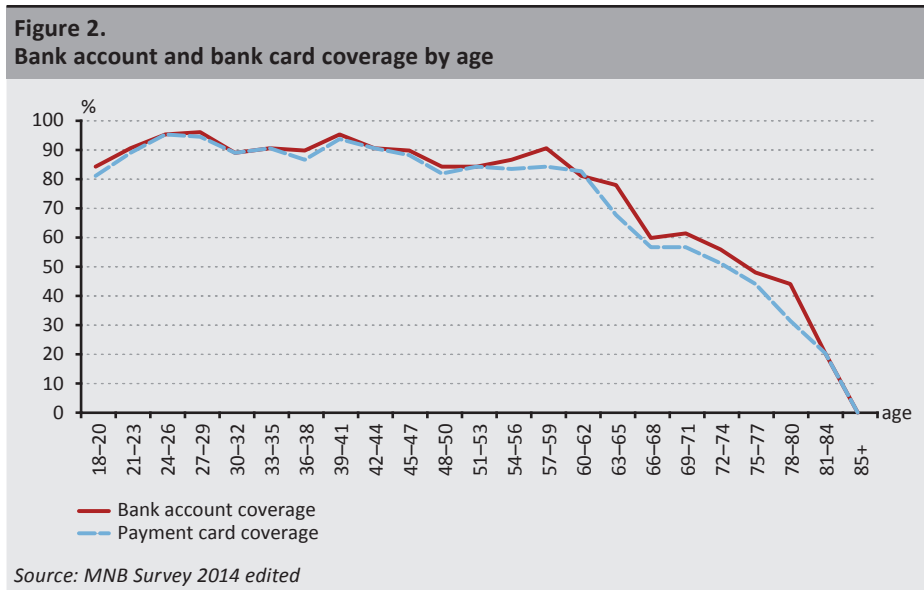
In this chapter we classify households into groups on the basis of various aspects, in particular the socio-demographic characteristics surveyed in the questionnaire. We then proceed to examine the differences observed – and verified by statistical methods – in the monthly payment transactions of individual groups to draw

⁵ The latter value does not necessarily equal the quotient of the monthly average transaction value and the monthly average transaction number shown in the table, because our calculation of the average value per transaction reflect only those responses where respondents provided data both for the number and for the value of the transactions made via the specific payment method.

conclusions about the factors influencing the payment habits of households and their impact. First of all, we examine access to the electronic payment infrastructure; in other words, the reasons for having a bank account or a payment card. We analyse the factors influencing the use of individual payment methods, with special regard to electronic payment transactions. We also examine the rationale behind the selection of a particular payment method in specific payment situations, and explore whether households can be divided into segments based on their payment habits and the characteristics of their transactions.

4.1. Access to the electronic payment infrastructure

For the purposes of the further analyses, we divide households into groups based on five socio-demographic characteristics. These characteristics are the following: age, education, labour market status, per capita monthly household income, and residence. First, we examine bank account and payment card ownership within each group. In this context, our goal was to determine whether the household had at least one bank account or bank card; the exact number of the accounts and cards was irrelevant, since a household can be connected to the electronic flow of payments with a single account and a single card.

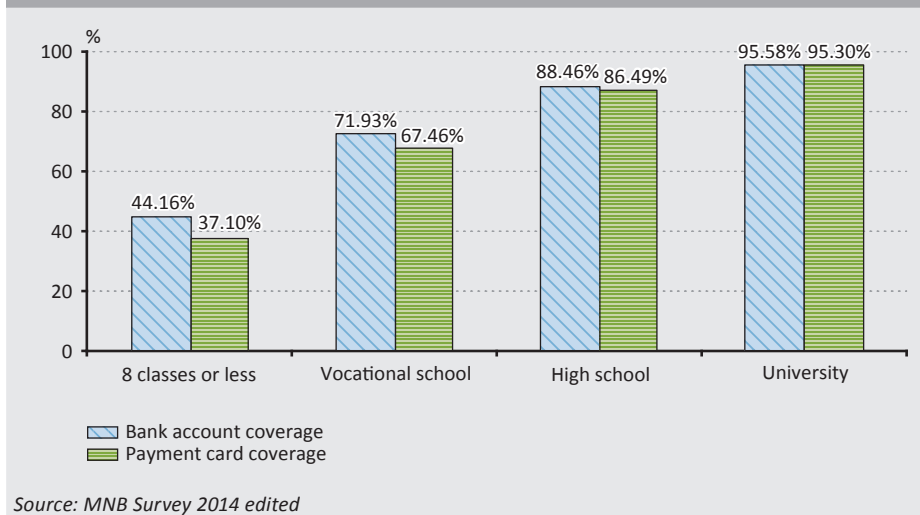


It is clear that account and card ownership is closely correlated with age. Coverage ratios are extremely high, around 90%, until age 50 in all age categories; they are slightly lower between the ages of 50 and 60, fluctuating between 80% and 90%, while a steep decline is observed above age 60 (Figure 2). It is also evident that the

ratio of bank account and payment card ownership move together closely below age 55, whereas payment card coverage lags behind bank account coverage in the higher age categories. Consequently, bank account holders who do not own a card are typically older than 55. In relation to the latter segment we can also establish that respondents tend to withdraw the income credited to their accounts practically in full, while this ratio is below 50% among those who have both a bank account and a card. This means that members of this segment hold an account for the sole purpose of receiving their income and exchanging it into cash, practically without performing any electronic payment transactions.

Since there is a discernible causal relationship between age and bank account and payment card ownership, we can assume that the bank account and the payment card coverage of higher age groups may increase in line with the gradual ageing of currently active age groups with higher penetration. Assuming that the currently employed account holders and cardholders will keep and use their accounts and cards above age 60 as well, while the coverage of new, young age groups will remain equally high, the penetration of the household sector will increase over time. According to our estimate prepared on the basis of the population statistics released by the CSO, as a result of this process and assuming that no other factor will change Hungarian households' willingness to own a bank account and a payment card, the ratio of bank account coverage to the total population may reach 80% by 2030 and 82% by 2040, compared to the current ratio of 76%.

Figure 3.
Bank account and payment card coverage by education level



Whether a person has a bank account or a payment card is strongly influenced by the person's level of education as well: we measured higher and higher levels of average coverage among those with higher education levels (*Figure 3*). As regards access to the electronic payment infrastructure, the marginalisation of the segment with primary school education or less is extremely significant, and even those with vocational education fall behind the national averages of 76% and 72%. These two groups include a relatively high number of respondents who have a bank account, but do not own a card. As we mentioned above, this segment is hard to involve in electronic payments, despite the existence of a bank account. Among respondents with high school education the ratios exceeded the national average by 10 percentage points, while those with university degrees exhibit nearly full coverage. Indeed, practically everyone in the latter group who has a bank account also has a payment card.

We also calculated the ratio of bank account and bank card ownership according to labour market status, per capita monthly household income and residence. The results are shown in the figures of Point 1 of the Annex. The ratio of account and card ownership in higher per capita income groups is unmistakably higher; in other words, access to the electronic payment infrastructure improves in line with the increase in income. While this result was highly predictable, it is noteworthy that the level of the positive correlation is not extremely high. Although coverage is particularly high (nearly 90% or above) in the per capita income categories above HUF 100,000, the ratio of bank account and bank card ownership is only slightly below the estimated national average even in the lowest per capita income category (below HUF 50,000). It is also evident that the coverage of respondents living in settlements is clearly lower than that of their urban peers, with the highest values measured in Budapest and at county seats. With respect to labour market status, as expected, active employees have the highest coverage. While it is a positive result that the average of students slightly exceeds the national average, the values of pensioners and the unemployed are far worse than that. The ratio of account and card ownership barely reaches 50% in the latter groups. Based on the results, besides the group of persons with the lowest education level, pensioners living in settlements are overrepresented among those who have a bank account, but do not own a card.

These results, however, are likely to be interrelated, or attributable to the same reasons. For example, the effect of age and education may conceal the indirect effect of income (the average income of pensioners is lower than that of the active age groups, and higher education levels are associated with higher average incomes), or vice versa. Similarly, differences by labour market status are clearly related to the differences observed in relation to age or education, while age may also play a role in the effect of residence (the average age of settlement dwellers

is higher), and so on. In order to identify the most influential factors of those examined on bank account and payment card coverage and the exact magnitude of the effects, we estimated logistic regressions. The value of the dependent variable of the regressions is 1 or 0 depending on whether the respondent has a bank account or a bank card or not. The explanatory variables of the regressions are the dummy variables of the categories defined according to per capita net monthly income, age, education, labour market status and residence. We also set up groups based on the age of respondents because, as *Figure 2* demonstrates, the relationship between age and coverage is not linear: in fact, there is an apparent break in the highest age groups, which can be best captured by a dummy variable.

Table 2.		
Estimated coefficients of the regressions explaining bank account and payment card coverage		
	Bank account	Payment card
Age (18-29)		
(30-39)	0.57	0.78
(40-49)	0.51	0.72
(50-59)	0.67	0.66
(60-)	0.30*	0.25*
Per capita income (in 10 thousand HUF)	1.04*	1.05
School qualification (8 elementary classes or less)		
Vocational school	2.02*	2.12*
High school	5.00*	5.60*
University	12.05*	14.04*
Labour market activity (Employee)		
Pensioner	0.51	0.50
Unemployed	0.28*	0.31*
Student	0.55	4.14
Other	0.53*	0.71
Type of settlement (Capital)		
County towns	0.72	1.10
Other towns	0.52*	0.84
Villages	0.49*	0.60
Constant	4.01*	4.14*
N	982	982
R ²	0.2069	0.2433
AUC	0.8017	0.8315
* Significant odds ratios with a 95% confidence interval		
Source: MNB Survey 2014 edited		

According to the results of the regression estimate, similar reasons as those seen above account for the difference in coverage observed between bank accounts and payment cards, given the negligible number of respondents who own only one of these two instruments. In the logistic regression the estimated odds ratio parameters quantify how strongly the presence of the given property increases – in the case of a multiplier above 1 – or reduces the odds ratio of card or account ownership compared to the benchmark group.⁶ Based on the estimated coefficients of the logistic regression, each of the main variable groups has a significant impact on coverage and has an additional explanatory power besides covariance (*Table 2*). The group of pensioners has significantly less coverage compared to the other age groups, while according to labour market status, the category of the unemployed shows significantly lower values. Based on settlement type, the ratio of bank account owners is far lower among respondents residing in other towns and settlements than among their peers living in Budapest, at county seats and in towns with county rank. The latter result may suggest that access to the payment infrastructure may also depend on the quality of the financial infrastructure located at the place of residence (e.g. number and accessibility of branches, number of merchants with POS terminals). Although we are unable to clearly determine the direction of the causal relationship from these results, this assumption is supported by the fact that smaller settlements have a demonstrably negative impact on bank account coverage, even beyond the effects of income, age, education and labour market status. Having said that, education level has the strongest explanatory power: even a high school diploma improves the odds ratio of coverage significantly, while the effect of a degree is exceptionally strong.

4.2. Use of payment methods

The next step is to examine the payment transactions of households to identify the effect of the aforementioned socio-demographic characteristics on the use of specific payment methods. To that end, based on the data from the questionnaire-based survey, we calculated the average usage ratio of six different payment transaction types, and the average monthly number and value of the transactions executed by the users of the given transaction type, calculated separately for 23 groups into which respondents were classified based on age, education, labour market status, per capita net monthly income and residence. The six payment transaction types comprise cash withdrawals from the account holder's bank account on the one hand, and the following five payment methods: cash payment, card payment, credit transfer, direct debit and payment by postal cheque.

⁶ As regards the bank account coverage, the odds ratio is 0.8:1 for those with a primary school education compared to 21.6:1 for graduates, as the ratio of bank account owners in these two groups is 44.16 per cent and 95.58 per cent, respectively. Thus, without the exclusion of other variables, the effect would be 27-fold between these two education levels, while, filtering the effect for the cross-correlation based on the regression, yields a result of 12.05.

The result of our calculations is shown in the tables included in Point 2 of the Annex. Under each value presented in the tables we indicated the confidence interval associated with the given estimated average, which is helpful in determining whether there is a statistically significant difference between the mean of a group and the mean of another group. For the sake of clarity, the means highlighted in bold in the individual rows of the tables mark the means, the deviation of which from another mean or more means in the same row holds the greatest significance for the purposes of our analysis.

Based on the results pertaining to the effect of *age*, we found that members of the youngest age group (ages 18–29) tend to withdraw cash in smaller amounts than the rest of the age groups; however, the value of their cash purchases is not demonstrably different from the values of other age groups. Members of this age group use their cards for purchases in the same proportions (60–70%) as any other age groups, but respondents in this group tend to use their bank cards less frequently (5–8 times a month) and spend less money compared to the other groups, which might be indicative of their smaller disposable income. They are less inclined to use direct debit: only 10–20% of the age group used direct debit, compared to approximately 30% recorded for the other groups. Only about 40% of the age group above 60 use payment cards for purchases, which is below the average. Those using payment cards tend to use them somewhat less frequently, but the value of their purchases does not significantly deviate from the average. In this age group, the ratio of respondents using credit transfer is below the average, amounting to merely 10–20% of account holders, compared to the average values of 20–30%. It is an interesting development that, while up until ages 40–49 respondents pay via postal cheques in larger and larger ratios, above this age the usage ratio does not increase demonstrably, and average monthly transaction numbers and values show no difference between the age groups. By contrast, older generations pay by direct debit in similar proportions as the rest of the age groups (except the youngest group, which lags behind in this regard), and the transactions performed correspond both in number and value. It is another important result that the statistics of cash payments show no difference whatsoever among the different age groups.

Although the average number of monthly cash withdrawals increases somewhat in line with *education levels*, the value of the transactions remains the same, and there is also no difference between the monthly values of cash purchases either. That notwithstanding, higher education levels have a clearly positive effect on the use of electronic payment methods. As regards card purchases and direct debit transactions, both the usage ratio and the average monthly transaction number and value show a high correlation with education levels, while in the case of credit transfers the usage ratio and the monthly number of transactions

increase significantly in accordance with higher education levels. While only 30% of the respondents with primary school education use their cards for purchases on 2–3 occasions per month on average, at a value of around HUF 20,000, the corresponding values for those with a high school degree are close to 70%, 7–8 occasions and HUF 33,000, and for those with a university degree are 80%, 10–15 occasions and nearly HUF 50,000. As the education level increases, the percentage of those paying via postal cheques declines continuously. Nevertheless, nearly one half of those with a university degree use this payment method, and the average monthly amount paid by the users does not differ significantly on the basis of education level.

As regards *labour market status*, the average monthly value of cash withdrawals and cash purchases by the unemployed and students is lower than that of active workers and pensioners (the values of the latter two do not differ from each other). Presumably, this is not mainly indicative of the lower ratio of cash usage in these groups, but rather reflects their lower level of disposable income. Average bank card usage ratios are clearly more favourable for active workers than for the other groups (a usage ratio of 70% and 8–10 purchases per month at a value of HUF 40,000). The same is true for the ratio of those paying via credit transfer and direct debit (both 30%). As regards average monthly values, pensioners use credit transfers about as intensively as active workers (more than HUF 30,000) and, in line with our previous results, the group of account holder pensioners does not lag behind in respect of the usage ratio of direct debit either. It is noteworthy that students practically do not use direct debit at all. This may be related to the fact that this group does not typically pay regular monthly bills, as reflected by their very low use of postal cheques (12%) compared to the other groups.

Looking at the groups defined based on *per capita net monthly income*, the differences found resemble those seen in relation to education level. In this case, the monthly value of both cash withdrawals and cash purchases increases in line with income, which is a predictable result. The increase in income correlates positively with card use: both the usage ratio and the number and value of monthly payments are higher in the group of higher-income respondents. While 40–50% of those belonging to groups where per capita net monthly income is less than HUF 100,000 (these groups have the highest number of elements) use their bank cards for purchases on 6 occasions per month on average, at a value ranging between HUF 15,000 and HUF 25,000, the corresponding values in the groups with per capita net monthly income above HUF 150,000 are 70–85%, 10–16 occasions and HUF 50,000–65,000, respectively. The percentage of respondents paying with credit transfer, the value of credit transfers, and the percentage of those using direct debit all increase with higher income levels. Among those using direct debit and postal cheques, however, only respondents in the highest income category paid higher-

than-average monthly amounts. It is also interesting that the statistics of postal cheque payments do not increase with income either in respect of user ratios or number of monthly payments.

In examining the payment statistics of groups created on the basis of *residence*, we only found a number of values significantly different from the average among residents living in Budapest. However, according to these values, Budapest residents use both cash-related and electronic transactions more intensively than the national average. The capital city has the highest percentage of residents withdrawing cash (90%), the highest average number of monthly cash purchases (34), and the highest average monthly value paid via postal cheque (HUF 46,000). In addition, the ratio of respondents making purchases with payment cards (73%), the average number of monthly card purchases (10) and the average monthly number (4) and value (HUF 52,000) of direct debit are also extremely high in Budapest. Regarding the rest of the values, there is no perceivable difference between the settlement types under review.

Based on the results described above, we found overall that the socio-demographic factors under review have a limited impact on cash-related payment transactions, i.e. cash withdrawals, cash purchases and the use of postal cheque payments, and a stronger impact on the use of electronic payment methods. Practically everyone pays with cash; thus the ratio of respondents using cash withdrawals is relatively stable in the groups under review, and the average monthly value of cash withdrawals and cash purchases only increases in line with an increase in income. The rest of the socio-demographic characteristics have no significant impact on the average monthly value of cash payments, which remains stable at around HUF 50,000 in the vast majority of the groups reviewed. The average number and value of postal cheque payments are even more stable at 3 monthly transactions and a value of HUF 35,000–45,000, irrespective of any increases in income.

By contrast, the diversity of the statistics measuring the intensity of the use of electronic payment methods is far more significant as a function of the socio-demographic characteristics under review: the difference between the means of the lowest and highest groups, in many cases, is three or four-fold. Education and per capita net monthly income have the largest degree of positive impact on the use of payment card purchases, credit transfers, and direct debit. Based on labour market status, clear deviations can be observed primarily to the benefit of active workers. By contrast, age and residence appear to have a smaller impact, restricted to certain areas or groups at most. Ages above 60 with bank accounts or payment cards tend to pay via credit transfer and payment card to a smaller degree compared to the average, but they are extremely active users of direct debit. By contrast, the payment habits of those using card purchases and credit transfers do not differ significantly from the average values of the other age groups either in terms of

the monthly number or the monthly value of the transactions. It is also evident that, for the most part, there is a clear positive correlation between the uses of different electronic payment methods; in other words, if a group defined on the basis of socio-demographic characteristics has higher statistics measuring the use of card payments, then the average usage ratios of credit transfer or direct debit will be typically higher as well.

Table 3.				
Estimated coefficients of the regressions explaining the use of payment card purchases and direct debit				
	Card payment		Direct debit	
	Usage	Number of transactions/month	Usage	Number of transactions/month
Age (18-29)				
(30-39)	0.41*	-0.37	1.50	-0.06
(40-49)	0.60	1.95	1.87*	0.33
(50-59)	0.38*	0.75	2.37*	0.05
(60-)	0.19*	-0.02	3.07*	0.48
Per capita income (in 10 thousand HUF)	1.05*	0.3680*	1.03*	0.00995
School qualification (8 elementary classes or less)				
Vocational school	1.81*	3.91*	1.84	0.19
High school	3.99*	3.78*	3.08*	-0.01
University	6.26*	7.91*	5.04*	1.24
Labour market activity (Employee)				
Pensioner	0.88	-1.87	0.89	0.29
Unemployed	0.64	-0.44	0.47	0.44
Student	0.37*	0.93	0.00	0.44
Other	0.68	-0.33	0.90	-0.54
Type of settlement (Capital)				
County towns	0.54*	-1.63	2.59*	-0.04
Other towns	0.52*	-1.80	1.57	-0.04
Villages	0.83	1.13	2.42*	-0.04
Constant	1.26	-0.34	0.03*	0.00*
N	782	466	811	210
R²	0.1356	0.2164	0.1097	0.2224
AUC	0.7382		0.7189	

* Significant odds ratios and coefficients with a 95% confidence interval
 Source: MNB Survey 2014 edited

However, there may also be correlations between some of our results relating to the different socio-demographic factors that influence the use of payment methods, or they may have the same underlying reasons, as was the case with the results shown in the previous chapter in relation to bank account or payment card ownership. Therefore, in this case also, we estimated regressions in order to identify the factors which have the most significant effect on the extent to which households use electronic payment methods, and the exact magnitude of their effect. We estimated logistic regressions for the explanation of the usage ratio of the six payment transaction types under review, where the dependent variable may be 1 or 0 depending on whether the respondent uses the specific transaction type or not. We estimated linear regressions to explain average monthly transaction numbers and values. The explanatory variables of the regressions are the dummy variables of the categories defined according to per capita net monthly income, age, education, labour market status, and residence.

In Table 3 we present the estimates for the coefficients of the regression explaining the usage ratio and monthly number of card purchases and direct debits because, based on the results detailed above, the usage of these electronic payment methods is relatively significantly influenced by the socio-demographic characteristics under review. However, we also estimated the above regressions for the rest of the payment transactions and monthly values (the estimated values of the coefficients are presented in Point 3 of the Annex), and, where relevant, we briefly touched upon their results. The use of cards for payment transactions is also affected by the combination of several variables; in addition, these variables have a significant explanatory power for monthly transaction numbers. Higher age categories reduce the odds ratio of usage, but not the monthly transaction numbers. This confirms our previous finding. The same is true for the student category. By contrast, education level and per capita income increases both the odds ratio of usage and the frequency of usage. A high school education, for example, almost doubles the average monthly number of card purchases (increases it by four), while the number of transactions executed by respondents with a university degree exceeds the average by four transactions. A HUF 25,000–30,000 increase in per capita income raises the monthly number of card purchases by one on average.

As regards the payment transactions considered as relevant alternatives to card payments, in the case of cash withdrawals we found that the odds ratio of usage tends to be worsened by certain labour market positions (typically those associated with a lack of independent income) – unemployed, student – and slightly improved by education, while none of the listed variables accounts for the unique differences in the extremely high ratios of cash payments. Owing to its nominal nature, income always has a strong explanatory power in respect of transaction numbers and values,

while categories related to employment – working age person in employment – tend to explain the differences in value, but not the intensity of monthly frequency.

The characteristics of direct debit were different from those of card usage. While age and education still have a strong explanatory power, education plays a role only in the odds ratio of usage, without having an effect on monthly intensity (similar to age, which exhibited the same behaviour in the case of card purchases as well). Again, we can draw the conclusion that higher education levels increase the odds of usage, while younger age decreases the odds of usage. Even so, once someone uses the service, these variables will not capture any further differences. The only significant relationship we observed was between per capita income and the monthly value of direct debits (see Point 3 of the Annex), which can be clearly perceived even on an intuitive basis. We found similar results in the case of payments via postal cheques. The odds ratio of usage decreases among members of the younger generation, and it is reduced even further by higher education levels. Pensioner status, however, increases the odds significantly. In this case, the nominal effect of per capita income is even stronger. Interestingly, in the case of postal cheques, less frequent monthly usage continues to characterise smaller settlement types; in other words, although respondents do not pay less with postal cheques, they pay with cheques less frequently.

4.3. Choice between payment methods

In the foregoing we analysed the factors influencing the use of individual payment methods separately. However, in several cases (e.g. within the groups of different per capita incomes) we found that the use of electronic payment methods and cash usage exhibit a kind of co-movement (increase or decrease in tandem) in the payments of households. Consequently, based on the results so far, sometimes we cannot determine with certainty the impact of the socio-demographic characteristics under review on households' choices between the available cash-based and electronic payment options. In order to decide this question, we derived a number of ratios from the responses to the questionnaire that can capture the strength of the choices between the available electronic payment methods in certain payment situations.

Table 4.	
Ratios measuring the choices of electronic payment methods	
Index	Calculation
Proportion of electronic payments	$(\text{Monthly value of card payments} + \text{credit transfers} + \text{direct debits}) / \text{monthly value of all payment transactions}$
Proportion of card payments	$\text{Monthly value of card payments} / (\text{monthly value of card payments} + \text{cash payments})$
Proportion of credit transfers	$\text{Monthly value of credit transfers} / \text{monthly value of all payment transactions}$
Proportion of direct debits	$\text{Monthly value of direct debits} / (\text{monthly value of direct debits} + \text{postal cheques})$

Of the ratios presented in *Table 4*, the first one captures, in general terms, the portion of an individual's monthly payment transactions that is executed via electronic means. The rest of the ratios, in a sense, break down this value according to different payment situations. The ratio of card purchases primarily measures the ratio of electronic transactions in such commercial, service provider, hospitality industry, etc. payment situations, where card payment is an alternative to cash payment. The ratio of credit transfers measures the share of credit transfers in total monthly payment transactions, while the ratio of direct debit primarily measures the share of direct debits in the payment of permanent, regularly charged (monthly, quarterly, etc.) bills (utility, telecommunications, insurance, etc.). We calculated the mean of the ratios thus defined for the groups created on the basis of the aforementioned socio-demographic characteristics.

Table 5.					
Ratios measuring the choices of electronic payment methods by per capita net monthly income (HUF)					
	0–50 000	50 001–100 000	100 001–150 000	150 001–200 000	200 001–
Proportion of electronic payments (conf. int. 95%)	0.14 (0.09 – 0.18)	0.16 (0.14 – 0.19)	0.27 (0.24 – 0.31)	0.39 (0.32 – 0.45)	0.49 (0.38 – 0.6)
Proportion of card payments (conf. int. 95%)	0.12 (0.07 – 0.16)	0.20 (0.17 – 0.23)	0.28 (0.24 – 0.32)	0.38 (0.32 – 0.44)	0.40 (0.3 – 0.49)
Proportion of credit transfers (conf. int. 95%)	0.02 (0.01 – 0.04)	0.04 (0.03 – 0.05)	0.05 (0.04 – 0.06)	0.06 (0.04 – 0.09)	0.17 (0.11 – 0.23)
Proportion of direct debits (conf. int. 95%)	0.22 (0.12 – 0.32)	0.19 (0.14 – 0.23)	0.27 (0.21 – 0.33)	0.35 (0.25 – 0.45)	0.52 (0.35 – 0.7)
<i>Source: MNB Survey 2014 edited</i>					

According to our results, as households' incomes increase they tend to increase their use of electronic payment methods in different payment situations to ever larger degrees (*Table 5*). In all cases – whether it is the share of card purchases, credit transfers or direct debit – the means of the highest income categories are significantly higher than the means of lower income categories. Accordingly, although we previously found that an increase in income will raise the monthly average value of both cash-based and electronic payment transactions, we can establish that the effect on electronic payment transactions is stronger.

Table 6.
Ratios measuring the choices of electronic payment methods by education level

	8 classes or less	Vocational school	High school	University
Proportion of electronic payments (conf. int. 95%)	0.05 (0.03 – 0.08)	0.16 (0.13 – 0.19)	0.28 (0.24 – 0.31)	0.49 (0.44 – 0.54)
Proportion of card payments (conf. int. 95%)	0.09 (0.05 – 0.12)	0.18 (0.15 – 0.21)	0.27 (0.24 – 0.31)	0.40 (0.34 – 0.45)
Proportion of credit transfers (conf. int. 95%)	0.02 (0.01 – 0.04)	0.03 (0.02 – 0.04)	0.05 (0.03 – 0.06)	0.11 (0.08 – 0.14)
Proportion of direct debits (conf. int. 95%)	0.09 (0.04 – 0.15)	0.16 (0.11 – 0.21)	0.25 (0.2 – 0.3)	0.50 (0.41 – 0.59)

Source: MNB Survey 2014 edited

The impact of education level on the choices between payment methods is similar, or perhaps, even stronger (*Table 6*). The group means of electronic payment methods, in particular, the group means of the ratios measuring the choice of card payments, significantly – and often considerably – exceed the mean of the category one level lower. It is also true for the ratios of credit transfers and direct debits that the means of the highest education categories exceed the means of the lower categories considerably and significantly. This result confirms the conclusion of our previous analyses; i.e. that the increase in education level has an extremely strong positive impact on choosing electronic payment methods.

The results for the categories defined according to age, labour market status, and residence are included in Point 4 of the Annex. While they do not add any important new information to the conclusions we have drawn so far, they confirm them in several cases. Typically, a higher percentage of active workers choose electronic payment methods compared to the average, while a significantly lower percentage of unemployed persons tend to opt for this choice. In the case of ages above 60 (in a different breakdown: pensioners), the ratio of card purchases and credit transfers lags behind the values of other age groups, while the ratio of direct debits does not. Based on residence, Budapest stands out somewhat in terms of choosing electronic payment methods, but the differences observed here are not pronounced, and are seldom significant from a statistical perspective. Similar to Budapest, county seats and towns with county rank show high values in respect of the share of electronic payments and direct debits. However, there is no perceivable difference between the residents of other towns and settlements.

We found that the ratio in which electronic payment methods are chosen is influenced, to a greater or lesser extent, by several socio-demographic factors. As was the case in the previous chapters, we estimated regressions in order to see which of these factors have the strongest influence and to identify the exact magnitude of their effect. The dependent variables of the linear regressions estimated here are the ratios explained above, while the explanatory variables, once again, are the dummy variables of the categories defined according to per capita net monthly income, age, education, labour market status, and residence.

Table 7.				
Estimated coefficients of the regressions explaining the ratios measuring the choice of electronic payment methods				
	Proportion of			
	electronic payments	card payments	credit transfers	direct debits
Age (18-29)				
(30-39)	-0.05	-0.02	0	0.06
(40-49)	-0.03	0.01	-0.01	0.06
(50-59)	-0.03	-0.02	-0.02	0.05
(60-)	-0.10*	-0.10*	-0.04*	0.08
Per capita income (in 10 thousand HUF)	0.00825*	0.00999*	0.00325*	0.00772*
School qualification (8 elementary classes or less)				
Vocational school	0.05*	0.06	0	0.03
High school	0.16*	0.14*	0.01	0.12*
University	0.35*	0.23*	0.07*	0.34*
Labour market activity (Employee)				
Pensioner	-0.03	-0.03	0.01	-0.01
Unemployed	-0.10*	-0.09	0	-0.07
Student	-0.08	-0.07	-0.02	-0.17
Other	-0.05	-0.07*	0.02	-0.05
Type of settlement (Capital)				
County towns	0.01	-0.03	0	0.09
Other towns	-0.03	-0.06*	0.01	-0.01
Villages	0.02	0.03	0.02	0.03
Constant	0.09*	0.09*	0	-0.02
N	862	703	701	601
R²	0.3033	0.2033	0.1221	0.144

* Significant coefficients with a 95% confidence interval
 Source: MNB Survey 2014 edited

The estimated coefficients of the linear regressions confirm our previous finding, according to which high retirement-age values of the age parameter's dummy variable significantly reduce the ratios under review (by 4–10 percentage points). The only exception is the ratio of direct debits, which does not show a significant difference between the age groups (*Table 7*). That notwithstanding, we can also conclude that the non-linear negative effect of age on the choice of electronic payment methods (which is only observed in the highest categories) is also present at most variables under review, even when the effect of the rest of the variables is excluded. Per capita income has a clear positive effect. Projected to a net monthly amount of HUF 10,000, the value of the estimated coefficient may appear low, but in case of the roughly HUF 50,000 difference between the means of the per capita income categories, it can improve the ratios explained by as much as 3–5 percentage points. It is important to stress that education level remains a strong, significant variable for all four ratios (the ratios of people with university degrees is 7–35 percentage point higher than the ratio of people with primary school education or less), while the results of the regression also confirm that residence and labour market status do not exert a significant impact.

4.4. Segmentation of Hungarian households based on payment habits

In the previous chapters we demonstrated that socio-demographic characteristics often have a strong impact on the use of payment methods, on their intensity, and on the choices between payment methods. We must also add, however, that the variables under review were mainly suitable for explaining covariance, whereas a significant part of the deviation does not depend on them primarily. For example, higher income calls for higher electronic payment turnover on average, but nevertheless a non-negligible percentage of high-income households still only execute a limited number of electronic payment transactions.

For this reason, in this chapter we reversed the course of our analysis: we created clusters based on the payment habits of the households observed and examined the characteristics of these clusters on the basis of the available socio-demographic variables. We performed the cluster analysis using K-centre clustering on the standardised versions of turnover and usage variables. We performed the analysis for 4–7 clusters, and found that the optimal cluster number is 5. We present the results of this analysis below. The substance of our results does not change for higher cluster numbers; only the edges of the groups shift or groups are divided into two.

Built on five clusters, the K-centre cluster analysis divides the group of the 802 households observed – each with a full set of data – into five stable and clearly distinguishable clusters. In addition to two clusters each comprising 100 persons and two clusters of more than 270 persons, there is a clearly separable, unique,

extremely stable group composed of 30 persons. This group becomes separate even with a smaller number of clusters.

The small, unique cluster (5) is approximately average from a demographic perspective, and while retired, low educated persons are partly overrepresented, they are not the sole components of the group. The main characteristic of the small group is that its members perform their finances nearly exclusively by cash transactions, and spend more than 95% of their income through cash purchases. Accordingly, the use and intensity of the rest of the payment methods is extremely low among them.

Table 8.
Characteristics of household clusters defined on the basis of payment habits

Serial number of cluster	Number of items	Per capita income (HUF)	Monthly value of cash payments (HUF)	Monthly value of card payments (HUF)
1	120	96 897	66 274	7 910
2	104	126 506	68 503	16 774
3	279	77 793	26 457	6 108
4	271	119 104	39 714	28 585
5	28	101 238	231 592	9 943

Source: MNB Survey 2014 edited

The four remaining groups are distinguished from one another mainly on the basis of income, consisting of a below-average (3), an average (1), and two above-average (2, 4) groups (*Table 8*).

Cluster 3, which includes below-average earners, is composed mainly of students, unemployed persons and a part of the pensioners. The majority of its members do not live in Budapest and have a lower education level. From a payment perspective, they are characterised by low turnover and low value in respect of all payment methods. It should be noted, however, that their electronically processed payments represent nearly the same percentage of their total turnover, as is the case in the high-income, intensive group.

The average group (1) is average even from a demographic perspective and does not have a clearly discernible character. Low-income non-urban members are slightly overrepresented in this cluster as well. As regards their payment habits, their payment transactions typically involve small amounts. Their payment card and credit transfer usage is low, but their postal cheque payments are frequent and involve large amounts.

The two groups comprising members with above-average income are clearly separated along the lines of their payments, which proves that income explains intensive use only with substantial dispersion. Controlled with other socio-demographic variables, they tend to move extremely similarly. Still, the positive impact of education is apparent in this case as well, and indeed, nearly all persons with a university degree belong to the group that is characterised by intensive use of electronic payment transactions. It is a favourable result, that in terms of size the proportion of the two groups benefits intensive users of electronic payment methods at a ratio of nearly 1 to 3. Importantly, however, cash-based payment methods are still strongly overrepresented in the payment transactions of one fourth of the households with above-average income.

The two high-income groups are mirror images of each other from the perspective of payments: in the smaller group (2) the value of cash withdrawals is nearly double, while the frequency of card purchases is nearly one half of the corresponding values recorded for the group composed of more intensive users of electronic payment methods. The use of direct debit is negligible, but postal cheques are extremely popular in group (2). By contrast, the larger group (4) is intensive in card-based and other electronic transactions, and its use of postal cheques is as limited as in the low-income group.

Based on the clustering exercise, we concluded that although demographic characteristics are good indicators of households' electronic payment habits, they fail to explain numerous factors and the substantial dispersion we found. This is particularly true for the per capita income of households, while education, even on the basis of the cluster analysis, can be considered a good indicator and a robust explanatory variable. In respect of all other variables under review, we found that Hungarian households could be divided into clusters that have similar socio-demographic characteristics, but different payment habits.

4.5. International comparison of our findings

Two international surveys have recently been performed on households' payment habits with results comparable to ours. The comparison is all the more interesting, as one of the international analyses is based on Polish data, while the other one relies on Dutch data. Therefore, we can simultaneously compare our results to another Central and Eastern European country and to a Western European country with an extremely advanced electronic payment system. Similar to our own survey, the surveys of both *Goczek–Witkowski (2015)* and *Crujisen–Plooi (2015)* are questionnaire-based surveys, and the dates of their data recording (2013 and 2014) are very close to our own date. Although the questions posed by the two studies are somewhat different from ours – in examining the choice between payment card and cash, they primarily focus on retail payments – they analyse the impact of several socio-demographic factors used by us.

In the framework of a logistic regression similar to the one presented in this study, *Goczek–Witkowski (2015)* examines the determinants of payment card ownership and the magnitude of their effect. Consistent with our findings, the authors found a positive correlation between card ownership and education level, income and size of residence. Although the impact of education is not as striking as in our case, it can still be considered strong. An important difference between the two surveys is the fact that, based on the Polish data, the odds ratio of card ownership for younger generations (ages 18–29) is significantly lower than that of the middle-aged population, while the odds do not decline perceptibly above age 60. In this regard, however, we must bear in mind that, as the Polish authors pointed out, the card possession ratio of the entire Polish population is 59%; i.e. far lower than the corresponding value of Hungary.

Although practically everyone owns a card in the Netherlands, by using Dutch data, *Crujisen–Plooiij (2015)* successfully demonstrated the negative effect of an increase in age and the positive effect of an increase in education level on payment card ownership. Debit card ownership declines slightly above age 45 and decreases a bit further above age 55, while a high degree of education moderately increases the odds of card ownership. As regards the determinants of the intensity of debit card payments, the authors found that the negative impact on card payments increases in line with the advancement of age, which is consistent with our findings. As opposed to our results, education, income and the size of residence do not affect the use of debit cards in the Netherlands, but the intensity of cash payments declines slightly in the highest categories. It appears therefore, that the socio-demographic variables reviewed by us have a less marked impact on card usage in the Netherlands. This, however, can be probably attributed to the high usage ratio of card payments in general, and in this regard the groups defined on the basis of socio-demographic characteristics do not differ significantly from one another.

4. Conclusions

Our study was intended to gain an insight into and improve the understanding of the payment habits of Hungarian households. Our research was based on a representative household survey, in the framework of which we collected a broad range of socio-demographic information in addition to detailed payment transaction data.

A high percentage of Hungarian households have a bank account (83%) and a payment card (80%), and these ratios have not changed since 2010. This suggests that the small decline observed in the number of household bank accounts and payment cards in recent years is primarily linked to the elimination of some of the presumably less frequently used second or third accounts and cards, i.e. the rationalisation of household bank relationships, and as such, it is not detrimental

to the electronic payment options of Hungarian households. A low degree of education, higher age and the lack of a regular income constitute the most important explanations in the case of those who do not hold a bank account or a payment card. Account ownership also lags behind in smaller settlements, which generally have a less developed financial infrastructure (accessibility of branches, availability of POS terminals).

The distribution of payment methods by number and value has not changed significantly since 2010 either, but a slight decline can be observed in cash usage. This is mainly apparent in the case of payment values: since 2010, the ratio of cash usage has dropped to 46% from 50%. By number, electronic payments rose from 12% to 14%, while based on the amounts paid, they increased to 26% from 20%. Meanwhile, the gap between the number and value of cash payments widened further; in other words, the average value of a single cash transaction continued to decline. These shifts indicate that the payment habits of households did not change substantially in response to the adoption of the regulations affecting payments and the pricing of payment services after 2010 (financial transaction duty, the option of bimonthly free cash withdrawals), and the proportion of cash-based payments did not increase.

The socio-demographic factors under review have a limited impact on cash-related payment transactions – i.e. cash withdrawals, cash purchases and the use of postal cheque payments – and a stronger impact on the use of electronic payment methods. Practically everyone pays with cash. Accordingly, the ratio of respondents using cash withdrawals is relatively stable in the groups under review, and the average monthly value of cash withdrawals and cash purchases only increases in line with an increase in income. The rest of the socio-demographic characteristics have no significant impact on the average monthly value of cash payments, which remains stable at around HUF 50,000 in the vast majority of the groups reviewed. The average number and value of postal cheque payments are even more stable at 3 monthly transactions and a value of HUF 35,000–45,000, and they are not influenced significantly by any other factor, even an increase in income. Whether it is habits or some other reasons that are behind this apparent stability, this result suggests that a more broad-based electronisation of regular bill payments can be only achieved over the short or the medium term if the electronic payment of postal cheques becomes widely available.

By contrast, the diversity of the statistics measuring the intensity of the use of electronic payment methods is far more significant as a function of the socio-demographic characteristics under review: the difference between the means of the lowest and highest groups, in many cases, is three or four-fold. Education has the largest degree of positive impact on the use of payment card purchases, credit transfers, and direct debit, and the use of these instruments is also influenced

positively by higher per capita net monthly incomes. Based on labour market status, clear deviations can be observed primarily to the benefit of active workers. By contrast, age and residence appear to have a smaller impact, restricted to certain areas or groups at most. People older than 60 with bank accounts or payment cards tend to pay via credit transfer and payment card to a smaller degree compared to the average, but they are active users of direct debit. In contrast to this, the payment habits of those using card purchases and credit transfers do not differ significantly from the average values of the other age groups either in terms of the monthly number, or the monthly value of the transactions. Most frequently, there is a clear positive correlation between the uses of different electronic payment methods; in other words, if a group defined on the basis of socio-demographic characteristics has higher statistics measuring the use of card payments, then the average usage ratios of credit transfer or direct debit will be typically higher as well.

Similarly, in examining the choices between payment methods in certain payment situations (e.g. retail purchases, payment of monthly or quarterly bills, etc.), we found that the odds of choosing electronic payment options increase with education primarily, but they are positively influenced by income as well.

On the whole, we can conclude that demographic characteristics are good indicators of households' electronic payment habits, but we found that, in their own right, they fail to explain all determinants and a substantial part of the variation. As the cluster analysis of Hungarian households based on payment habits demonstrated, this is particularly true for the per capita income of households: even among people in high income categories there is a non-negligible group that relies heavily on cash usage. At the same time, the cluster analysis confirmed that education is a good indicator and a robust explanatory variable from the perspective of payment transactions.

In accordance with the above, we can conclude that it is the payer's level of education that is most positively correlated with the intensity of the use of electronic payment transactions and the odds ratio of electronic payment choices in different payment situations. In addition, there is an extremely large difference between those with a low degree of education and those with a higher degree of education, and the values measured improve significantly at each level compared to the previous level. In view of the results of financial literacy surveys, this relationship is probably even more relevant in the area of financial knowledge and education, the measurement of which was beyond the scope of this study.⁷ This result clearly demonstrates that the enhancement of financial literacy could strongly facilitate the widespread use of electronic payment instruments. And in order to reduce

⁷ In this regard, see for example the summary article of Kovács (2015), and the research conducted by Kovács (2014) and Németh *et al.* (2013) referenced in the article.

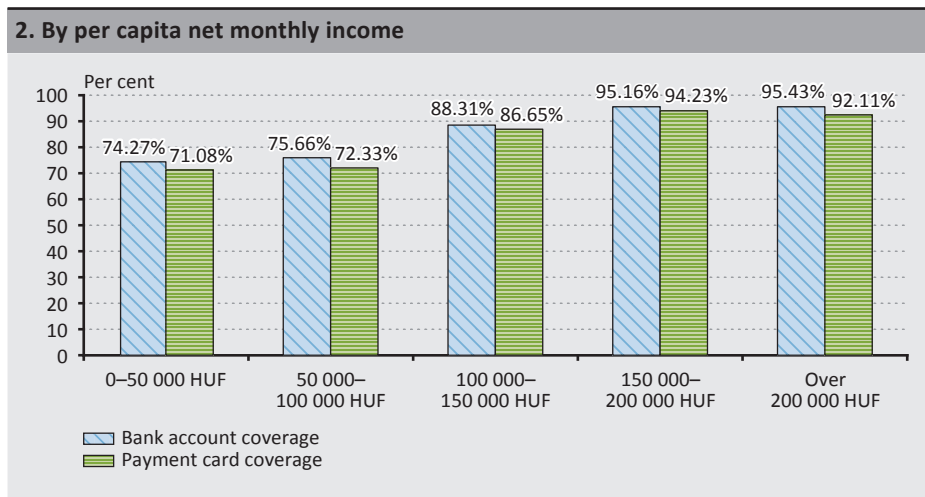
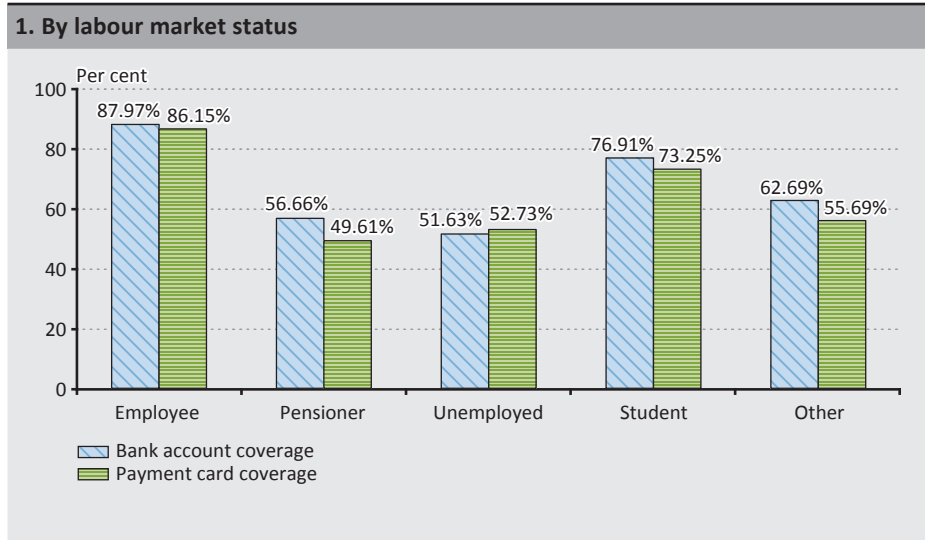
the current gap between different education categories as much as possible, the training of practical financial skills should be started at school as early as possible.

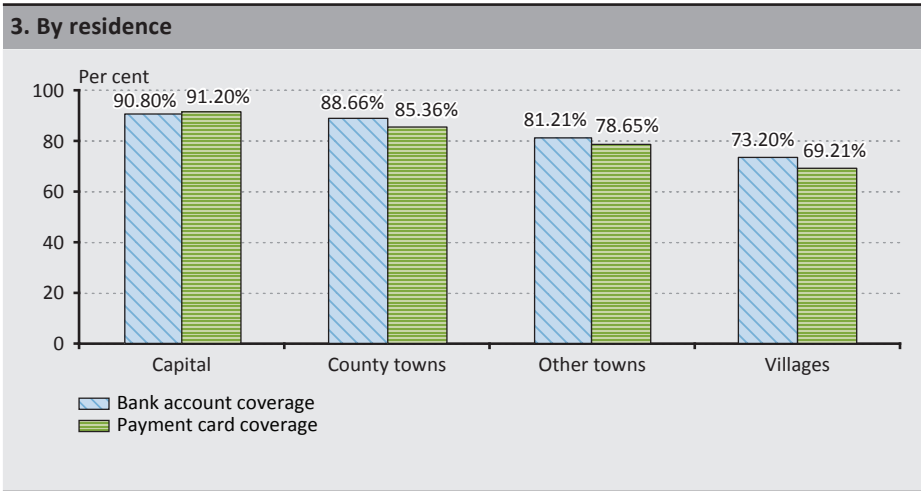
References

- Cruisen, C. Van Der – Plooi, M. (2015): *Changing payment patterns at point-of-sale: their drivers*, DNB Working Paper No. 471.
- Divéki, É. – Listár, D. (2012): Better safe than sorry: views of the Hungarian public on the security of payment instruments. MNB Bulletin, October 2012.
- Goczek, L. – Witkowski, B. (2015): *Determinants of non-cash payments*, NBP Working Paper No. 196.
- Ilyés, T. – Takács, K. – Varga, L. (2014): Changes in the fees on payment services and the structure of payments following the introduction of the financial transaction tax. MNB Bulletin, March 2014.
- Kovács, L. (2015): *A pénzügyi kultúra kutatása és aktuális feladataink*, Gazdaság és Pénzügy, 2015. március 2. évfolyam 1. szám.
- Kovács, P. (2014): *Középiskolások pénzügyi kultúrája felmérés eredményei (összefoglaló)*, Szegedi Tudományegyetem Gazdaságtudományi Kar – Econventio Pénzügyi kultúra kutatócsoport.
- Payment table set of the Magyar Nemzeti Bank, <http://www.mnb.hu/Statiztika/statiztikai-adatok-informaciok/adatok-idosorok/xiii-penzforgalmi-adatok/penzforgalmi-adatok/penzforgalmi-tablakeszlet>
- Német, E. et al. (2013): *Felmérés a felsőoktatásban tanuló fiatalok pénzügyi kultúrájáról*, kutatási jelentés, Állami Számvevőszék, 2013. június.
- Takács, K. (2011): A magyar háztartások fizetési szokásai (The payment habits of Hungarian households). MNB Occasional Papers, 98.
- Turján, A – Divéki, É. – Keszy-Harmath, Z. – Kóczán, G. – Takács, K (2011): Nothing is free: A survey of the social cost of the main payment instruments in Hungary. MNB Occasional Papers, 93.

Annex

1. Bank account and payment card ownership by groups defined on the basis of socio-demographic characteristics





2. Statistics of monthly payment transactions by groups defined on the basis of socio-demographic characteristics⁸

1. By age (years)		18–29	30–39	40–49	50–59	60–
Cash withdrawal	proportion of users (conf. int. 95%)	0.80 (0.74–0.86)	0.81 (0.75–0.87)	0.80 (0.73–0.86)	0.82 (0.76–0.88)	0.82 (0.76–0.88)
	average number of transactions per month (conf. int. 95%)	1.5 (1.4–1.7)	1.7 (1.5–1.8)	1.7 (1.5–1.8)	1.7 (1.5–1.9)	1.5 (1.4–1.6)
	average value of transactions per month (HUF) (conf. int. 95%)	49 943 (43 337–56 550)	73 730 (63 206–84 255)	77 201 (68 388–86 013)	65 804 (58 338–73 269)	70 711 (64 437–76 985)
Cash payment	proportion of users (conf. int. 95%)	1.00 (0.99–1.01)	0.99 (0.97–1)	0.99 (0.97–1)	0.98 (0.96–1)	0.98 (0.97–1)
	average number of transactions per month (conf. int. 95%)	29.8 (25.8–33.9)	29.0 (25.9–32.1)	27.5 (24.2–30.8)	27.6 (24.2–31)	23.8 (21.7–25.9)
	average value of transactions per month (HUF) (conf. int. 95%)	43 575 (34 413–52 737)	52 460 (46 350–58 570)	53 547 (47 180–59 913)	55 767 (46 344–65 189)	47 953 (42 469–53 436)
Card payment	proportion of users (conf. int. 95%)	0.67 (0.6–0.74)	0.63 (0.56–0.71)	0.64 (0.56–0.72)	0.58 (0.5–0.66)	0.38 (0.31–0.46)
	average number of transactions per month (conf. int. 95%)	6.6 (5.4–7.8)	8.8 (7.1–10.6)	10.0 (8–12)	8.9 (7.1–10.7)	6.6 (5.2–7.9)
	average value of transactions per month (HUF) (conf. int. 95%)	24 541 (20 612–28 471)	39 682 (32 716–46 648)	43 259 (35 510–51 009)	37 054 (30 246–43 862)	29 783 (24 076–35 491)
Credit transfer	proportion of users (conf. int. 95%)	0.21 (0.15–0.28)	0.34 (0.27–0.41)	0.29 (0.22–0.37)	0.24 (0.17–0.31)	0.14 (0.09–0.19)
	average number of transactions per month (conf. int. 95%)	2.3 (1.7–2.9)	2.7 (1.8–3.5)	2.7 (2.2–3.3)	2.5 (1.7–3.3)	3.0 (1.8–4.2)
	average value of transactions per month (HUF) (conf. int. 95%)	25 210 (17 946–32 474)	35 687 (27 376–43 998)	36 954 (26 926–46 982)	30 604 (23 113–38 095)	34 825 (23 901–45 750)
Direct debit	proportion of users (conf. int. 95%)	0.13 (0.08–0.18)	0.28 (0.21–0.35)	0.30 (0.23–0.37)	0.31 (0.24–0.38)	0.35 (0.28–0.42)
	average number of transactions per month (conf. int. 95%)	2.6 (1.8–3.4)	3.0 (2.4–3.6)	3.2 (2.6–3.8)	2.5 (1.9–3.1)	3.6 (2.9–4.3)
	average value of transactions per month (HUF) (conf. int. 95%)	31 987 (21 419–42 554)	41 735 (33 378–50 092)	41 459 (29 880–53 037)	38 290 (24 453–52 127)	34 606 (28 793–40 419)
Postal cheques	proportion of users (conf. int. 95%)	0.44 (0.37–0.51)	0.64 (0.58–0.71)	0.74 (0.68–0.81)	0.76 (0.69–0.82)	0.82 (0.77–0.86)
	average number of transactions per month (conf. int. 95%)	2.7 (2.3–3)	3.0 (2.7–3.3)	3.2 (2.9–3.4)	3.0 (2.7–3.3)	3.2 (3–3.4)
	average value of transactions per month (HUF) (conf. int. 95%)	37 742 (28 941–46 543)	39 008 (34 594–43 421)	45 839 (40 710–50 967)	35 653 (31 792–39 514)	36 143 (32 215–40 072)

⁸ In the tables means highlighted in bold mark the means the deviation of which from another mean or more means in the specific row holds the greatest significance for the purposes of our analysis

2. By education level		8 classes or less	Vocational school	High school	University
Cash withdrawal	proportion of users (conf. int. 95%)	0.7 (0.62–0.79)	0.76 (0.71–0.82)	0.85 (0.81–0.89)	0.89 (0.84–0.94)
	average number of transactions per month (conf. int. 95%)	1.3 (1.2–1.5)	1.5 (1.4–1.6)	1.7 (1.5–1.8)	1.9 (1.7–2.1)
	average value of transactions per month (HUF) (conf. int. 95%)	64 160 (55 504–72 815)	76 330 (67 653–85 007)	61 823 (56 906–66 740)	66 314 (58 648–73 980)
Cash payment	proportion of users (conf. int. 95%)	0.98 (0.97–1)	0.99 (0.98–1)	0.98 (0.97–1)	0.99 (0.98–1.01)
	average number of transactions per month (conf. int. 95%)	22.5 (20.5–24.6)	28.7 (26.1–31.2)	28.6 (25.9–31.4)	27.4 (23.9–30.9)
	average value of transactions per month (HUF) (conf. int. 95%)	48 726 (40 510–56 942)	52 737 (47 445–58 028)	49 493 (44 401–54 586)	49 685 (40 311–59 059)
Card payment	proportion of users (conf. int. 95%)	0.29 (0.2–0.37)	0.47 (0.41–0.54)	0.67 (0.62–0.72)	0.79 (0.72–0.86)
	average number of transactions per month (conf. int. 95%)	2.5 (1.8–3.2)	6.8 (5.7–8)	7.3 (6.4–8.1)	12.6 (10.4–14.8)
	average value of transactions per month (HUF) (conf. int. 95%)	19 234 (9 993–28 475)	29 810 (25 651–33 969)	32 660 (28 530–36 790)	47 834 (40 482–55 186)
Credit transfer	proportion of users (conf. int. 95%)	0.09 (0.03–0.14)	0.15 (0.1–0.19)	0.25 (0.2–0.3)	0.50 (0.42–0.58)
	average number of transactions per month (conf. int. 95%)	1.3 (1–1.7)	1.8 (1.3–2.3)	2.2 (1.8–2.6)	3.5 (2.8–4.3)
	average value of transactions per month (HUF) (conf. int. 95%)	30 496 (15 865–45 127)	31 327 (22 395–40 259)	27 604 (22 493–32 714)	38 613 (30 838–46 387)
Direct debit	proportion of users (conf. int. 95%)	0.13 (0.07–0.19)	0.21 (0.16–0.26)	0.27 (0.22–0.32)	0.49 (0.4–0.57)
	average number of transactions per month (conf. int. 95%)	1.9 (1.2–2.6)	2.6 (2–3.1)	2.6 (2.2–3)	4.1 (3.5–4.7)
	average value of transactions per month (HUF) (conf. int. 95%)	39 761 (–7 840–87 362)	30 190 (23 653–36 727)	33 405 (27 128–39 682)	48 053 (41 282–54 825)
Postal cheques	proportion of users (conf. int. 95%)	0.81 (0.76–0.87)	0.77 (0.72–0.82)	0.65 (0.61–0.7)	0.47 (0.39–0.55)
	average number of transactions per month (conf. int. 95%)	2.8 (2.6–3)	3.2 (3–3.4)	3.2 (3–3.4)	3.1 (2.7–3.4)
	average value of transactions per month (HUF) (conf. int. 95%)	32 532 (28 380–36 684)	41 865 (37 912–45 817)	38 384 (34 952–41 817)	42 353 (34 176–50 530)

3. By labour market status						
		Employee	Pensioner	Unemployed	Student	Other*
Cash withdrawal	proportion of users (conf. int. 95%)	0.86 (0.83–0.89)	0.82 (0.76–0.88)	0.55 (0.38–0.73)	0.61 (0.47–0.75)	0.69 (0.59–0.8)
	average number of transactions per month (conf. int. 95%)	1.7 (1.6–1.8)	1.5 (1.3–1.6)	1.7 (1.2–2.1)	1.4 (1–1.8)	1.4 (1.2–1.6)
	average value of transactions per month (HUF) (conf. int. 95%)	71 193 (66 429–75 958)	69 955 (62 978–76 933)	43 235 (25 740–60 730)	18 167 (13 070–23 264)	62 978 (51 151–74 806)
Cash payment	proportion of users (conf. int. 95%)	0.99 (0.98–1)	0.99 (0.97–1)	0.98 (0.95–1.02)	1.00 –	0.97 (0.93–1)
	average number of transactions per month (conf. int. 95%)	29.8 (27.8–31.9)	23.6 (21.5–25.6)	24.3 (19.4–29.3)	21.9 (18.4–25.4)	26.1 (20.8–31.4)
	average value of transactions per month (HUF) (conf. int. 95%)	54 841 (50 132–59 550)	48 195 (42 304–54 085)	35 932 (27 835–44 029)	27 422 (13 577–41 267)	49 251 (40 291–58 211)
Card payment	proportion of users (conf. int. 95%)	0.68 (0.64–0.72)	0.39 (0.31–0.46)	0.35 (0.19–0.52)	0.47 (0.33–0.62)	0.44 (0.33–0.56)
	average number of transactions per month (conf. int. 95%)	9.1 (8.2–10.1)	5.8 (4.4–7.1)	5.2 (2.1–8.2)	5.8 (3.7–7.8)	6.0 (3.8–8.2)
	average value of transactions per month (HUF) (conf. int. 95%)	39 401 (35 741–43 062)	28 231 (21 900–34 563)	17 739 (10 526–24 952)	13 213 (8 267–18 159)	19 887 (14 285–25 489)
Credit transfer	proportion of users (conf. int. 95%)	0.30 (0.26–0.34)	0.14 (0.09–0.19)	0.13 (0.01–0.25)	0.12 (0.02–0.21)	0.22 (0.12–0.31)
	average number of transactions per month (conf. int. 95%)	2.8 (2.4–3.2)	2.7 (1.6–3.7)	1.3 (0.9–1.8)	1.9 (0.5–3.3)	1.4 (1–1.8)
	average value of transactions per month (HUF) (conf. int. 95%)	35 517 (30 616–40 418)	31 213 (21 577–40 849)	12 533 (5 775–19 292)	10 280 (5 774–14 786)	23 629 (14 136–33 123)
Direct debit	proportion of users (conf. int. 95%)	0.30 (0.26–0.34)	0.33 (0.26–0.41)	0.09 (–0.01–0.18)	0.00 –	0.20 (0.11–0.3)
	average number of transactions per month (conf. int. 95%)	3.0 (2.7–3.3)	3.6 (2.8–4.4)	2.7 (–1.9–7.3)	–	1.7 (1–2.4)
	average value of transactions per month (HUF) (conf. int. 95%)	39 196 (34 214–44 179)	34 928 (28 610–41 246)	24 090 (–15 010–63 189)	–	42 068 (–2 273–86 409)
Postal cheques	proportion of users (conf. int. 95%)	0.66 (0.62–0.7)	0.83 (0.79–0.88)	0.58 (0.44–0.72)	0.12 (0.02–0.21)	0.79 (0.71–0.88)
	average number of transactions per month (conf. int. 95%)	3.0 (2.9–3.2)	3.3 (3.1–3.5)	2.5 (1.8–3.2)	2.1 (1.6–2.7)	2.9 (2.5–3.2)
	average value of transactions per month (HUF) (conf. int. 95%)	41 204 (38 243–44 164)	35 912 (31 775–40 049)	31 680 (22 930–40 429)	20 376 (6 545–34 207)	36 226 (30 428–42 024)
* Childcare allowance, childcare benefit, disability pensioner, homemaker, other inactive, other dependant						

4. By per capita net monthly income (HUF)		0–50 000	50 001–100 000	100 001–150 000	150 001–200 000	200 001–
Cash withdrawal	proportion of users (conf. int. 95%)	0.75 (0.67–0.84)	0.79 (0.74–0.83)	0.85 (0.81–0.9)	0.90 (0.85–0.96)	0.83 (0.71–0.94)
	average number of transactions per month (conf. int. 95%)	1.3 (1.2–1.5)	1.5 (1.4–1.6)	1.6 (1.5–1.7)	1.9 (1.7–2.1)	2.1 (1.5–2.7)
	average value of transactions per month (HUF) (conf. int. 95%)	44 650 (37 836–51 463)	59 573 (54 985–64 162)	74 337 (68 459–80 216)	83 280 (67 888–98 673)	86 051 (67 242–104 861)
Cash payment	proportion of users (conf. int. 95%)	0.98 (0.95–1)	0.98 (0.97–1)	1.00 (0.99–1)	0.99 (0.96–1.01)	1.00 –
	average number of transactions per month (conf. int. 95%)	26.3 (22.4–30.2)	26.4 (24.3–28.5)	27.6 (25–30.1)	33.3 (28.3–38.3)	20.5 (17–24)
	average value of transactions per month (HUF) (conf. int. 95%)	39 381 (33 107–45 655)	49 450 (44 247–54 653)	53 462 (47 566–59 357)	53 909 (42 518–65 299)	73 523 (56 370–90 676)
Card payment	proportion of users (conf. int. 95%)	0.41 (0.31–0.51)	0.53 (0.47–0.59)	0.64 (0.58–0.7)	0.72 (0.63–0.81)	0.84 (0.73–0.96)
	average number of transactions per month (conf. int. 95%)	5.9 (3.2–8.7)	6.0 (5–7)	8.6 (7.4–9.8)	10.4 (8.7–12.1)	16.3 (11.9–20.7)
	average value of transactions per month (HUF) (conf. int. 95%)	15 841 (12 029–19 652)	26 987 (23 431–30 543)	35 267 (30 638–39 896)	50 077 (42 491–57 664)	64 276 (43 608–84 944)
Credit transfer	proportion of users (conf. int. 95%)	0.13 (0.06–0.19)	0.20 (0.16–0.25)	0.29 (0.24–0.35)	0.26 (0.17–0.35)	0.62 (0.47–0.77)
	average number of transactions per month (conf. int. 95%)	2.6 (1.7–3.4)	2.0 (1.6–2.4)	2.2 (1.7–2.6)	3.0 (2–4)	5.2 (3.3–7)
	average value of transactions per month (HUF) (conf. int. 95%)	26 567 (15 303–37 831)	31 023 (24 871–37 175)	25 851 (19 985–31 716)	47 979 (33 045–62 912)	46 515 (34 463–58 567)
Direct debit	proportion of users (conf. int. 95%)	0.19 (0.11–0.26)	0.23 (0.19–0.28)	0.32 (0.26–0.37)	0.36 (0.27–0.46)	0.44 (0.29–0.6)
	average number of transactions per month (conf. int. 95%)	4.6 (2.7–6.5)	2.2 (1.8–2.6)	3.1 (2.6–3.6)	3.6 (3–4.3)	3.5 (2.5–4.5)
	average value of transactions per month (HUF) (conf. int. 95%)	39 794 (26 596–52 992)	28 386 (23 253–33 518)	39 307 (31 401–47 212)	40 740 (32 344–49 137)	66 045 (33 805–98 285)
Postal cheques	proportion of users (conf. int. 95%)	0.60 (0.52–0.68)	0.76 (0.72–0.8)	0.72 (0.66–0.77)	0.60 (0.51–0.7)	0.52 (0.37–0.67)
	average number of transactions per month (conf. int. 95%)	2.7 (2.3–3)	3.0 (2.9–3.2)	3.3 (3–3.6)	3.1 (2.7–3.5)	3.5 (2.8–4.1)
	average value of transactions per month (HUF) (conf. int. 95%)	32 978 (27 742–38 214)	35 668 (33 070–38 266)	40 628 (36 546–44 711)	44 643 (37 249–52 038)	70 342 (38 577–102 107)

5. By residence		Capital	County towns	Other towns	Villages
Cash withdrawal	proportion of users (conf. int. 95%)	0.89 (0.84–0.94)	0.81 (0.75–0.87)	0.79 (0.74–0.84)	0.78 (0.73–0.83)
	average number of transactions per month (conf. int. 95%)	1.8 (1.6–2)	1.6 (1.5–1.7)	1.6 (1.5–1.8)	1.5 (1.4–1.6)
	average value of transactions per month (HUF) (conf. int. 95%)	70 611 (63 570–77 652)	64 727 (57 091–72 363)	67 176 (61 354–72 998)	67 205 (58 363–76 046)
Cash payment	proportion of users (conf. int. 95%)	1.00 (0.99–1.01)	1.00 –	0.98 (0.97–1)	0.98 (0.96–0.99)
	average number of transactions per month (conf. int. 95%)	33.6 (29.6–37.5)	26.6 (23.4–29.8)	25.4 (23.1–27.7)	25.7 (23.5–27.9)
	average value of transactions per month (HUF) (conf. int. 95%)	53 088 (46 105–60 072)	51 878 (42 247–61 509)	47 805 (43 409–52 202)	50 519 (44 685–56 353)
Card payment	proportion of users (conf. int. 95%)	0.73 (0.66–0.8)	0.54 (0.47–0.62)	0.52 (0.46–0.59)	0.56 (0.5–0.63)
	average number of transactions per month (conf. int. 95%)	10.0 (8.4–11.6)	7.7 (6.1–9.4)	6.7 (5.4–7.9)	8.8 (7.2–10.3)
	average value of transactions per month (HUF) (conf. int. 95%)	39 757 (33 938–45 577)	36 218 (29 649–42 787)	30 887 (25 242–36 533)	34 108 (28 794–39 422)
Credit transfer	proportion of users (conf. int. 95%)	0.29 (0.22–0.36)	0.21 (0.15–0.27)	0.26 (0.21–0.31)	0.22 (0.17–0.28)
	average number of transactions per month (conf. int. 95%)	2.9 (1.7–4)	3.1 (2.5–3.7)	2.3 (1.7–2.9)	2.5 (1.9–3.1)
	average value of transactions per month (HUF) (conf. int. 95%)	33 329 (22 921–43 738)	35 371 (27 318–43 424)	30 929 (24 480–37 379)	34 187 (26 191–42 183)
Direct debit	proportion of users (conf. int. 95%)	0.26 (0.19–0.33)	0.36 (0.29–0.43)	0.23 (0.18–0.28)	0.26 (0.2–0.32)
	average number of transactions per month (conf. int. 95%)	4.2 (3.5–4.8)	3.7 (3–4.4)	2.3 (1.9–2.7)	2.3 (1.8–2.8)
	average value of transactions per month (HUF) (conf. int. 95%)	52 256 (43 320–61 192)	37 734 (31 593–43 875)	32 634 (24 674–40 593)	33 870 (21 795–45 945)
Postal cheques	proportion of users (conf. int. 95%)	0.66 (0.59–0.73)	0.61 (0.54–0.67)	0.70 (0.65–0.75)	0.76 (0.71–0.81)
	average number of transactions per month (conf. int. 95%)	3.5 (3.2–3.8)	3.2 (2.9–3.6)	3.0 (2.8–3.2)	2.8 (2.7–3)
	average value of transactions per month (HUF) (conf. int. 95%)	46 230 (39 427–53 034)	39 311 (34 897–43 725)	38 450 (34 593–42 306)	34 303 (30 972–37 634)

3. Estimated coefficients of the regressions explaining the use of electronic payment methods								
	Card payment	Direct debit	Cash payment			Postal cheques		
	Value of transactions per month	Value of transactions per month	Usage	Number of transactions per month	Value of transactions per month	Usage	Number of transactions per month	Value of transactions per month
Age (18-29)								
(30-39)	4 911	2 511	0.37	-3.07	509	2.22*	0.31	184
(40-49)	11 047*	5 236	0.46	-4.91	2 724	2.61*	0.51*	8 035
(50-59)	3 950	4 751	0.35	-4.20	4 284	2.30*	0.31	-2 963
(60-)	118	-8 410	0.26	-6.48	-3 539	1.96	0.30	-1 052
Per capita income (in 10 thousand HUF)	2 117.03*	997.42*	1.06	-0.124	1 163.58*	0.99	0.01	1 175.68*
School qualification (8 elementary classes or less)								
Vocational school	1 523	-11 183	1.02	4.04	-2 730	0.68	0.39*	4 648
High school	2 757	-9 311	0.42	3.55	-5 950	0.55*	0.42*	-1 075
University	10 234	1 265	0.99	1.51	-11 989	0.21*	0.17	-57
Labour market activity (Employee)								
Pensioner	-5 167	11 504	1.46	-2.17	-3 148	2.03*	0.42	-1 434
Unemployed	-6 728	-7 439	0.62	-4.26	-12 609	0.57	-0.37	-926
Student	-7 498			-11.95*	-22 263*	0.10*	-0.48	-11 882
Other	-10 375	9 130	0.53	-1.84	-3 249	1.34	0.11	1 627
Type of settlement (Capital)								
County towns	-3 173	-7 522		-6.12*	2 370	0.70	-0.25	-4 660
Other towns	-4 504	-10 981	0.35	-7.74*	-3 631	0.86	-0.40*	-5 351
Villages	1 883	-9 786	0.25	-7.15*	548	0.98	-0.55*	-7 937*
Constant	5 272	34 902*	349.44*	37.20*	46 404*	2.78*	2.62*	30 685*
N	435	203	955	942	911	984	695	661
R ²	0.2578	0.1143	0.1045	0.0464	0.0325	0.1302	0.0515	0.0857
AUC			0.7961			0.7286		

* Significant coefficients and odds ratios with a 95% confidence interval

4. Ratios measuring the choices of electronic payment methods by groups defined on the basis of socio-demographic characteristics

1. By age (years)					
	18–29	30–39	40–49	50–59	60–
Proportion of electronic payments (conf. int. 95%)	0.24 (0.2–0.28)	0.27 (0.22–0.32)	0.27 (0.22–0.32)	0.26 (0.21–0.3)	0.14 (0.11–0.17)
Proportion of card payments (conf. int. 95%)	0.24 (0.2–0.28)	0.27 (0.23–0.32)	0.29 (0.24–0.34)	0.26 (0.21–0.31)	0.16 (0.12–0.2)
Proportion of credit transfers (conf. int. 95%)	0.05 (0.03–0.06)	0.07 (0.05–0.09)	0.05 (0.03–0.07)	0.05 (0.03–0.07)	0.03 (0.02–0.04)
Proportion of direct debits (conf. int. 95%)	0.17 (0.09–0.25)	0.26 (0.19–0.33)	0.27 (0.19–0.34)	0.25 (0.18–0.31)	0.28 (0.21–0.34)

2. By labour market status					
	Employee	Pensioner	Unemployed	Student	Other*
Proportion of electronic payments (conf. int. 95%)	0.30 (0.27–0.33)	0.14 (0.11–0.17)	0.08 (0.03–0.13)	0.16 (0.09–0.23)	0.14 (0.09–0.19)
Proportion of card payments (conf. int. 95%)	0.30 (0.27–0.32)	0.16 (0.12–0.21)	0.10 (0.04–0.16)	0.16 (0.09–0.24)	0.15 (0.09–0.2)
Proportion of credit transfers (conf. int. 95%)	0.06 (0.05–0.07)	0.03 (0.02–0.05)	0.03 (–0.01–0.06)	0.02 (0–0.04)	0.05 (0.02–0.09)
Proportion of direct debits (conf. int. 95%)	0.28 (0.23–0.32)	0.27 (0.2–0.33)	0.08 (–0.04–0.21)	0.00 –	0.13 (0.05–0.21)

* Childcare allowance, childcare benefit, disability pensioner, homemaker, other inactive, other dependant

3. By residence				
	Capital	County towns	Other towns	Villages
Proportion of electronic payments (conf. int. 95%)	0.29 (0.24–0.34)	0.27 (0.22–0.31)	0.19 (0.16–0.22)	0.19 (0.16–0.22)
Proportion of card payments (conf. int. 95%)	0.30 (0.25–0.34)	0.25 (0.2–0.3)	0.20 (0.17–0.23)	0.25 (0.21–0.29)
Proportion of credit transfers (conf. int. 95%)	0.05 (0.03–0.07)	0.04 (0.03–0.06)	0.05 (0.04–0.06)	0.05 (0.03–0.07)
Proportion of direct debits (conf. int. 95%)	0.29 (0.21–0.37)	0.35 (0.27–0.42)	0.21 (0.16–0.26)	0.20 (0.15–0.25)

Analysis methodology of interbank reference rates – International trends and the results of the first Hungarian annual statistical analysis for 2014

Dániel Horváth – Eszter Makay

The importance of interbank rate quotations is enormous from the aspect of pricing loans, deposits, and financial instruments, and in general for the efficiency of resource allocation mechanisms in the economy. Consequently, it is crucial to ensure that interest rate quotations are defined in a transparent, authentic, and reliable way, and that they reflect true market conditions and the widest possible information base without any distortion. In recent years, following the manipulation experienced on international financial markets, the regulatory environment has been made stricter, and the mechanism of determining key interbank reference indicators has been transformed. Adjusted to international trends, the quoting practice of BUBOR has been reconsidered, and the control has been transformed. Apart from official and internal banking audits offering direct insights in the checking of interbank rate quotations, more emphasis has been laid in recent years on statistical analyses that belong to the scope of indirect analysis methods, and our article will focus on this new method of examination. The article reviews the methods used so far in international and domestic statistical examinations, and presents the Hungarian analysis framework compiled on the commission of the Quotation Committee of the Hungarian Forex Association (MFT), as well as the results of the first analysis regarding 2014. The article contributes to the international technical literature on the subject mainly by building an analytical frame based on the example of the Hungarian interbank reference rate, using various statistical approaches, which will demonstrate the key aspects of the conduct of individual panel banks and the development of the reference rate.

Journal of Economic Literature (JEL) Classification: G14, G18, G21, C38

Keywords: BUBOR, reference rate, LIBOR, cluster analysis, structural breaks

*Dániel Horváth is an economist analyst at the Magyar Nemzeti Bank. E-mail: horvathd@mnb.hu.
Eszter Makay is a junior analyst at the Magyar Nemzeti Bank. E-mail: makaye@mnb.hu.*

1. Introduction

In recent years, following the manipulation experienced on international financial markets, the regulatory environment has been made stricter, and the mechanism of determining key interbank reference indicators has been transformed. In addition to the United States, reference rates were reviewed in the United Kingdom, the euro area, Canada, Denmark, Sweden and Japan, as a number of deficiencies were discovered in relation to the global financial crisis. In parallel with the audits conducted by national supervisory bodies, international institutions have also formulated some guidelines for the definition, checking, and supervision of reference rates. For instance, the “Wheatley Review” produced in the wake of the manipulation of LIBOR (*Wheatley Review 2012*) included several relevant proposals for the future of interbank rate quotations. Among other things, in order to improve transparency, this review recommended that the audits by the supervisory bodies be more transparent and quotations be subject to regular statistical examinations.

Adjusted to international trends, the quoting practice of BUBOR has been reconsidered as well. The revision of the BUBOR quoting methodology and regulations, as well as the quotations themselves have been going on in parallel with the international re-working of the principles related to reference rates.¹

The code of conduct strengthening the control process of rate quotations is presently being developed in Hungary and might offer some guidelines for panel banks on the consideration of factors potentially influencing quotations and an organisational structure that allows for prudent quotation activities, as well as the controlling and supervisory processes.

The importance of BUBOR is enormous in many respects, and therefore it is important that it is defined in a transparent, authentic, and reliable way. On the Hungarian markets, a significant portion of financial products use the 3-month BUBOR as reference rate, and therefore even small changes may have a significant impact, and the general public may also pay close attention to its development.² It also needs to be pointed out that the possibilities of substituting BUBOR with other reference rates are limited, and thus strengthening the reliability of the existing quoting process and BUBOR is of special importance. From the aspect of the financial market and financial stability monitoring activities of the central bank, it is also important that BUBOR reflects true market conditions and the widest possible information base without any distortion.

¹ International experiences, the Hungarian attempts and other issues related to BUBOR are reviewed in detail by *Erhart–Mátrai (2015)* and *Erhart et al. (2013)*.

² In the case of corporate loan products, traditionally, it is variable interest rates adjusted to BUBOR that have been typical (see *Walter 2014*), and their weight has also recently increased in the retail segment.

In connection with the reform of BUBOR, it is also necessary to strengthen the control functions and external control. This is why there is a need for regular, annual statistical analyses, which allow the BUBOR-related processes to be captured with annual frequency and reasons for possible changes to be detected. Another objective of examinations related to BUBOR is that possible signs of manipulation activities, mistypings, and in general non-market-conform price quotations can be identified, and, as a result, the credibility of BUBOR and the information contents of interbank rate quotations can improve.

It is important to note that international experience indicates that several methods are required to test the reliability of reference rates: official audit methods (e.g. checking e-mails and other communication channels), internal audits in banks (compliance), and statistical analysis. These audits complement one another. The statistical approach is suitable for the identification of certain signs of the intention of manipulation and for the detection of systematic behaviour patterns, but these can be considered as indirect instruments only, which are unable to capture all forms of manipulation. Official audit methods and internal bank audits provide a direct insight into the activities of panel banks; therefore they are also useful in specific evidentiary procedures, and are able to detect the intention of manipulation even in cases when statistical instruments are not able to do so, or when it does not seem to be significant. However, the main advantage of statistical examinations is that they are able to detect the intention of manipulation even when no specific proof is available. The publication of analyses has a deterring effect on such conduct as well, as the affected institutions would run a serious reputation risk with any manipulation.

In this article, we first present the international experiences and results of statistical analyses related to key reference rates, and then provide a brief overview of the features of the Hungarian unsecured interbank market. Following that, we present the objectives of regular analysis and the Hungarian statistical analysis framework developed on the commission of the Quotation Committee of the Hungarian Forex Association, as well as the results of the first examination regarding 2014, sorted by the six key analysis considerations.

2. Methods of statistical analysis used in international practice

At the end of 2012, the experts of the European Banking Authority (EBA) and the European Securities and Markets Authority (ESMA) jointly analysed the EURIBOR quoting process,³ using the following key considerations:

³ EBA–ESMA (2013)

- In the course of the examination of EURIBOR quotations, they found that identical interest rate quotations submitted on several consecutive days were rather frequent. In one case, the quoting bank listed the same interest rate levels permanently, for 67 days, for several tenors.
- The analysis pointed out the importance of identifying quoting banks that permanently divert from the average. The observation of most frequently trimmed panel banks on both the low and the high side may facilitate the identification of one-sided quoting behaviour that often differs from the average.
- In order to identify deviating quoting behaviour, the development of interbank reference rates of different countries were compared. The comparison of EURIBOR and LIBOR quotations shows that these two rates were very close to each other before the crisis, but since the end of 2009, EURIBOR has been significantly higher than LIBOR, by approximately 10 basis points. The lower level of LIBOR may be explained by the fact that in the stricter interbank rate environment during the crisis, the banks may have felt an urge to conceal their own financing problems with lower quotations (stigma effect).

In addition to the retrospective examination of EURIBOR quotations, it is worth mentioning that EURIBOR rate quotations are also subject to preliminary checking. Thomson Reuters, which accepts, records and then publishes the quotations, conducts a preliminary check before publication, in the course of which outliers are reconciled with the quoting banks. In spite of the preliminary examination (“sanity check”), the analysis of EURIBOR identified presumably incorrect quotations which, in the course of trimming, were removed from quotations used for the calculation of the average, but if they had been filtered out during the preliminary checking by Thomson Reuters, the EURIBOR fixing would have had a different value. This highlights the need for the refinement of preliminary checking as well.

Fouquau–Spieser (2014) examines LIBOR quotations in the period 2007–2012, looking for structural breaks and cartelling behaviour:

- *Identification of structural breaks:* The authors used two different methods⁴ to examine the time series of LIBOR quotations, depending on whether or not there was a structural change in the level or dynamics of indicators. Both methods applied identify 9 October 2008 as the date of the significant structural break for the time series of LIBOR rates. Looking at the quotations of individual banks, most models indicated 9 October 2008 as well, but there was an exception (Barclays) where the behaviour changed 2–3 weeks earlier. As a result of further investigation and based on direct evidence (correspondence, etc.), the authorities defined the primary responsibility of this bank (“the organiser of the cartel”),

⁴ For details see *Zivot et al. (1992)*, and *Perron (1997)*.

which indicates that it might be really worthwhile to examine the time series from this aspect, using statistical approaches.

- *Identification of cartels*: The authors carried out hierarchic cluster analysis on the whole sample and on the two parts of the sample determined by the structural break. This method allows for the grouping of banks that follow similar quotation strategies, and for examining the behaviour of groups one by one. The results suggest that in the whole time series, as well as in the sample taken before the structural break, Barclays bank followed a special strategy, while the rest of the banks belonged to two large groups. However, between the groups and inside the groups, only relatively loose relations were identified. In the sample taken after the structural break, Barclays is already part of one of the larger groups, and within the group, the strategies of banks were moving closer to each other, which means the strengthening of coordination. All in all, the results of the cluster analysis indicate events similar to those detected by the official investigation.

Monticini–Thornton (2013) examined whether or not LIBOR rate quotations distorted downwards significantly influenced the development of LIBOR. In the course of the examination, they tested the statement that if LIBOR quotations were really and deliberately diverted downwards, there had to be a statistically significant reduction in the difference between LIBOR and the banks' CD rates⁵, as a result of the LIBOR manipulation. The authors were looking for the presence of structural breaks in the spread among the examined rates, using the Bai-Perron test. The econometric examination carried out on the difference between the rates of 1-month and 3-month LIBOR and bank deposit certificates identified structural breaks. The results of both tenors indicated that LIBOR quotations significantly diverted downwards by some banks had a significant impact on the LIBOR rate.

In February 2013, the Hungarian Financial Supervisory Authority published a detailed study⁶ on the statistical analysis of portfolios related to BUBOR and BUBOR quotations. The results of the examination of potential problems occurring during the BUBOR quotation process and the methods used for the identification of signs of manipulation were as follows:

- *Relation between interest rate derivative positions and BUBOR quotations*: The institution-level development of net positions originating from forint FRA, IRS and CIRS transactions related to 3-month and 6-month reference rates were compared with the BUBOR quotations. Following the examination of significant net position changes that occurred in the period from the beginning of 2009 to the middle of 2012, and the development of the quotations of the given bank, it was found that

⁵ The CD or Certificate of Deposit is a financial instrument which helps credit institutions collect funds.

⁶ *Hungarian Financial Supervisory Authority (2013)*.

there was no relation between the BUBOR-related derivative positions of banks and the quotations, and no signs of manipulation were detected.

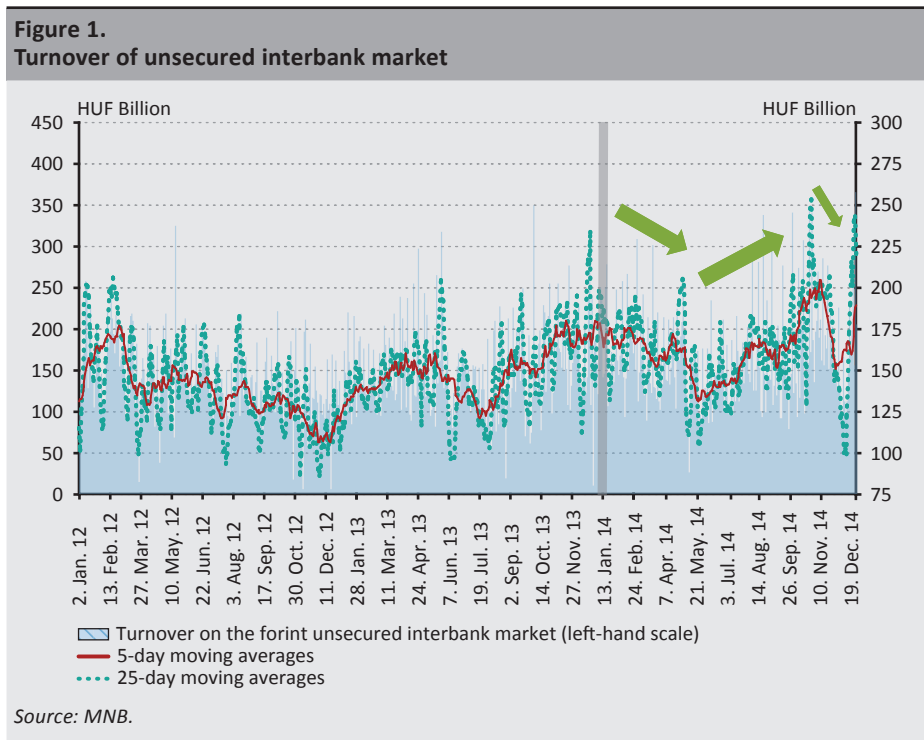
- *Identification of data errors:* Incorrect quotations were identified in the time series of O/N, 1-month, 3-month and 6-month individual BUBOR quotations of banks, indicating deficiencies in data quality.
- *Standard deviation of interest rate quotations:* The examination of the standard deviation of quotations may be a suitable method for the identification of possible anomalies that can be observed in the quoting behaviour of banks. According to the supervisory examination, between the beginning of 2004 and June 2012, the standard deviations of quotations remained low in the tenors of 1, 3 and 6 months, and only increased in turbulent periods.
- *Comparison of BUBOR with reference rates:* BUBOR quotations primarily follow the course of the base rate, but are influenced by other reference rates as well, although this relationship changes in time, which indicates that BUBOR values cannot be derived from any other market benchmark rate.
- *Cluster analysis:* The supervisory study carried out a cluster analysis for 3- and 6-month BUBOR quotations in order to identify any potential systematic behaviour in the quoting activities of banks. Based on the cluster analysis, it can be stated that some institutions tend to drive BUBOR downwards, while others tend to drive it upwards. However, no joint distortion in the same direction was found, which would imply harmonised behaviour by banks.

In addition to the above methods, the literature describes a number of other alternative approaches. *Haaker (2013)* uses game theory methods to analyse the LIBOR manipulation case, and points out the role of punishments and long-term reputation risks. *Bariviera et al. (2015)* use information theory methods for the examination, also in connection with the LIBOR case. Based on the results, the applied information theory indicators (entropy and statistical complexity) seem to be useful in the examinations, because they point out “suspicious” patterns in the conduct of panel banks. Another relevant and related research subject is the cooperative game theory, which can be used to model the background of community decisions and the formulation of interest groups (see e.g. *Bachrach et al. 2011*). In the future, these approaches may serve as a basis for the further improvement of the Hungarian analysis methodology described in the article.

3. Unsecured interbank market in 2014 in Hungary

From the aspect of the development of BUBOR, the market of unsecured bank transactions is of key significance, because in optimal cases the interest rates of unsecured interbank loans provide guidance for panel banks quoting the rates for the determination of rate quotations.

In terms of the major scenes of bank liquidity management, the unsecured interbank market is one of the smaller markets, as it still has a relatively moderate turnover, even after the restoration of the trust that was lost during the global financial crisis. On the other hand, it needs to be pointed out that at the beginning of 2014 the turnover of the unsecured interbank market exceeded the average volume which was typical in previous years, suggesting rising activity. In the first half of the year, depo market turnover followed a slightly decreasing trend and fell to a more significant extent in May, but historically it was still not low. In May, with the narrowing of interbank forint liquidity, depo market turnover temporarily dropped, which may have been caused by seasonal factors related to the Hungarian banks' keeping their reserves and the expected negative liquidity shock. At the end of May, depo market activity started to increase again, and by the end of October it surpassed the higher level experienced at the beginning of the year. All in all, in view of these processes, we can say that the turnover of the unsecured interbank



market in the examined period was driven by factors that generally characterise the market, and thus the impacts of the changes in the market did not really influence the quotation of BUBOR. On the other hand, it is a favourable development that the slow and gradual increase in the annual average turnover after the crisis also continued in 2014 on the depo market (*Figure 1.*).

Another important feature of the unsecured interbank market – in addition to the fact that this market has the lowest turnover among the key domestic money markets – is that significant activity can only be observed in tenors of less than 1 month, and most of the transactions are made by the banks in the shortest, one-day segment.

In 2014, most of the deals were also concluded with the shortest O/N tenor by the market players. In the case of longer maturities, turnover was lower and gradually decreased with the increase in the term. While deals with overnight tenors were concluded on each trading day, 3-month unsecured interbank deals were only concluded on 47 days, for a total of 49 such transactions in 2014. All of this implies that in spite of the moderate increase in interbank market turnover, the frequency of deals with longer tenors is still low, and for lack of real market transactions, this makes the quoting practice of interbank reference rates difficult, as the panel bank involved in quoting has to consider other data sources as well, instead of transactions observed on the reference value market. Compared to previous years, the annual amount of contracts with tenors of 3 months declined slightly in 2014, but the frequency of transactions increased, while annual turnover with tenors of 6 months increased significantly, just like the frequency of transactions.

All in all, we can say that similarly to previous years, activity remained low in the 3-month and 6-month segments of the unsecured interbank market in 2014, and the liquidity of the 6-month tenor is still below that of the 3-month tenor, in spite of the increase.

4. Considerations in Formulating the Analytical framework

As we already noted, the importance of BUBOR quotations is very significant from a number of aspects, and therefore it is important that the quotations are defined in a transparent, authentic, and reliable way, and reflect real market conditions and the widest possible information base without distortion. For this purpose, we considered five key considerations in the formulation of the analytical framework.

4.1. Checking the adjustment of quotations to market prices

Although there are usually no transactions behind banks' quotations, it is a key objective to ensure that quotations correspond to market conditions. That can guarantee that BUBOR is defined on the basis of the latest information base, in

such a manner that increases market efficiency and that financial products are priced in a way that is reassuring and “fair” for the general public as well. In this respect, it is a good idea to compare BUBOR quotations with yield levels emerging on other markets.

Duffie–Stein (2014) demonstrated that, as interbank reference rates gain ground, their use has also become widespread on a number of other markets which are not directly related to the costs of interbank fund placement. All of this means, for instance, that reference rates based on the interest rates of less liquid interbank market transactions also serve as a benchmark on the derivative market with much higher turnover. In the case of a large derivative portfolio, a slight modification of the reference rate may result in a significant change in cash flows related to the derivative portfolio, which might be an incentive to divert the reference rate.

4.2. Identification of panel banks that regularly divert from the average

In respect of diversions from the average, naturally the focus may be on diversions that last longer and that are significant and one-way, but it is difficult to draw the line for the term and the extent. During the examination, this consideration should be used in relation to other analytical methods (e.g. examination of interest rate derivative positions).

There may be several reasons why individual quotations are different from the official BUBOR quotation. The “natural” factors include the following:

- different rate expectations of banks;
- difference between the risk premiums of banks;
- if the liquidity position of the given bank is permanently unfavourable, or it can collect funds at a higher cost, it will probably offer funds to other banks at higher cost, and thus it will quote higher rates;
- on the other hand, the stricter internal rules of the bank may also be the reason for its lending with yields higher than the average;
- experience shows that the standard deviation of quotations increases in an uncertain money market environment.

It is important to note that the code of conduct strengthening the control process of rate quotations is presently being elaborated, and that may offer some guidelines to panel banks for the consideration of factors that influence quotations.

Therefore, quotations that permanently differ from the average may have several justified reasons. The objective is to separate natural reasons from intended

manipulation. While manipulation distorts the market, the above mentioned factors are natural characteristics of rate quotations and facilitate the integration of information.

4.3. Improvement of data quality

In international practice, examples were found when quotations were submitted unchanged for a longer period of time.⁷ Quotations that get stuck indicate that the quoting bank does not reflect the information collected from the changes in the market environment in its rate quotations, which is against the objectives of the functions to be served by BUBOR. For the improvement of the information contents of interbank fixing, it is important to filter out unchanged or stuck quotations, as well as incorrectly submitted rate quotations.

4.4. Support for bank treasury staff involved in quotation

The production and publication of regular examinations related to BUBOR quotations and the strengthening of communication among the parties may facilitate the work of panel banks, and, in connection with the previous point, may encourage them to improve the quality of data submitted.

4.5. Audits should not jeopardise the existence of BUBOR

In the establishment of the regular analysis and checking of BUBOR quotations, one important consideration is that these activities should not punish panel banks and should not reduce the motivation of banks to submit quotations. If the range of active quoting banks is wide, the BUBOR fixing provides a wider scope of information on interbank lending conditions; therefore, the objective is to make sure that the number of panel banks does not drop after the strengthening of external control. This consideration is especially important for the trimmed average used for the establishment of fixing, as a reduction in the number of data points may have a negative impact on the robustness of fixing.

At the end of 2012, 16 banks were participating in the quoting of BUBOR, while presently only 9 are involved. The higher number of active quoting banks reduces the possibility of manipulating BUBOR, because the highest and lowest values are ignored, and extreme or “diverted” values are not included in the average. However, in the case of fewer quoting banks, the extent of trimming is lower as well, which might give a chance to consider possible manipulating quotations.

⁷ EBA–ESMA (2013).

5. The Hungarian framework and the results of the examination in 2014

In the following, we describe the six key methods used in the Hungarian analysis framework and demonstrate their use on the example of the examination of 2014. In our analysis, we focus on the 3-month BUBOR only, but it is important to note that we also conducted analyses for the equally important 6-month maturity and obtained similar results.

Based on theoretical considerations and international experience, several signs should be checked in quotations; some of these may be related to data errors and others to possible manipulation. Patterns to be examined from the aspect of data errors include stuck or extreme quotations. In respect of manipulation, it is worth examining individual extreme quotes, quotations that permanently differ from the average, the relations between individual quotations, the time series features of quotations and the relations with interest rate positionings. We tried to enforce these considerations in formulating the framework.

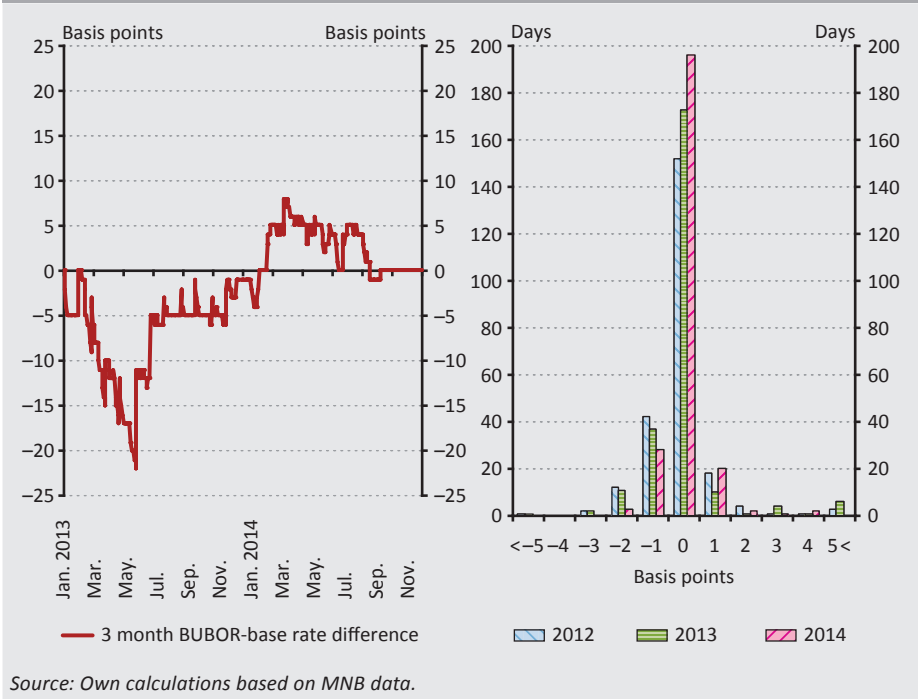
5.1. Identification of stuck quotations

International reference rate analyses show that the unchanged nature of quotations (when they get stuck) may be a problem. For the improvement of the information contents of interbank fixing, it is important to filter out unchanged or stuck quotations and to identify incorrectly submitted quotations.

In 2014, the banks quoted BUBOR on 252 days. In the first 7 months of the year, 10 quoting banks listed BUBOR, and then for the rest of the year, the number of quoting banks dropped to 9. Within the 252 daily fixings, the 3-month BUBOR changed overnight on 57 occasions, and in other cases, a value corresponding to the value of the previous day became the daily BUBOR fixing, which means that in 77% of the cases, the 3-month BUBOR fixing was identical to the previous day's value. In this respect, there seems to be a sharp difference between the first and second half of the year: in the first half of the year, the fixing was unchanged in 68% of the cases, while in the second half, this ratio climbed to 87%. The change observed in the development of 3-month BUBOR quotations may have been supported by the end of the rate-cutting cycle and expectations of rates being maintained, and with the unchanged nature of the base rate, these factors may have reduced the volatility of BUBOR quotations as well.

Based on the daily fluctuations of the 3-month BUBOR, it can be said that in the past 3 years, the fixing was more and more closely related to the base rate (*Figure 2.*). This implies that compared to the base rate, BUBOR has not offered any additional information lately. This historic trend was present in 2014 as well, in the development of the Hungarian reference rate: the longest period in which the 3-month BUBOR fixing did not change was 58 days. At that time, the emerging

Figure 2.
Development of the difference between 3-month BUBOR and the base rate (left panel), and distribution of the daily changes of the differential in the past 3 years



fixing remained at 2.1%, the level of the central bank base rate from the beginning of October to the end of the year.

At the level of individual banks, we evaluated the volatility of bank quotations on the basis of three considerations. First, we examined how many times a bank modified its submitted quotation, and then we checked the maximum length of possible stuck periods. Finally, with the length of the average stuck period, we tried to show the average number of days for which the quotations submitted by panel banks remained unchanged during the year.

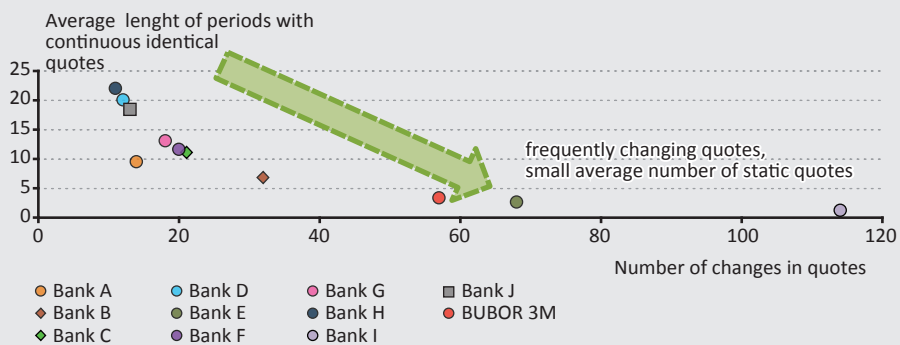
The results indicate that 7 among the 10 rate quoting banks submitted a quotation different from the previous day's on maximum 20 occasions, which indicates low volatility, but this cannot be considered as general, because two banks modified their BUBOR quotations fairly often.

The maximum lengths of stuck periods also show different pictures in the case of various panel banks: the length of unchanged quotations exceeded 50 trading days in the case of 6 banks, but in the case of banks that frequently modified their

quotations, the lengths of stuck periods were effectively shorter. It is interesting to note that from October until the end of the year, i.e. the end of the examination, 6 banks quoted BUBOR at unchanged levels. This resulted in the BUBOR fixing also remaining at 2.1% in the period from 8 October to 31 December.

Based on the average length of stuck periods, the banks moved in a wide spectrum, and the picture of the conduct of individual panel banks seems to be identical to the picture given by the other two “getting stuck” indicators (*Figure 3.*). At Banks I and E on the edge of the spread, long stuck quotations were less frequent, as they often modified their quotations. However, the high value of the average length of stuck periods at some banks indicate that long-lasting unchanged rate quotations happened not only on a few occasions, but are a fairly frequent phenomenon. The high number of quotations stuck at the same time indicates that most of the banks did not make any change in their quotations, and this may imply the stability of market conditions or the improper channelling of market information.

Figure 3.
Length of average unchanged quotations of quoting banks and the number of modifications



Source: Own calculations based on MNB data.

Although it is rather difficult to define how often BUBOR quotations should change on average, when the central bank base rate changes, it is usually justified to modify the quotations, so these cases can be examined separately.⁸ In the 3-month term, we found stuck quotations in the case of 5 banks in the rate-cutting environment. Owing to the calculation methodology of the BUBOR, these individual stuck quotations did not influence the official quotation in 2014. In the quoting of the 6-month BUBOR, it happened slightly more frequently that the banks did not immediately reflect

⁸ In the autumn of 2013, the individual rates stuck after the base rate changes resulted in a situation that the 3-month BUBOR was adjusted downwards only with delays of a few days, after the interest rate cuts.

the base rate change in their quotations, but we did not experience a significant difference in the conduct of the banks regarding these two terms.

In general, we can say that the reduced volatility of the BUBOR fixing, the low frequency of the modifications of individual bank quotations, and the length of stuck periods imply the fact that interbank market conditions were not reflected at all in the BUBOR quotations in certain periods, or only to a limited extent. Looking at the indicators of stuck periods together with stuck rates following the base rate changes, two banks acted differently from other active quoting banks: Bank H seldom modified its rate quotation, even compared to other banks, and submitted unchanged quotations already from July, while Bank I was on the other edge of the spectrum with its activity.

5.2. Relation to alternative market benchmarks

BUBOR quotations reflect money market information which may appear in other reference rates as well, and thus it may be worthwhile to review their relations and their changes in time, as this may also be indicative for the explanation of the development of BUBOR. We compared the BUBOR quotations to the development of 4 alternative indicators. The *base rate* influences interbank rates – including the BUBOR level reflecting costs of funds by definition – through the various channels of monetary transmission. The comparison of *FRA yields* with BUBOR is relevant because the parties to the agreement make a bet on the future value of the reference rate, i.e. the FRA yields reflect market expectations regarding rates. The advantage of FRA yields is that it is a liquid market, but in comparison with BUBOR, one disadvantage is that the capital amount does not change hands, i.e. credit risk is not reflected in the rates.⁹ The *FX swap market implied HUF yield* reflects the rate of the secured FX market transaction interest rate. Similarly to BUBOR, both interest rate and liquidity risk factors can be detected in the development of the *3-month discount Treasury note*, but apart from the interbank market processes, other impacts such as the default risk of the state are also reflected in T-bill yields.

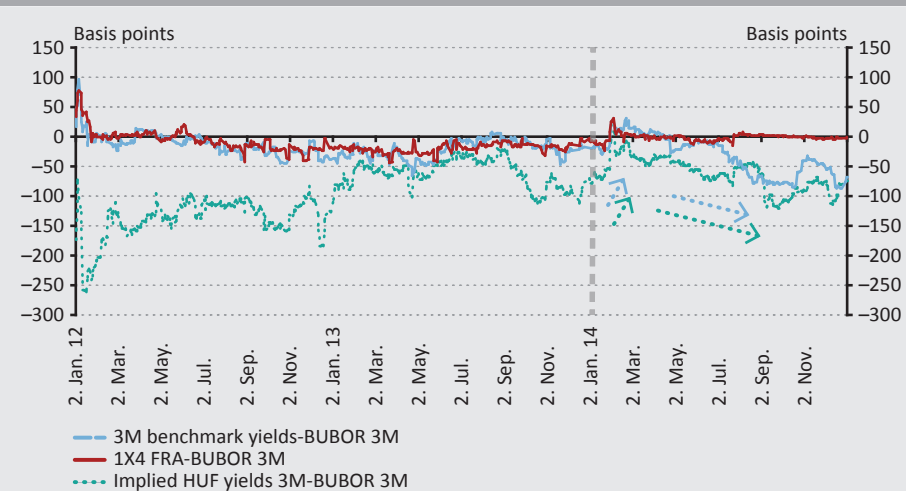
In examining the relation with other benchmarks, the analysis of correlation data is also an option, but as a result of the low volatility of BUBOR (see *Figure 2.*), this method is not informative under the Hungarian conditions. Therefore, we examined the difference between BUBOR and alternative yield indicators.

⁹ It is important to add that in the pricing of FRA deals, the parties use the expected future value of BUBOR as a base, and therefore the FRA rates also partly include the information reflected in BUBOR, and thus it is not a benchmark that is independent of BUBOR. On the other hand, the comparison of BUBOR and FRA quotations might still be justified, considering the fact that, owing to the higher turnover, the FRA market offers more information on the market rate expectations than the depo market and thus renders the picture of the financial market rates more complex. The relation of BUBOR to rate expectations is analysed in more detail by e.g. *Horváth et al. (2013)*.

The deviation of base rates and FRA yields from BUBOR did not really change during the year, as it stagnated around zero (*Figure 4.*). It is worth noting that at the beginning of the year, during the emerging market turbulence, interbank rates effectively increased, and thus the 1X4 FRA quotations increased by 43 basis points, and the EUR/HUF exchange rate rose from 305 to over 313 in 4 days. In the meantime, the 3-month BUBOR increased by 4 basis points to the level of the base rate, and then steadily tracked the central bank policy rate.

In the case of the three-month T-bill, an effective decline in yields started at the beginning of July, which continued even after the closing of the rate-cutting cycle of the end of July, but this was not reflected in BUBOR quotations. The low level of short-term government securities market yields was remained in place, all the way until the end of the year. This can be explained partly by the transformation of the set of MNB tools and the related change in the liquidity management of the banking system, and partly by the reduced issues by the Government Debt Management Agency. In addition to a number of other seasonal and individual factors, another aspect which was also partly related to the change in the set of central bank tools was that the HUF liquidity released after the transformation of MNB bonds into deposits may have increased the HUF supply on the FX swap market, which may have contributed to a reduction in the implied HUF yield, and thus to its deviation from BUBOR.¹⁰

Figure 4.
Difference between reference rates and BUBOR



Source: MNB; Bloomberg

¹⁰ The development of the FX swap market implied HUF yields is influenced among other things by the position of foreign players and the HUF liquidity of banks. The latter is influenced by a number of factors, for example the end-of-quarter impact or deposits and withdrawals related to the treasury account. In 2014, the central bank introduced its self-financing programme, which may have further influenced implied HUF yields, in addition to the factors already mentioned and observed in earlier years.

All in all, in the course of 2014, BUBOR quotations were close to the key benchmarks, which means that BUBOR changed in harmony with other market indicators. The occasionally different dynamics were explained by individual factors affecting the benchmarks, i.e. the reason was not a change in the dynamics of BUBOR.

5.3. Outlier quotations

From the aspect of the reliability of the BUBOR fixing, the identification and examination of outlier rate quotations is of special importance. A quotation that is effectively different from the average rate quotation may indicate a data error, a shock affecting the individual bank, or even deliberate manipulation.

5.3.1. No significant data quality problems originating from mistyping in 2014

The time series of individual bank quotations moved together in 2014, and quotations differed from the average, i.e. from the BUBOR fixing, to a small extent only. It is a positive phenomenon, that in the case of quotations submitted in 2014, no outliers suggesting data errors can be identified, which means that problems of data quality nature originating from mistyping did not deteriorate the reliability of BUBOR in the last year.

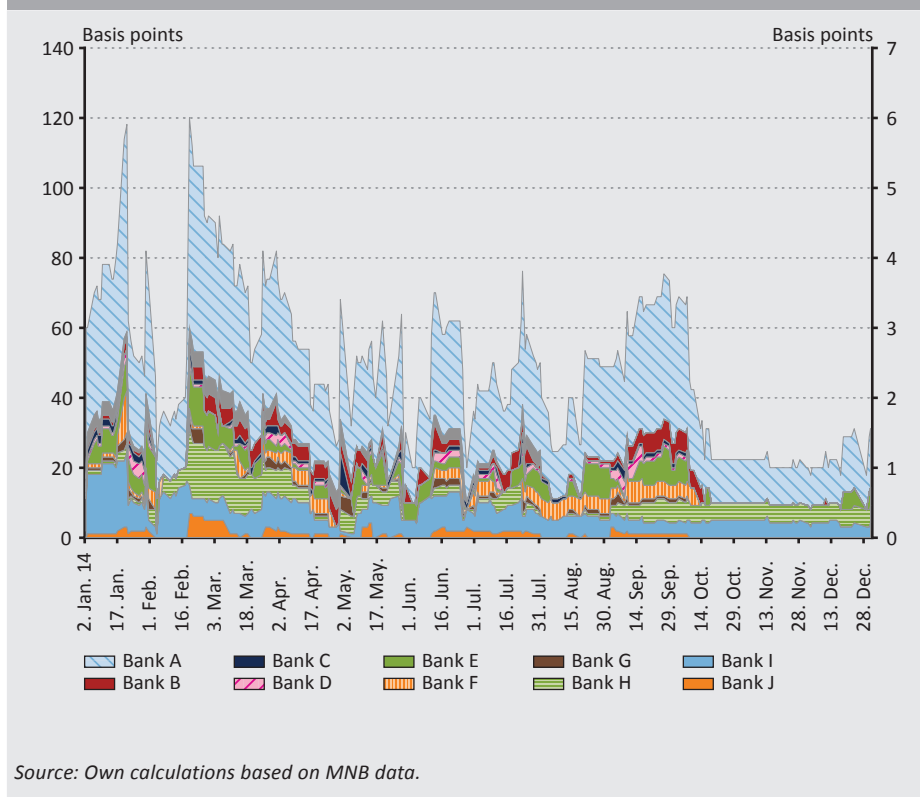
5.3.2. No outliers found in individual bank quotations

The value of the absolute difference calculated from the 3-month BUBOR of active quoting banks moved in a narrow band in 2014, between 1 and 6 basis points on an average (*Figure 5.*).¹¹ The differences compared to BUBOR were extremely high on two occasions, both times in connection with the drop in the central bank base rate, but the difference was not caused by an outlier value but by stuck quotations, because in the environment of the February base rate cut, one of the banks did not modify its quotation.

Individual quotations which are different from the official BUBOR quotation can be explained by several natural reasons, such as the different rate expectations of banks, the difference between the risk premiums of banks, the stricter internal rules of the banks, or their changed liquidity position. Therefore, quotations permanently different from the average may have several reasons, which is measured in the examination with the average of the absolute difference from BUBOR. A significant difference compared to the average may mean that other effects may have driven the rate quotation as well, in addition to natural factors. In the respect of 3-month BUBOR quotations, a difference from the average by more than 10 basis points was observed in the case of 3 banks last year, but outlier individual bank quotations were not the reason for any difference.

¹¹ The absolute differences are the differences in absolute values between the individual quotations of quoting banks and the official BUBOR of the given day. Therefore, we did not consider the direction of the difference, only its rate. The average absolute difference refers to the average of differences experienced at the panel banks.

Figure 5. Absolute differences of rate quotations of banks from the 3-month BUBOR in 2014

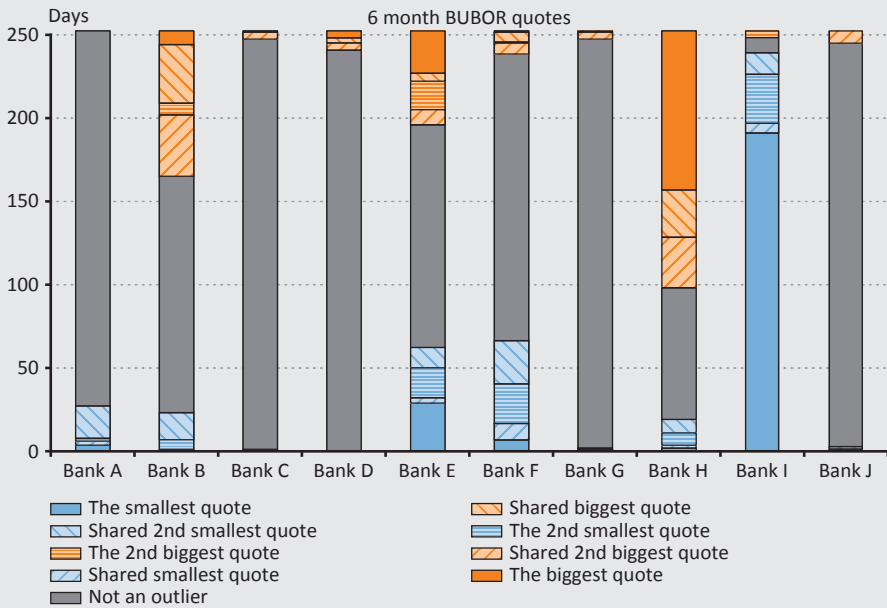
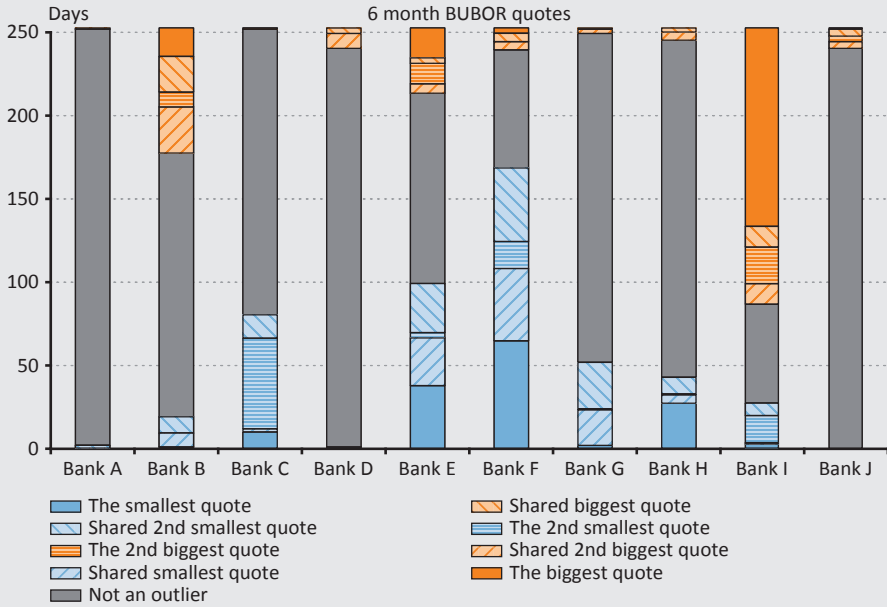


5.3.3 Quotations to be eliminated

The effects of outlier values can be mitigated by the trimmed averages used in the generation of interest rate fixing, when in the case of certain quotation number the upper and the lower values are ignored in a certain proportion. A different rate quotation activity may be indicated when a bank's rate quotations are regularly excluded from the trimmed average, but it is also possible that the difference can be explained with natural reasons. In the definition of the quotations to be eliminated, it may be a problem that several banks submitted the same quotations at the tails of the dispersion. In that case, the extreme value to be eliminated is not considered to be an outlier. (In the examination, we applied the rule that when more than two banks submitted the same value, the quotation was not included as an outlier.)

Last year, the 3-month BUBOR quotation of Bank I proved to be the lowest quotation in more than three quarters of the cases, which means that it did not only regularly deviate downwards from BUBOR, but that it also provided the smallest quotation among the panel banks. Bank I was often at the bottom of the range not only as

Figure 6.
Frequency of potentially ignored quotations of panel banks

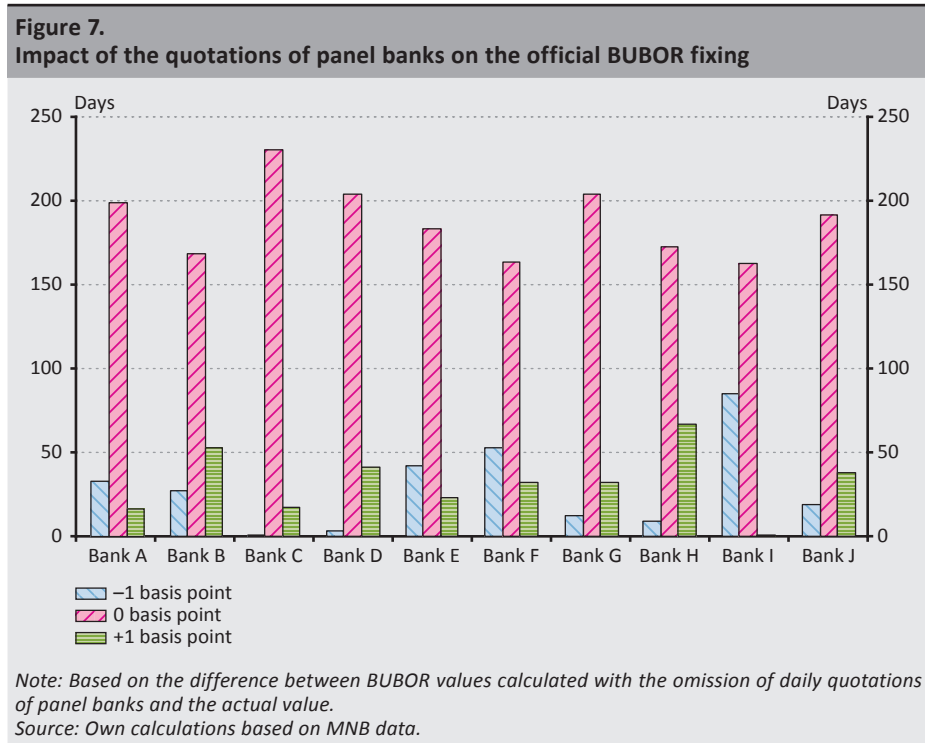


Note: Cases when the number of identical rate quotations was more than two were not considered as outliers, while the two identical extreme values were put into the divided category.

Source: Own calculations based on MNB data.

the lowest value, but as the second lowest value as well. Similarly to the smallest quotation, the highest quotations were concentrated in the quotations of one bank. In more than 50% of the cases, Bank H quoted the highest BUBOR value among the panel banks, which can be explained with the quotations stuck at a level higher than the average in the second half of the year (Figure 6.).

However, it can be stated that during the year the quotations of individual banks did not affect the official BUBOR fixing (Figure 7.), and when it did, it was by a maximum of 1 basis point, which is a negligible extent.



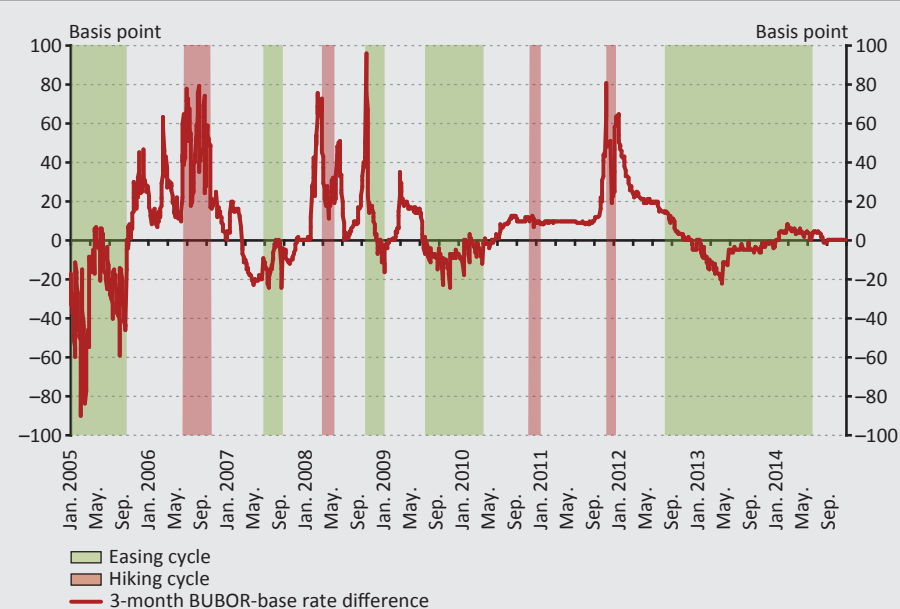
All in all, it can be stated that the differences of individual bank quotations from BUBOR are of a moderate extent, and the differences refer to stuck quotations, and not to outlier rate quotations. In some cases, the turbulent market environment at the beginning of the year and the slowdown and end of the MNB rate cycle may have contributed to the difference between individual bank quotations and BUBOR. Based on the quotations to be eliminated in the calculation of the trimmed average, there were banks which behaved differently from the average, but individual quotations had no effective impact on the official fixing. The individual differences should be examined together with other considerations.

5.4. Identification of structural breaks

From the aspect of the examination of the quotations, it is also a relevant issue whether there is a turning point in the development of BUBOR quotations which indicates a serious change in conduct. First, we examine the official 3-month BUBOR quotation and then turn to the conduct of individual panel banks.

As BUBOR shows a strong relation to the base rate, we primarily examine this relationship, which gives us a chance to analyse the changes justified by general market trends. Based on the observations from the past 10 years (Figure 8.), we can say that the relation of the 3-month BUBOR and the base rate is effectively defined by the rate cycle the MNB is currently in: in increasing cycles and at times of unchanged base rate, the 3-month BUBOR is usually over the level of the base rate, and in decreasing cycles, it moves below that. The background to this phenomenon consists of several related factors. On the one hand, the expectation regarding the two-week interest rate may appear in BUBOR, which can explain the observed relation. On the other hand, the rate cycles are related to the changes in the risk premium, which may affect the BUBOR level as observed. Thirdly, the 3-month BUBOR may contain premium factors as well (e.g. maturity premium¹²), which justify

Figure 8.
Development of the difference between 3-month BUBOR and the base rate in the MNB rate cycles



Note: The positive values mean a 3-month BUBOR level higher than the base rate.
Source: Own calculations based on MNB data.

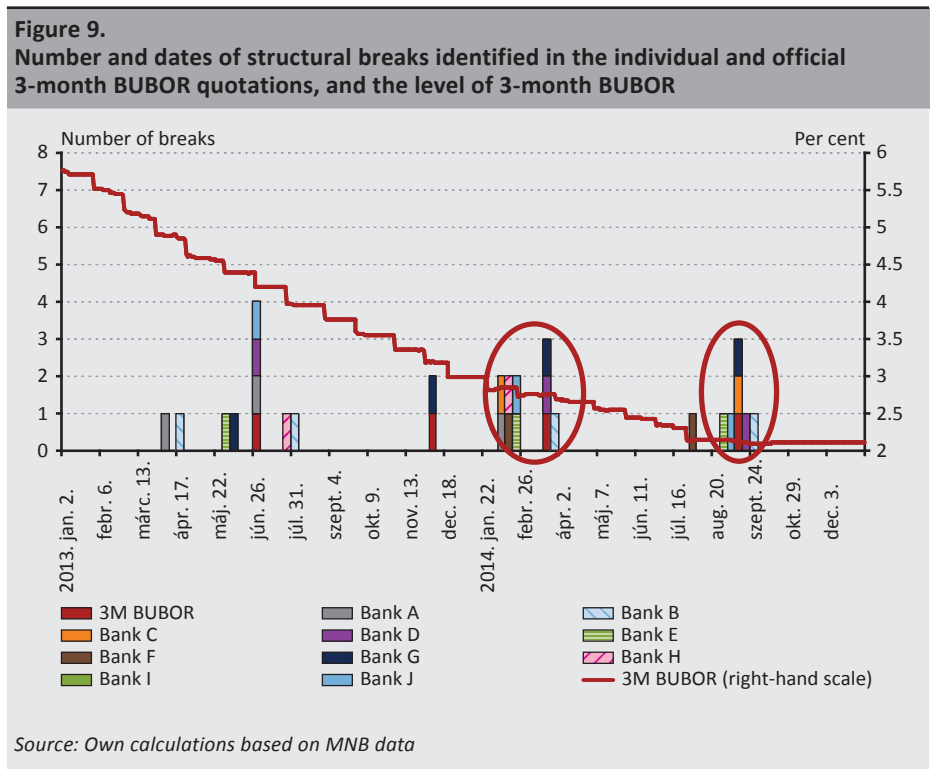
¹² See e.g. Horváth et al. (2013).

the fact that in calm periods and at times of an unchanged central bank rate, BUBOR is over the base rate level.

In 2014, at the time of the slowdown and then the end of the MNB rate-cutting cycle, changes corresponding to the pattern of previous years took place in the BUBOR-base rate differential: in the last months of the cycle, the difference started to increase, and then it entered the positive range that is a feature of maintaining periods. By the end of the year, the difference stabilised at 0 level, which can be partly explained by the forward guidance of the MNB in relation to leaving the level of the base rate unchanged. The 3-month BUBOR tied to the base rate also means that in the second half of 2014, BUBOR did not present any additional information compared to the base rate.

All in all, we can say that in 2014, the change experienced in the development of the 3-month BUBOR corresponds to the pattern observed at the time of closing base rate cycles in the past, and is in harmony with the course justified by theoretical considerations.

Based on the statistical analysis of the official 3-month BUBOR time series, two major breaks can be identified in the time series in 2014 (*Figure 9.*): early spring and



end of summer. The change in the behaviour of individual quoting banks is related to these two dates, although there may be a difference of a few weeks. It is important to point out that it is possible to identify an event for both dates which may explain the change in the conduct of panel banks. In the case of the early spring time, the slowdown in the MNB rate-cutting cycle, and in the case of the end of the summer, the end of the rate cycle may have been important background factors, which can explain the change in the behaviour of the BUBOR quotations.

Methodology description: Structural breaks

We looked for the structural breaks of time series with the so-called Bai-Perron test.¹⁴ Technically, the test determined the break points of the linear trend adjusted to the time series of the difference between individual quotations and BUBOR. Thus, with this method, the changes in the conduct of the panel bank are identified on the basis of the relation to the official BUBOR quotation. For the sake of more precise estimates, we carried out the test for the period of 2013–2014, but the analysis focused on the break points of 2014 only. In the case of the official BUBOR quotation, the BUBOR-base rate differential was used.

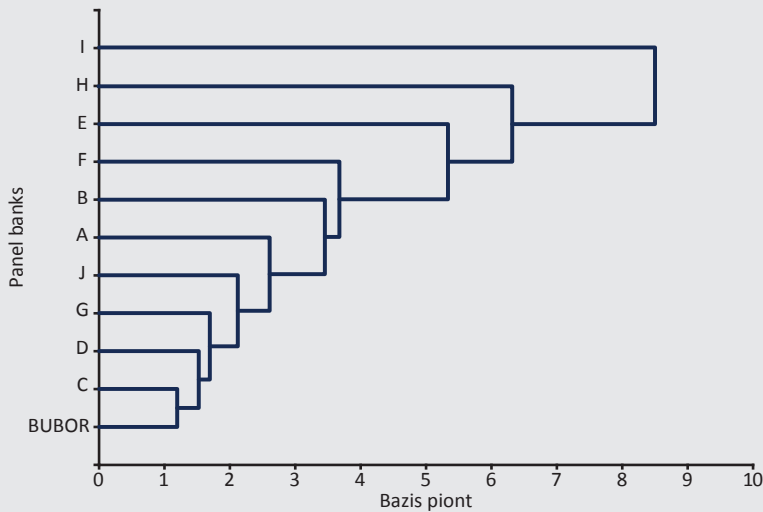
5.5. Cluster analysis

The cluster analysis can be used to examine the relation of individual quoting strategies, allowing us to answer the question of whether it is possible to identify some groups among market makers who behave in a different way. Based on the results (*Figure 10.*) we can say that there is no separate group among the BUBOR quoting banks whose conduct is effectively different from the others, and thus there is no sign of coordination between panel banks.¹⁴ Based on the dendrogram summarising the results of cluster analysis, the [A, J, G, D, C] group followed the official BUBOR quotation more closely than the others. Among the panel banks which followed the official quotation more loosely, Bank I was different. It is an important result that this structure suggests that every entity adjusted primarily to BUBOR, and not to another player or group of players.

¹³ Bai et al. (2003).

¹⁴ We obtained similar results in the case of 6-month quotations.

Figure 10.
Dendrogram of hierarchic cluster analysis produced on the basis of 3-month BUBOR quotations



Note: The distance of market makers and clusters on the horizontal axis may be interpreted as daily average base point difference. Clusters created at a lower level indicate the closer relation of elements. Source: Own calculations based on MNB data.

Methodology description: Cluster analysis

In the course of the hierarchic cluster analysis, we examined the similarities between the individual quotations and BUBOR time series. In the first step of this process, the “distance” of the time series per pair is defined, which in this case is interpreted as the square median of the difference of daily quotations (“Euclidean distance”) which can be interpreted as the daily average basis point difference. Then we define the two closest time series and combine them in one cluster. In this case, this meant the official BUBOR quotation and the time series of bank C, at the basis point level of 1.2. After that, we find the shortest distance again, but instead of the already combined two time series, we use the average difference from these. If the shortest difference is between two “intact” observations, we will create a new cluster from them, but if the difference between an existing cluster and a new time series is the smallest, this cluster is extended with a new time series. This process goes on until all constituents have been put into a group. Based on the dendrogram, the sequence of combinations and the distance among groups can be examined. In our case, in each step, a new time series was added to the already existing cluster, i.e. the time series of each panel bank was around the BUBOR (common average), in a way that they effectively differed from each other in pairs.

5.6. Relation between interest rate derivative positions and BUBOR quotations

The relation between individual BUBOR quotations and the interest rate derivative positions (FRA, IRS and CIRS) was examined using multi-variable regression. For the analysis, we estimated for each bank to what extent the difference between individual BUBOR quotations and the official BUBOR can be justified by the Hungarian CDS spread, the EUR/HUF exchange rate, the base rate and the individual interest rate derivative position (Table 1.). In the regression, the use of the first three common financial variables allows that we take into consideration the fact that the panel bank defines its new individual BUBOR quotation related to these indicators. We tested the analysis with similar results on several partial samples; we analyse the results for the whole sample only.

According to the results, the interest rate derivative positions of Banks G, J and D show significant positive correlations with the BUBOR quotation. In these cases, we examined the development of positions and quotations in more detail as well. Based on the examination, two independent factors may have played a role in the fact that there seems to be a significant relation between the interest rate derivative position and BUBOR quotations. One of the factors is the end of the rate-cutting cycle of the MNB and the message that the rate level would be left unchanged, as a result of which banks submitting higher BUBOR quotations started to submit quotations corresponding to the base rate. The other factor is that as a result of the MNB CIRS tenders related to the conversion of FX loans to HUF, the net CIRS portfolio of banks has fallen. In the second half of the year, these two factors together resulted in the concurrent reduction in the interest rate derivative portfolio tied to the 3-month BUBOR and the BUBOR quotations. This concurrent move is identified by our regression as a relation of positive direction, but there is probably no manipulation intent behind this relation.

All in all, we can say that the BUBOR quoting practice of banks does not show any relation with the individual interest rate derivative positions in addition to the extent justified by external factors.

Table 1.
Results of regressions explaining the difference between individual quotations and BUBOR, by bank

	B	D	E	F	G	H	I	J
c	-0.13 (-0.5)	-0.57 (-3.46)	-0.06 (-0.15)	1.27 (4.13)	-0.05 (-0.33)	-1.06 (-3.29)	-1.1 (-5.61)	-0.41 (-2.38)
CDS	5.52 (0.7)	19.55 (3.9)	1.17 (0.1)	-34.66 (-3.97)	3.94 (0.85)	35.73 (3.65)	33.53 (5.65)	11.07 (2.1)
EURHUF	-0.04 (-2.37)	-0.02 (-1.58)	0.16 (5.28)	0.11 (5.69)	0.01 (1.11)	0.14 (5.55)	0.16 (10.93)	0.04 (3.46)
base rate	3.45 (1.33)	-2.48 (-1.37)	-11.65 (-3.16)	-14.97 (-4.99)	-6.66 (-4.26)	-11.41 (-3.6)	-14.08 (-7.83)	-1.46 (-0.92)
position	-0.04 (-1.04)	1.91 (6.71)	0.07 (1.19)	-0.2 (-3.74)	0.25 (12)	0.03 (1.26)	-0.36 (-14.11)	0.11 (5.79)
R ²	0.05	0.23	0.18	0.21	0.39	0.28	0.66	0.24

Note: In brackets behind the regression coefficients: t-statistics. c: constant; CDS: 5-year Hungarian CDS-spread; EURHUF: euro/forint exchange rate; base rate: MNB base rate; Position: the institution's daily interest rate derivative position tied to BUBOR (FRA, IRS, CIRS).
Source: Own calculations based on MNB data.

6. Conclusion

The statistical approach presented is suitable for the identification of certain signs of manipulation and the detection of systematic behaviour patterns, but it can be considered as an indirect instrument only, which has its limitations. Direct insight into the activities of panel banks is provided by official examination methods and internal bank audits only, but statistical analyses may compliment other audits, and may have a favourable impact on the quality of BUBOR quotations.

All in all, we can say that on the basis of the statistical analysis of BUBOR quotations in 2014, there is no condition that would require the further examination of the official BUBOR fixing or the individual bank quotations.

The reduced volatility of the BUBOR fixing, the low frequency of the modification of individual bank quotations, and the length of stuck periods indicate that in certain time periods, market conditions are not reflected in the BUBOR rate quotations, or only to a limited extent. On the other hand, it can be seen that in the course of 2014, the occasionally stuck individual quotations in the environment of the changes to the base rate did not really influence the BUBOR level, owing to the calculation methodology. In connection with the conduct of individual banks, several analysis methods show that Banks I and H follow a quotation strategy that is effectively different from the strategies of the other panel banks. However, while Bank I differs from other quoting banks with its activities, Bank H differs with its inactivity and often stuck quotations.

In the course of 2014, the BUBOR quotations were close to the key benchmarks, and the occasionally different dynamics can be explained with individual factors affecting the benchmarks. All in all, it can be stated that the differences of individual bank quotations from BUBOR are of a moderate extent, and tend to suggest stuck quotations, and not stem from outliers in rate quotations. The structural change observed in 2014 in the time series of individual quotations and the fixing corresponds to the pattern observed in the past at the time of ending rate-cutting cycles, and is in harmony with the dynamics justified by theoretical considerations. The individual quotation strategies are significantly different, and the methodology used found no signs of coordination. The BUBOR quoting practice of banks does not show any relation with the individual interest rate derivative positions in addition to the extent justified by external factors.

With further processing of the findings of the Hungarian analysis methodology, the methodology may change in the years ahead. Our findings collected so far are summarised in the table below.

Table 2.
Summary table related to the Hungarian examination methodology

Method	Description	Advantages	Drawbacks
Identification of "stuck" quotes	Identification of stuck quotes and other "obvious" errors	Strengthening the information content of BUBOR	It is an ex post tool, it can not prevent errors
Analysis of benchmarks	Analysis of the connection between BUBOR and other benchmark rates	Development of other benchmarks can shed light on the factors influencing BUBOR	Noisy connection
Outlier detection	Identification of the most frequently trimmed panel banks	Capable of identifying banks with significantly different strategy	Different strategy often reflects different conditions ("natural causes")
Cluster analysis	Identification of banks with similar strategy	It can indicate cooperation	It is quite difficult to define what "similar" means
Structural breaks	Identification of structural breaks in the time series of individual quotes and of the fixing	Identification of behavioral changes	A number of "natural" causes can trigger a behavioral change
Analysis of derivative positions	Linear regression between the derivative position and the quotes	It can reveal manipulation motivations in connection with the BUBOR exposure	A number of "natural" causes can be in the background

Source: Own compilation based on the results.

References

- Bacharac, Y. – Elkind, E. – Faliszewski, P. (2011): *Coalitional Voting Manipulation: A Game-theoretic perspective*. International Joint Conference on Artificial Intelligence.
- Bai, J. – Perron, P. (2003): *Computation and Analysis of Multiple Structural Change Models*. Journal of Applied Econometrics, Vol. 18., Issue 1., pp. 1–22.
- Bariviera, A. F. – Guercio, M. B. – Martinez, B. L. (2015): *Data manipulation detection via permutation information theory quantifiers*. XVIII Conference on Nonequilibrium Statistical Mechanics and Nonlinear Physics.
- Duffie, D. – Stein, J. C. (2014): *Reforming LIBOR and Other Financial-Market Benchmarks*. <http://www.gsb.stanford.edu/gsb-cmis/gsb-cmis-download-auth/376246> Downloaded: 2015.04.22.
- Eba, Esma (2013): *Report on the administration and management of Euribor*. https://www.esma.europa.eu/system/files/eba_bs_2013_002_annex_1.pdf Downloaded: 2015.04.22.

- Erhart, Sz. – Ligeti, I. – Molnár, Z. (2013): *A LIBOR-átvilágítás okai és hatásai a nemzetközi bankközi referenciakamat-jegyzésekre*. MNB-szemle, január, pp.22-32.
- Erhart, Sz. – Mátrai, R. (2015): *The most important steps of BUBOR reforms led by the Central Bank of Hungary in an international comparison*. Financial and Economic Review, Vol. 14 No. 1, March, pp. 129-165.
- Fouquau, J. – Spieser, Ph. K. (2014): *Statistical evidences about LIBOR manipulation: A "Sherlock Holmes" investigation*". Journal of Banking & Finance, Vol. 50., January, pp. 632–643.
- Haaker, A. (2013): *To manipulate or not to manipulate – A short comment ont he game of interest rate manipulation*. International Journal of Economics, Finance and Management Sciences. 1(1).
- Horváth, D. – Kálmán, P. – Kocsis, Z. – Ligeti, I. (2014): *Milyen tényezők mozgatják a hozamgörbét?* MNB Szemle, March, pp. 28-39.
- Monticini, A. – Thornton, D. L. (2013): *The Effect of Underreporting on LIBOR Rates*. Federal Reserve Bank of St. Louis, Working Paper 2013-008A. <http://research.stlouisfed.org/wp/2013/2013-008.pdf> Downloaded: 2015.04.22.
- Perron, P. (1997): *Further evidence on breaking trend functions in macroeconomic variables*. Journal of Econometrics, Vol. 80(2), pp. 355-385.
- Pénzügyi Szervezetek Állami Felügyelete (2013): *A BUBOR-hoz köthető állományok és a BUBOR jegyzések részletes statisztikai elemzése*. https://felugyelet.mnb.hu/data/cms2384951/BUBOR_allomanyok_jegyzesek.pdf Downloaded: 2015.04.22.
- Walter, Gy. (2014): *A sztenderd kereskedelmi banki hiteltermékek*. In: Walter György (szerk.) *Vállalatfinanszírozás a gyakorlatban: lehetőségek és döntések a magyar piacon*. 244 p. Budapest: Alinea, pp. 63-76.
- Wheatley Review (2012): *The Wheatley Review of LIBOR: Final Report*. September. http://cdn.hm-treasury.gov.uk/wheatley_review_libor_finalreport_280912.pdf. Downloaded: 2015.04.22.
- Zivot, E. – Andrews, D. W. K. (1992): *Further Evidence on the Great Crash, the Oil-Price Shock, and the Unit-Root Hypothesis*. Journal of Business & Economic Statistics, Vol. 10(3), pp. 251-70.

The macroeconomic impacts of demographic changes in Hungary in the context of the European Union

Emese Kreiszné Hudák – Péter Varga – Viktor Várpalotai

The article provides a review of Hungarian and international demographic trends and examines the macroeconomic impacts of demographic developments in Hungary in comparison with the European Union. Based on available population projections, it is expected that ageing will also characterise Hungarian demographic processes, but the extent of ageing in Hungary may be more moderate than the estimated impact in several regional and Western European countries. According to the population projections and estimations found in the literature, we came to the conclusion that in the long run population ageing is expected to substantially change labour supply, consumption, and savings ratios, dampen growth prospects and potentially exert a disinflationary impact in the upcoming decades. Demographic processes may affect developments in key variables relevant for the conduct of monetary policy and the effectiveness of transmission channels. In addition, population ageing may increase budgetary expenditures through the pension and the healthcare system. The adverse impacts may be mitigated by economic policy measures and adjustment by economic agents. At the same time, demographic processes may also represent an economic opportunity that can be exploited through the adequate reallocation of resources.

Journal of Economic Literature (JEL) Classification: E21, J10, J11, H50

Keywords: economic growth, demographic trends, Hungary

1. Introduction

One of the greatest challenges facing the global economy is population ageing caused by the declining birth rate, coupled with an expected rise in life expectancy. The expected rate and speed of ageing varies by geographic region and country, but Europe is expected to have the highest ratio of older persons in its population by 2050.

*Emese Kreiszné Hudák is an analyst at the Magyar Nemzeti Bank. E-mail: hudake@mnb.hu.
Péter Varga is an intern at the Magyar Nemzeti Bank. E-mail: vargape@mnb.hu.
Viktor Várpalotai is an economist. E-mail: varpalotaiv@gmail.com.*

The authors would like to thank Gergely Baksay and Barnabás Virág for their valuable comments offered for the writing of this article. The article reflects the opinion of the authors, who assume responsibility for any potential errors.

Similarly to the European trend, changes in the population structure in Hungary are also shaped by population ageing. If current demographic trends continue, the old-age dependency ratio may double by 2060. This process is driven by two fundamental factors. On the one hand, Hungary's fertility rate is exceptionally low even in a European comparison, while on the other hand, life expectancy is gradually increasing, albeit from a lower point and at a slower rate than the European average. Assuming a gradually increasing fertility rate and life expectancy remaining below the European Union average, the old-age dependency ratio may slightly exceed the average of the European Union by 2060.

One key question is how the changing age structure will impact the development of macroeconomic variables and how economic policy may help in preparing for these changes. Based on the current prognosis, population ageing is set to impact every facet of life, shaping the expected developments in macroeconomic indicators. It may have an adverse impact on growth prospects and the fiscal balance. In terms of the conduct of monetary policy, it may affect the degree of inflationary pressure, the equilibrium real interest rate and the effectiveness of transmission channels. Adverse impacts can be cushioned using economic policy tools, and negative impacts can also be mitigated through adjustments induced by demographic processes.

2. Demographic processes in Hungary in an international context

2.1. International demographic trends

Population ageing is a trend essentially prevailing in the entire world, but at diverging rates and speeds. The change in the population's age structure may be characterised by an increase in the proportion of older persons (aged 65 or older) in the coming decades (*Table 1*). According to the World Bank's forecast, the proportion of elderly within the population may be the highest in high-income countries: in these countries, one out of four people will be over the age of 65 by 2050. The speed of ageing, which can be identified as the change in the proportion of elderly (*UN 2013b*) may be the most significant in middle-income countries. In these countries, the ratio of persons over the age of 65 may almost triple by 2050 compared to the level in 2000. The number of older persons may increase at a faster pace in less developed regions compared to developed ones, mainly due to the higher birth rates in earlier decades, with the result that 80% of the total older population may be concentrated in less developed regions (*UN 2013b*). This could create an issue, because developing countries could age before their economies converge with developed countries (*Lee et al. 2010*).

Table 1.
Expected rate of ageing across various country groups of the world based on the World Bank's forecast

Country/Country group ¹	Share of 65 years and older in the population			Old-age dependency ratio		
	2000	2050	Change	2000	2050	Change
High income countries	13.7	25.8	+88%	20.3	44.3	+118%
Middle income countries	5.5	15.4	+180%	8.7	24.0	+176%
Low income countries	3.5	7.3	+109%	6.3	11.5	+83%
European Union	15.7	28.9	+84%	23.4	51.4	+120%
Central Europe and Baltic countries	13.5	27.9	+107%	19.8	48.5	+145%
Hungary ²	15.1	26.0	+72%	22.3	43.8	+96%
Hungary ³	15.0	27.5	+84%	22.0	47.3	+115%

Note: 1. Country groups are defined based on the classification featured in the World Bank database, which categorises countries based on gross GDP per capita for 2013. 2. World Bank (2014). 3. Eurostat (2014).
Source: Eurostat (2014), World Bank (2014)

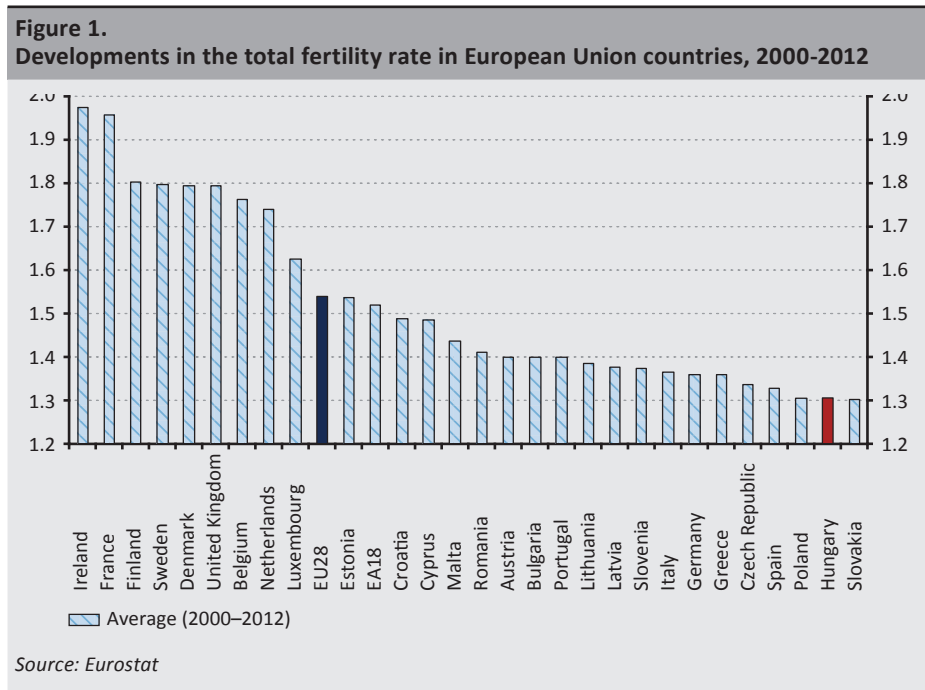
Population ageing refers to a relative rise in the proportion of older cohorts within the population compared to younger ones, which – *ceteris paribus* – could result in a significant rise in the burden of the economically active population. The proportion of older persons relative to persons of working age (*old-age dependency ratio*) may rise to the greatest extent in middle-income countries, driven by the increase in persons aged 65 or older, but the indicator may still fall significantly short of the value in high-income countries (Table 1). In terms of global regions, the old-age dependency ratio may be the highest in the European Union in 2050, rising from 23% in the 2000s to 51% by 2050. This means that while in 2000 there were 23 older persons for every 100 persons of working age, by 2050 there will be more than double this amount, i.e. 51 older persons. The old-age dependency ratio may approach 60% by 2050 in several Western European countries, including Germany and Portugal. Alongside European countries, the number of older persons relative to persons of working age may also increase significantly in Japan: by 2050 this ratio may reach 72% according to the World Bank's population projection (World Bank 2014). Hungary's old-age dependency ratio may double by 2050, but still remain slightly below the estimated average for Central European countries.

Population ageing can also be captured through other population statistics indicators than those mentioned above (ratio of persons aged 65 and older within the population, old-age dependency ratio). These include the ageing index, calculated as the number of older persons (aged 65 or older) per hundred children (persons aged between 0–14) (CSO 2014a). Demographic ageing is also indicated by the population's rising median age (Chawla et al. 2007). Demographic dependency

indicators with modified content also appear in the literature for the evaluation of economic and social impacts of ageing. These indicators compare the number of older persons or inactive persons to the number of persons actually employed rather than those of working age (for instance the total economy dependency ratio).

2.2. Hungarian demographic processes in a European comparison

Hungary's fertility rate is exceptionally low even by European standards, based on Eurostat (2014) data. In European countries, the total fertility rate¹ has declined gradually since the 1960s, but has exhibited a slightly increasing trend since the turn of the millennium, rising from 1.45 to 1.6. The fertility rate in European Union countries is set to fall short of the 2.1 figure necessary for a long-term reproduction,² in spite of the rising trend, and the European fertility rate will be the lowest among the world's regions (UN 2013a). The fertility rate exhibits a significant deviation within the European Union: the rate stood at around 2 in Ireland and France and at 1.3–1.4 in the Visegrad group and Southern Europe (Figure 1). The total fertility rate in Hungary has fluctuated between 1.25 and 1.34 since the turn of the millennium.



¹ The total fertility rate is the “average number of children born alive that would be born to each woman during her lifetime if the prevailing age-specific fertility rates applied during her child-bearing years” (CSO 2014b).

² A total fertility rate of 2.1 children per women ensures broad stability of the population, on the assumptions of no migration flows and unchanged mortality rates (OECD 2013).

Life expectancy has increased slightly since the turn of the millennium, but its level and growth rate remain low by European standards. Life expectancy at the age of 60 averaged 23.6 years in 2012 in the European Union, and Hungary's value (20 years) is one of the lowest in the EU. Since the turn of the millennium, life expectancy at the age of 60 has increased by the same number of years for men and women in Hungary, and thus the gap in life expectancy between the genders has not narrowed.

The low fertility rate and the gradual increase in life expectancy result in the ageing of population in Hungary as well. The falling fertility rate results in smaller cohorts of younger age compared to older generations and also decreases the future number of women of childbearing age, while members of older generations are expected to live longer due to rising life expectancy. In Hungary, 17.5% of the total population is aged 65 and older (*Eurostat 2014*), similarly to the average in other European Union countries (18.6%). The old-age dependency ratio stands at 25.8% in Hungary, which falls slightly short of the 28% of average value of European Union countries.

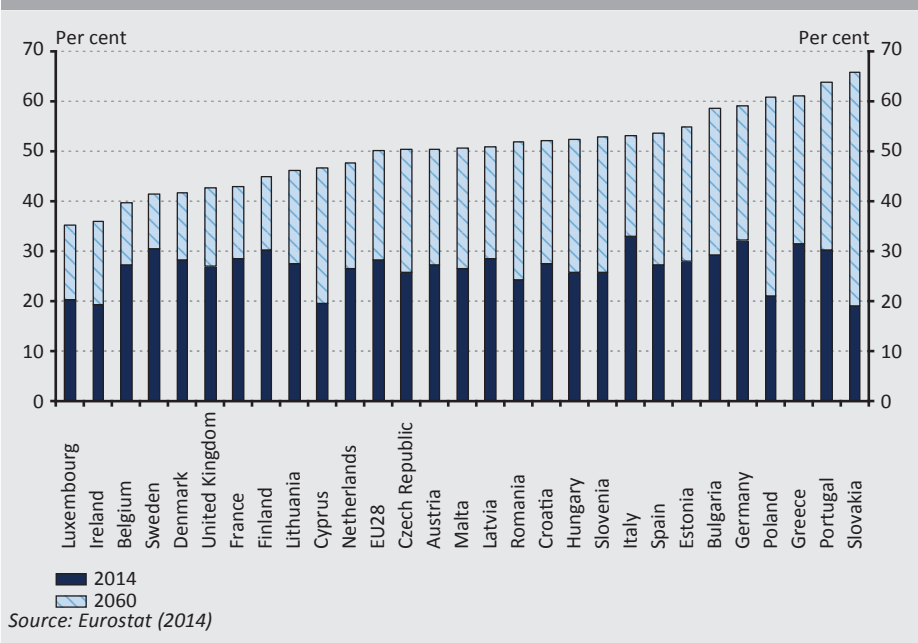
2.3. Expected developments in demographic processes by 2060

*In the coming decades, the ageing of the Hungarian and European population is expected to continue based on the population projections, and the speed of ageing may accelerate.*³ We use the *Eurostat (2014)* forecast as the baseline scenario for presenting demographic processes, which contains data comparable at the European Union level. In the European Union, the proportion of persons aged 65 and older within the total population could rise from the current 18.6% to 28.4% by 2060 while the overall population of the European Union may increase slightly by 2050. The proportion of older persons within the population may be the highest by 2060 in Slovakia, Portugal, and Greece, and the rate of ageing may be most significant in Slovakia and Poland. In these countries, the old-age dependency ratio may rise above 60% by 2060 (*Figure 2*). The old-age dependency ratio may reach 52% in Hungary by 2060, with ageing thus exerting a slightly higher impact compared to the European average (50%). The speed of ageing may also accelerate in the coming decades, as the proportion of older persons is expected to rise at a faster pace than at present. While the proportion of persons aged 65 and older increased by 72% between 1960 in 2010, a rate of increase of 92% is expected in the European Union between 2010 and 2060 (*Eurostat 2014*).

In Hungary, population ageing may be accompanied by a decreasing population in the coming decades according to available population projections. The *Eurostat (2014)* forecast assumes that the fertility rate and life expectancy may converge from their current low level to the higher European average (*Table 2*). According to

³ The population projections of Eurostat and CSO *HDRI (2013)* show a very similar picture regarding the expected development of Hungarian population. Hungarian population projections are compared in Annex.

Figure 2.
Expected developments in the old-age dependency ratio in European Union countries



the population projection, Hungary will remain a net destination country in terms of migration, although the rate of migration will be lower in the second half of the projection horizon. As a result of all these factors, the total Hungarian population may shrink to 9.2 million by 2060 from 9.9 million in 2014, according to Eurostat's projection. The ratio of the working age group (between 15 and 64) within the total population could fall to 56% by 2060 from 68% in 2014; in other words, the cohort of persons of working age may decrease by 1.6 million over the 2014–2060 period. The ratio of persons aged 65 and older within the total population could rise to close to 30% by 2060, from 18% in 2014.

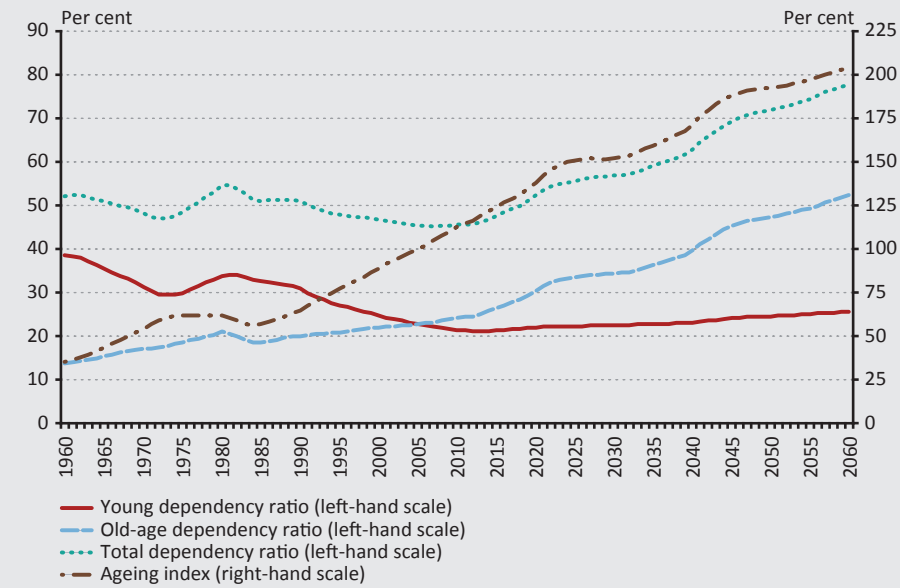
Table 2.
Hypotheses of Hungarian population projection

Indicator	2012 data	2020	2040	2060
Fertility rate	1.34	1.50	1.68	1.74
Life expectancy at birth (years), men	71.6	73.6	78.1	82.0
Life expectancy at birth (years), women	78.7	80.2	83.8	87
Net migration (thousand persons)	8.1	24.3	24.2	14.0

Source: EC (2014).

Population ageing results in a rise in the old-age dependency ratio. Based on population projections, the ratio in Hungary may double between 2014 and 2060, rising from 26% in 2014 to 52% in 2060 (Figure 3). This means that while in 2014 there were 26 older persons for every 100 persons of working age, by 2060 there will be more than double that amount, i.e. 52 older persons to be supported. The total dependency ratio may increase at a lower pace, as the decline in the number of children can partly offset the rise in the ratio of elderly.⁴ The young dependency ratio may rise only slightly, from 21% to 26% between 2014 and 2060.⁵ Despite the shrinking proportion of children, the young dependency ratio may nevertheless rise as the number of persons of working age could shrink even faster than the number of children according to population projections. Based on the *ageing index*, the number of older persons equalled the number of children by 2006, and the index may rise to 240% by 2060, meaning that by this date there will be twice as many older persons (204) for every 100 children. As a result of population ageing, the median age of the Hungarian population could rise from 41 in 2014 to 48 by 2060.

Figure 3.
Dependency ratios and the ageing index in Hungary



Source: Eurostat (2014).

⁴ The total dependency ratio is the proportion of older persons and children relative to the number of persons of working age.

⁵ The young dependency ratio is the proportion of children (age 0–14) the number of persons of working age (age 15–64).

The expected population ageing and the decline in the population is also reflected in the shifting of the population pyramid (Figure 4). The rise in the proportion of older persons (aged 65 and older) within the total population will be affected by the large age cohorts reaching age 65 during certain periods (members of the Ratkó generation, i.e. Hungary's baby-boomers, and their children), which could affect the macroeconomic and fiscal impacts of ageing.

Figure 4.
Composition of the Hungarian population by age and gender, 2014-2060



3. Macroeconomic impacts

The following section quantifies the impact of demographic changes on the labour market, the consumption and savings ratio, asset prices, economic growth, the budget deficit and the presumed inflationary trend. For this exercise, we use the estimates found in the literature alongside the *Eurostat (2014)* population projection as our baseline scenario.

The estimates presented in the reviewed literature explain developments in macroeconomic variables with demographic variables (amongst other things). Using the coefficients associated with demographic variables used in the estimates, and using the Eurostat's population projection (*Eurostat 2014*), we calculate the expected impacts of demographic processes on macroeconomic variables for

each European Union member state. For the sake of comparability, we apply two additional transformations to our results. As a first step, we took the average of the impacts for each decade and country. Then as a second step, we deducted the quantified average impact for the decade of the 2000s for the macroeconomic variable at issue for Hungary from the decade averages each country. This renders the calculated impacts comparable across both time and space. For Hungary, as the result of demographic processes, the expected changes in the macroeconomic variable at issue are presented. We therefore present the change induced by demographic processes compared to the average of the 2000–2009 period. The interpretation of impacts among the other European Union countries is similar; the consequences of demographic processes can be assessed compared to the decade of 2000–2009, and the demographic processes of specific countries on the macroeconomic indicator under review can be compared to the degree expected in Hungary. For the sake of transparency, we represent the impacts relevant to Hungary and – interpreted as the arithmetic average of the impacts affecting individual member states – the European Union. We also represent the band covering the minimum and maximum impact estimated for European Union member states.

Before presenting the results of our calculations, we must stress the uncertainty of the calculations. While the estimates found in the literature are generally crafted using observations of several countries and/or longer periods, their future projectability is limited because they are usually not based on deep parameters derived from theory, but on the historic covariance of data. Covariance observed in the past may change and the measured covariance may not necessarily signify causality, thus the customary “*ceteris paribus*” analysis could be misleading.⁶ Demographic processes project changes on a scale never seen before, and that may question the calculations based on the projection of correlations measured in the past. First, impacts measured in the past (typically linear) were measured in a model framework that was suitable for adequately measuring the impacts in the context of the demographic variable values prevailing at the time. Second, significant demographic changes may also trigger adjustment processes that did not exist in the past, and so their impact could not be quantified. Third, in many cases our calculations are based on earlier estimates that analysed the impact of demographic processes on a specific macroeconomic indicator. For instance, there are separate estimates for developments in consumption, savings and investment ratios in function of demography, although these do not necessarily exhibit trends that are numerically comparable even though these macroeconomic indicators

⁶ Applying the “*ceteris paribus*” assumption, that is, other things being equal, to projections spanning several decades could be particularly contentious. The expected substantial future change in demographic processes may compel changes, including the macroeconomic impacts addressed in the following section or potential modifications to social welfare systems, which may in and of themselves shape demographic processes and may also generate a knock-on effect on macroeconomic developments, which may invalidate calculations assuming all other things being equal.

are linked by similarities. The potential consistency issue mentioned above does not affect the calculations using the outcomes of the general equilibrium model.

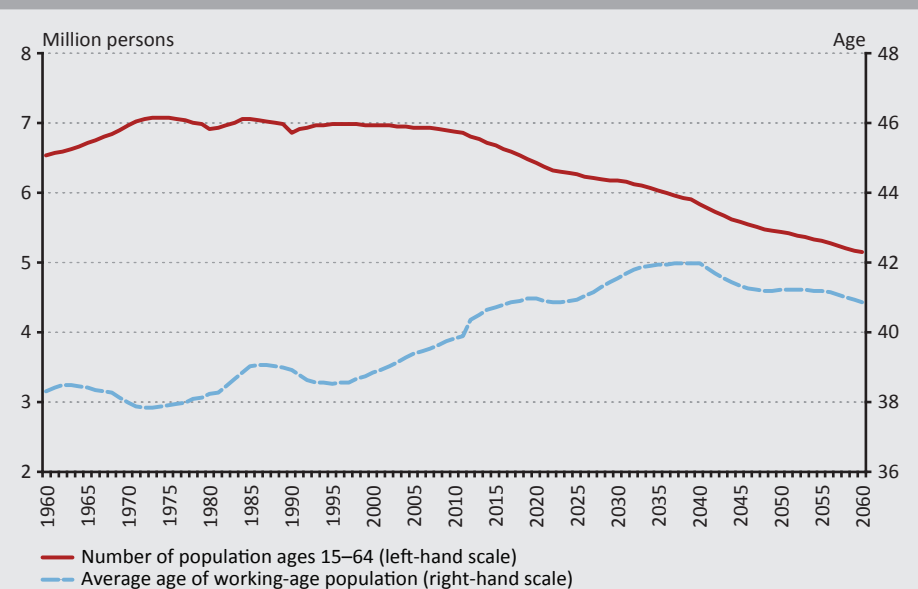
3.1. Labour market

Demographic processes have a direct impact on the supply side of the labour market. The Hungarian population aged 15 to 64 may shrink gradually from 6.7 million in 2014 to 5 million by 2060 (Figure 5) based on Eurostat's population projection (Eurostat 2014). The ratio of persons of working age within the total population may fall to 56% by 2060 from 68% in 2014. The impact may be less pronounced within the European Union as a whole, where the proportion of working age may shrink by 11% by 2060 compared to a 23% decline in Hungary. The ratio of persons of working age within the total population in EU member states may decrease at a slower rate, from 66% in 2014 to 57% by 2060. Meanwhile, the gradual ageing of persons of working age is also expected in Hungary. The average age of the active population has gradually been rising since the 1990s, a trend that may be broken after 2040 due to the age composition of immigrants and the grandchildren of the Ratkó generation reaching the inactive age.

The labour force participation rate – the ratio of economically active persons relative to persons of working age – may fundamentally shape developments in labour supply, alongside demographic processes. In the 15–64 age cohort, the labour

Figure 5.

Size and average age of the working-age (aged 15-64) population in Hungary



Source: Eurostat (2014).

force participation rate is low in international comparison, despite the increased seen in recent years. Especially the labour force participation rates of career starters, persons before retirement age, unskilled workers and mothers with small children fall short of international averages. The adverse labour market impact of demographic processes may be partially offset by measures boosting the labour force participation rate and steps aimed at raising the effective retirement age in line with life expectancy.

3.2. Consumption

Population ageing can also affect developments in the aggregate consumption and savings ratios, due to changes in life expectancy and age cohort proportions. According to the life-cycle theory, individuals' average and marginal propensity to consume and save depends on their age. The consumption rate is higher and the savings ratio lower at younger and older ages compared to middle age. With the shift in age structure, the determinants of economic growth, including aggregate consumption and savings may change depending on the life cycle that the largest number of individuals find themselves in (*Bloom et al. 2010*).

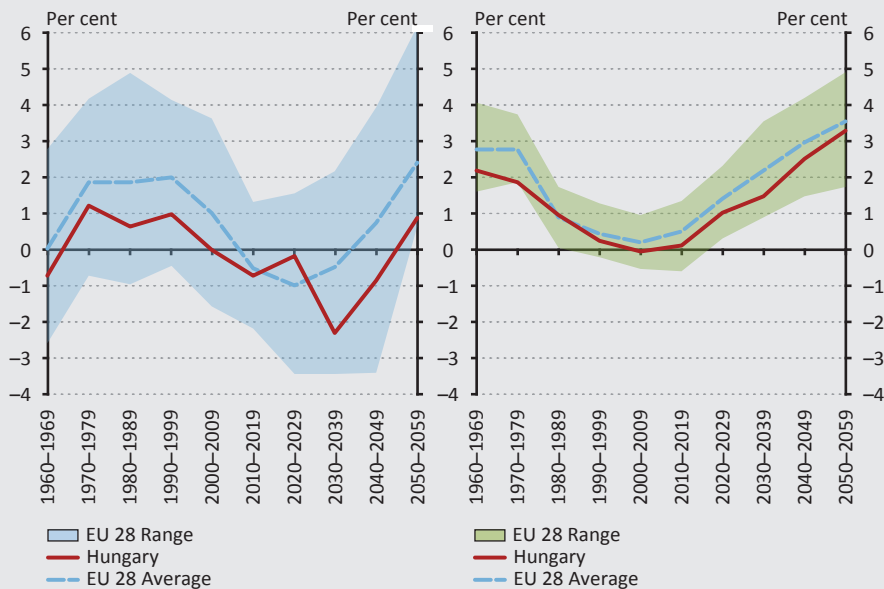
The empirical findings of *Erlandsen and Nymoer (2004)* also corroborate *the significant impact of the population's age structure on aggregate consumption*. In their regression model, the authors explain developments in the consumption rate with the proportion of the 50–66 age cohort within the total population, alongside macro variables (income, real interest rate). The 50–66 age cohort is highlighted in the study because they are on the cusp of retirement, therefore their propensity to save is much higher, while their propensity to consume is much lower compared to younger age cohorts, while their income is higher relative to other middle-aged cohorts.

The impact of demographic changes on consumption can also be estimated using the total dependency ratio according to the findings of *Masson and Tryon (1990)*. The consumption rate of dependents relative to their income is characteristically higher compared to actively employed persons, therefore an increase in the total dependency ratio boosts consumption. In their study, *Masson and Tryon (1990)* apply a regression to model the logarithm of total consumption expenditure, in which the logarithm for real disposable income for the previous period, propensity to consume, the long-term real interest rate and changes in the logarithm of net GDP after taxes are also included as explanatory variables alongside the total dependency ratio. Estimates have confirmed the positive correlation between the total dependency ratio and consumption: a 1% increase in the total dependency ratio generates a 0.1 percentage point increase in the consumption rate (*Masson and Tryon 1990*).

According to the above methods, using the Hungarian population projection as our basis, Hungary's consumption rate could rise gradually in the decades following 2030. Over a shorter horizon, the two calculations yield opposing impacts in terms of their sign, the difference in absolute terms only amounts to a few percentage points, meaning that neither version reflects a material change in the consumption rate in the upcoming decade and a half. The estimates of *Erlandsen and Nymoer (2004)* reveal that all other things being equal, the consumption rate could decline gradually compared to 2000–2009, by 3 percentage points up until the 2030s (*Figure 6, left-hand panel*). Hungary's slightly more unfavourable population projection presages a more pronounced decline relative to the European Union average. The reason for the discrepancy is that the grandchildren of the Ratkó generation will reach the 60s in the 2030s, which could go hand-in-hand with their gradual preparation for retirement. According to the model, consumption could return to the level prevailing before the 2000s starting from the 2040s following a 4 percentage point slump.

Adapting the estimate of *Masson and Tryon (1990)* to Hungarian data, a progressive rise in the consumption rate can be observed (*Figure 6, right-hand panel*). This

Figure 6.
Estimated developments in the consumption rate in Hungary and the European Union compared to 2000–2009 according to *Erlandsen and Nymoer (2004)* (left-hand figure) and *Masson and Tryon (1990)* (right-hand figure)



Source: Authors' calculations.

stems from the gradual increase in the total dependency ratio, resulting in a rise in the propensity to consume based on the life-cycle theory. The discrepancy between the two outcomes may be due to the fact that the proportion of persons aged between 50 and 66 could increase less dynamically compared to the total dependency ratio during the period under review.

According to our projections based on the estimates of *Masson and Tyron (1990)*, demographic processes in Hungary presage a lower consumption rate compared to European Union standards, but the changes in the Hungarian consumption rate may be on par with the European Union average. Looking ahead, demographic processes could exert the greatest impact on the consumption rate in the Mediterranean countries (GR, ES, PT) and the smallest impact in Luxembourg, Denmark and Sweden. According to the estimates of *Erlandsen and Nymoen (2004)*, the smallest impact on the consumption rate is expected in Slovakia and Hungary, while the greatest impact is expected in the Baltic States (LV, LT) and Ireland.

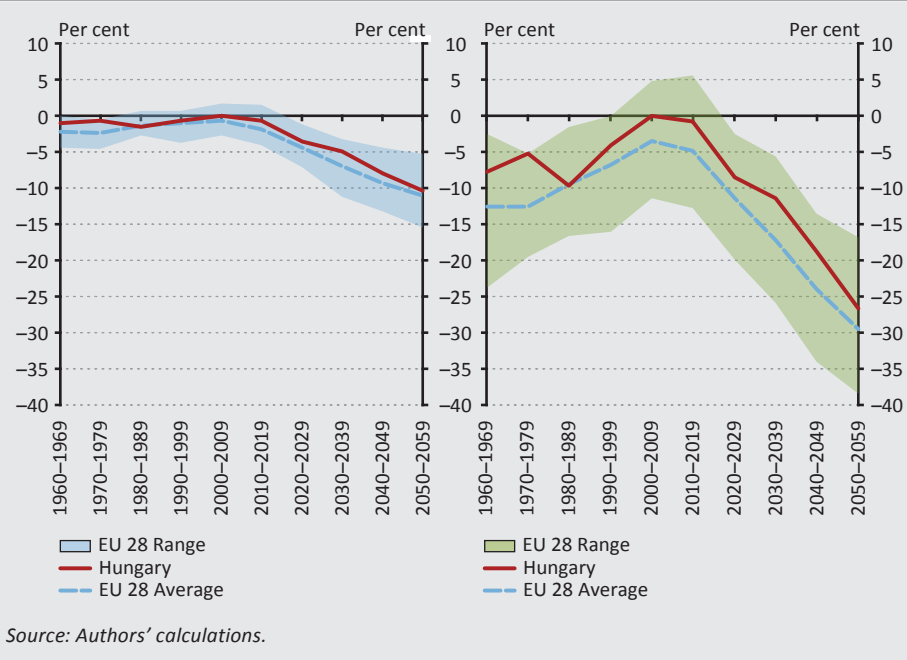
3.3. Savings

Similar driving forces are at play in the relationship between the savings ratio and the composition of the population as between the consumption rate and the composition of the population. Beyond the fact that the savings and consumption rate are mutually complementary, the savings ratio and demographic processes can also be linked through the life-cycle theory: the consumption rate is higher and the savings ratio lower at younger and older ages compared to middle age.

Meredith (1995) captures the impact of demographic processes on savings using demographic dependency ratios. After reviewing the findings in the literature, the author concludes that the increase in both the young and old-age dependency ratio lowers the savings ratio. The life-cycle theory therefore prevails: there is no available income to set aside during the younger age, while the savings accumulated are used up during the older years, and thus the rise in the total dependency ratio has an adverse impact on the savings ratio. Although estimates deviate across a broad range, it can be determined that a rise in the old-age dependency ratio lowers the savings ratio to greater degree.

Also partly referencing the life-cycle theory, *Lindh (1999)* gives an estimate of the impact of changes in age cohort proportions on inflation, GDP growth, the savings ratio, and the investment ratio. In his model, the author divides the population into six groups (persons aged 0–14, 15–29, 30–49, 50–64, 65–74 and 75 and over) and uses this classification to explain, amongst other things, developments in the savings ratio. According to the findings, the size of the youngest age cohort and the cohort of persons aged 65 and over has a significant negative impact on the savings ratio.

Figure 7.
Developments in the savings ratio in Hungary and the European Union compared to 2000–2009, according to Meredith (1995) (left-hand figure) and Masson and Lindh (1999) (right-hand figure)



Applying the models of *Meredith (1995)* and *Lindh (1999)* to Hungary, the savings ratio could fall significantly as a result of demographic processes (*Figure 7*). In the case of the former, a ten percentage point decline can be forecast, all other things being equal (*Figure 7, left-hand panel*), while in the case of the latter, and even more drastic decline is observed (*Figure 7, right-hand panel*). The large discrepancy between the findings stems from the fact that in the case of *Meredith (1995)*, we use the unweighted average of earlier estimates, which cushions our estimated result. In relation to the findings, it should be noted that the savings ratio in Hungary remains above the European Union average practically throughout the entire period based on both projections. This is due to the fact that demographic processes are unfolding somewhat differently in Western European countries, where population ageing is not accompanied by a significant decline in the population (due to higher immigration and fertility rates), and the young dependency ratio is higher across the forecast horizon compared to the Hungarian ratio, which exerts a more adverse impact on the savings ratio compared to Hungary.

Although our calculations for Hungary based on the estimates of *Meredith (1995)* are higher compared to the European Union average, they exhibit the same degree

of change in the savings ratio. Mediterranean countries (GR, ES, PT) may exhibit the lowest savings ratios, while Denmark, Belgium and Luxembourg may exhibit the highest ratios, even after a significant drop. Our calculations based on the estimates of *Lindh (1999)* show a similar path: the savings ratio in Hungary could exceed the European Union average, but may decline significantly following a parallel trajectory. The sharpest decline in the savings ratio could materialise in the Mediterranean countries (GR, ES, PT) and the Baltic states (LT, LV, EE), while the smallest decline is expected in Belgium, Denmark and Luxembourg, in line with the calculations based on the estimates of *Meredith (1995)*.

A comparison of calculations of consumption and savings ratios shows that although they are in line with theoretical considerations in terms of their overall direction (rising consumption and falling savings ratios), their rate of change differs. With regard to the fact that the extent of decrease in the savings ratio linked to demographic processes seems excessive, we consider calculations related to changes in the consumption rate to be more reliable.

In the literature, the link between ageing and investments attracts less scrutiny than the link between ageing and savings. According to the available findings, ageing could potentially have a greater impact on investments than on savings. *Kim (2014)* used the data of OECD countries to determine that a rising proportion of older persons within the population leads to a slowing in the capital stock growth rate, while the capital stock growth rate correlates positively with the potential GDP growth rate. In addition, there is a positive link between the proportion of the population of working age and the investment ratio, and a negative link between the investment ratio and dependency ratios. According to *Kim's regression outcomes (2014)*, demographic variables are more closely correlated with the investment ratio than with the savings ratio in OECD countries, and thus ageing could exert a greater impact on investments than on savings.

3.4. Impact on asset prices

According to the life-cycle theory and the asset price meltdown hypothesis, demographic changes impact equilibrium real asset prices (in particular property prices), and households completely shed (deplete) their assets during their economically inactive life phases as consumption and savings behaviour changes (*Börsch-Supan 2006*). However, empirical observations somewhat contradict this theory, as research shows that while wealth shrinks substantially, accumulated assets are not entirely depleted thanks to the impacts of inheritance and prudence (*Mosolygó 2009*). According to the life-cycle theory, the rising old-age dependency ratio and continuously declining population exert a demand-side impact on asset prices. According to the theory, in terms of the impact on property prices, the population's age distribution is the most decisive factor, with significant differences in property ownership among age groups. In his study, *Takáts (2012)* uses a panel

regression (22 countries, sample between 1970 and 2009) to investigate the impact of demographic processes on inflation and finds that the outcomes show a significant negative impact of the old-age dependency ratio and the change in the overall population on property prices.

Figure 8.
Average annual impact of demographic processes on property prices in Hungary and the European Union between 1961–2060 according to Takáts (2012) (in basis points)

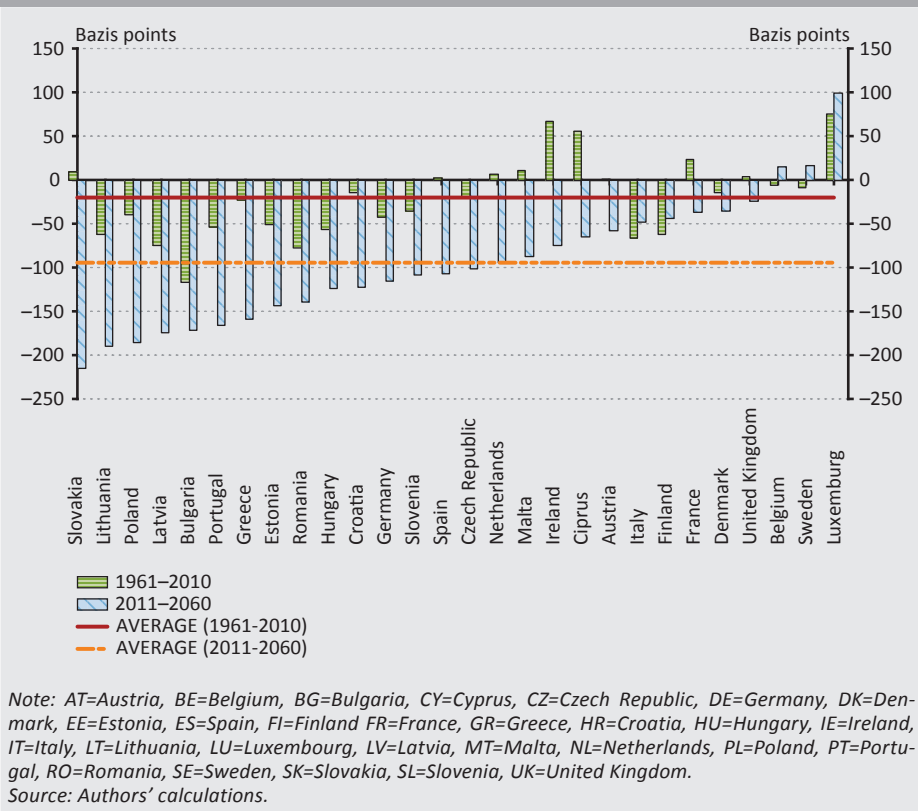


Figure 8 illustrates that the historical average remained in the negative range for the European Union; therefore, with the exception of a few individual cases, demographic processes lowered property prices in the majority of member states. This tendency is set to gain momentum between 2011 and 2060, which could exert significant downward pressure on property prices, particularly in South-Eastern Europe. This is due to the fact that in these countries, the drastic ageing of the population is expected to be coupled with a greater population decrease than in Western Europe. Hungary may witness a sharp drop in property prices in the upcoming decades compared to the European Union average.

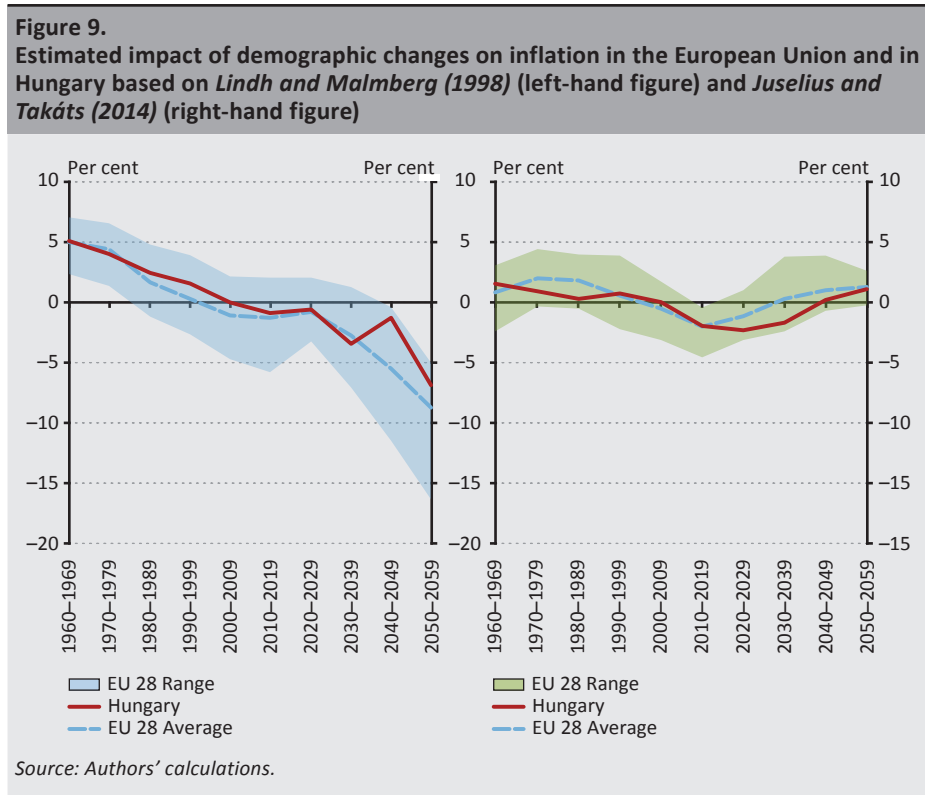
There is no broad consensus among researchers regarding the impact of demographic processes on financial asset prices. According to *Mosolygó (2009)*, the underlying cause of the moderate impact identified in empirical studies is mainly the fact that demographic processes unfold slowly, and the mechanisms of globalised money and capital markets may cushion their impact (flows of money and capital from low-yield markets to higher yield ones) and international migration flows may mitigate the fundamental issue.

The literature broadly examines the changes in the allocation of savings by various age cohorts. Empirical observations show that the preponderance of equities within the portfolio is characteristic of younger and economically active age cohorts, while the emphasis shifts to bonds and deposit-type assets among older cohorts, as risk appetite varies by age (*Bergantino 1998*). The increase in the weight of older generations could therefore alter the relative price of financial assets: demand for higher risk assets may fall while demand for safer assets may rise, which could entail a rise in the relative price of safer assets compared to riskier ones.

3.5. Inflation

According to the life-cycle theory, net consuming cohorts (persons of non-working age, the elderly) may exert an inflationary impact on the economy, while net savers (persons of working age) may exert an opposite impact. Considering similar demographic processes are expected all over the developed economies, the above mentioned effect can occur in several countries among others in Hungary as well. The economically active population, besides creating assets for the entire population, consumes less income on the demand side due to its greater marginal propensity to save. By contrast, the economically inactive population is by definition not present on the supply side: its income originates from earlier periods or other transfers and it generally consumes its income, thereby creating demand and indirectly, inflationary pressure. In addition, the declining population may lower the relative price level through property prices (*Anderson et al. 2014*). According to *Juselius and Takáts (2014)*, the inflationary impact of demographic processes is expressed through the equilibrium real interest rate. In their study, the authors establish that during periods of demographic expansion, less savings are available in the economy, which raises the real interest rate, and vice versa. The study of the causality link between demography and inflation is even less advanced than for growth impacts. Based on the studies by *Juselius and Takáts (2014)* and *Lindh and Malmberg (1998)*, demographic processes may have a significant impact on inflationary developments. On a closer horizon, both estimates show a weaker inflationary impact compared to the current level. The estimate of *Lindh and Malmberg (1998)* forecasts extraordinary disinflationary pressure for the period following 2030, especially in Mediterranean countries (ES, PT, GR, IT). The order of magnitude of this disinflationary impact, however, can be called into question

in this case as well. Granted, the projection based on the estimates of *Juselius and Takáts (2014)* presages impacts of more plausible degree over longer horizons as well (*Figure 9*).



3.6. Economic growth

The population's changing age composition also affects economic performance. Demographic change exerts an impact on both demand and supply side: the demand side is affected through consumption and savings as discussed above, as well as the fiscal channel, while the supply side affects economic performance through the labour market, capital accumulation, and productivity channels.

At the same time, demographic changes raise the broader issue of measuring economic performance. In the case of rapidly ageing populations, real GDP as an economic indicator is not the best gauge, and a temporal comparison of GDP growth could be misleading. While the impacts of ageing may be mitigated by increasing productivity, real GDP, GDP per capita or GDP growth calculated for economically active cohorts could yield a different picture. As a result, growth in GDP per capita

could be a more accurate reflection of the rise in living standards, and GDP per working-age person could be a better indicator of sustainable development.

In the following section, we examine the impacts of demographic processes on economic performance using four different approaches. Firstly, we determine the expected impacts based on what is referred to as growth accounting. This approach deducts expected growth effects from the potentially available labour supply, i.e. developments in the size of the working age population and the number of dependents. The production function used as the second method follows a similar approach, linking growth effects to developments in labour supply and the total population. Thirdly, we use the findings of general equilibrium model. The advantage of the general equilibrium approach is that it takes into consideration the series of adjustments induced by demographic processes when quantifying impacts. Finally, we give an estimate of the expected growth impacts on the basis of earlier empirical work scrutinising the correlations between growth and demography.

3.6.1. Growth accounting approach

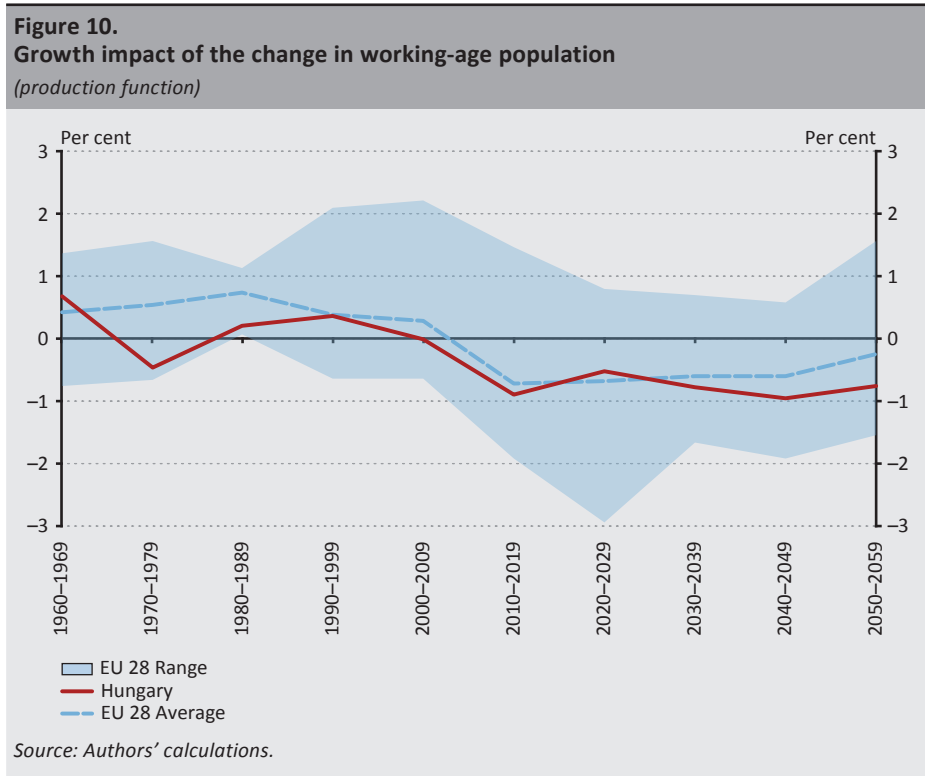
The per capita GDP growth rate can be broken down into output growth per worker and developments in the ratio of active workers within the population. Population ageing – assuming unchanged age-specific behaviour – could lower the labour supply and the savings ratio by decreasing the proportion of persons of working age within the population, thus yielding lower economic growth. Using this subdivision, *Bloom et al. (2010)* found that OECD country economies would have only grown by 2.1% instead of 2.8% between 1960 in 2005 if demographic processes would have followed the trajectory estimated for the upcoming decades.

This subdivision of output implicitly assumes that value added can only be created through labour. *Ludwig (2005)* expresses output as a function of aggregate productivity, labour supply and capital stock, based on which a reduction in the size of the working age population results, *ceteris paribus*, in a decrease in GDP. Economic downturn can be avoided by increasing productivity, the employment rate or capital stock (*Ludwig 2005*). The author argues that it is warranted to examine per capita variables, as falling output is distributed between increasingly fewer individuals.

3.6.2. Production function-based approach

Demographic forecasts point to an accelerating decline in the population and a decreasing proportion of working age population. The increasing rate of decrease of the working age population – alongside an unchanged labour force participation rate, technological progress and capital accumulation – suggests slowing growth, all other things being equal. Assuming the Cobb–Douglas production function and the customary two-thirds work ratio, it is evident that demographic processes made a positive growth contribution between 1980 and 1999, while a nearly 0.5

percentage point slowdown in growth can be demonstrated after 2000 due to the declining number of persons of working age. The per capita slowdown in growth could be even greater (0.6–0.7 percentage points), due to the continuous rise in the inactivity rate. As the grandchildren of the Ratkó generation become economically inactive, the slowdown in growth in the 2040s could be even greater than the European Union average (Figure 10). The slowdown in growth is expected to exceed Hungary’s figure in three countries, Slovakia, Poland and Bulgaria.



The adverse growth impacts presented above assume an unchanged labour force participation rate. The rise in life expectancy – alongside an unchanged activity rate – could mitigate the growth losses if the number of years for which an individual is economically active increases at the same rate. The calculations of the European Commission’s working group responsible for analysing population ageing (AWG- Ageing Working Group) attribute a growth effect of a similar degree to demographic processes (EC 2012). According to the AWG’s calculations, total hours worked could decrease each year by 0.1% between 2010-2020, by 0.2% between 2021 and 2040 and by 0.9% between 2041 and 2060. Due mainly to the lower total hours worked and the increasing proportion of economically inactive persons, the potential

growth per person could be 0.7 percentage points lower between 2041 and 2060 than in 2021–2030 (1.3% compared to 2.0%).

The limitations of calculations based on the production function reside in their inability to factor in the other economic impact of restructuring among generations. In addition, demographic processes may also affect capital accumulation and productivity (technological progress). Earlier findings reveal that demographic processes are expected to lower the savings and the investment ratio, eroding the contribution of capital accumulation to growth. Population ageing may erode innovation potential, as this is a characteristic of younger generations and younger cohorts also have greater risk appetite. These factors may lower the rate of improvement in productivity. At the same time, the rising average age of the economically active population and greater accumulated professional experience may boost productivity until 2040.

3.6.3. Model-based approach

A more differentiated view of the growth effect of demographic processes can be obtained nuanced using the correct general equilibrium approach. The overlapping generations model (OLG) proposed by Fougere and *Merette (1998)* also factors in generational transfers. According to basic simulations performed for OECD countries, with the results from Japan and Italy also applicable to Hungary, based on their similar demographic processes, demographic processes are expected to lower per capita growth by 0.4 percentage points between 2010–2050. As a result, GDP per capita could be nearly 30% lower around 2050 than in the absence of population ageing. The authors also scrutinise the impact of demographic effects in the context of a model framework expanded to include human capital. In this case, due to life expectancy, increasing human capital over a longer life phase generates higher income, and therefore the growth sacrifice of demographic processes may be smaller, thanks to the improving productivity stemming from higher human capital, which may even fully offset the growth losses defined in the basic simulation (*Fougere and Merette 1998*).

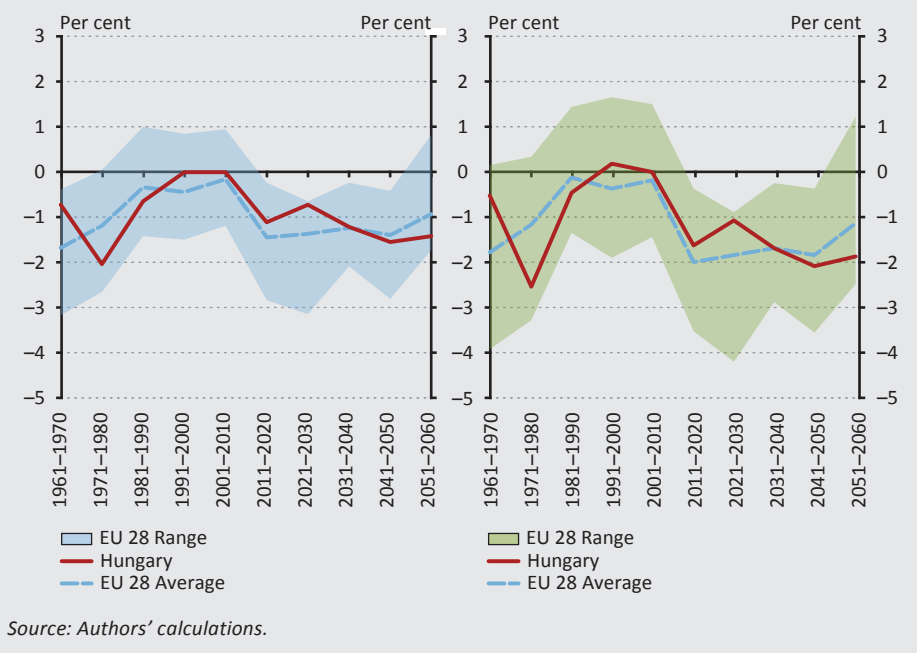
According to the life-cycle model-based calculations of *McMorrow and Roeger (1999)* for the European Union, the USA, and Japan, population ageing may lower per capita growth by 0.4 percentage points between 2000 and 2050 in the European Union, by 0.5 percentage points in Japan and by 0.2 percentage points in the USA. Given that Hungarian demographic processes are expected to be similar to those of the EU and Japan, a 0.4–0.5 percentage point decline in per capita GDP growth could also hold true for Hungary.

Börsch-Supan *et al.* (2014) examine the impact of ageing on growth by applying the overlapping generations model to three Western European countries.⁷ Assuming unchanged age-specific and gender-specific labour force participation rates, the authors conclude that an expected 20% decline in the proportion of active workers within the population could lower GDP per capita by 15% and consumption per capita by 10% by 2050, relative to 2005. The decline in consumption falls short of the decline in the proportion of economically active persons, as declining labour could be partially replaced by supplementary capital.

3.6.4. Regression results

In addition to the production function and model simulation-based approaches, growth effects can also be estimated using regression results. Bloom and Canning (2004) examine the data of 75 countries between 1960 and 1995 and conclude that demographic variables (life expectancy, proportion of working-age persons within the population) exert a significant and positive impact on the per capita GDP growth rate. Longer life expectancy is presumably coupled with better health, which could

Figure 11. Estimated change in Hungarian economic growth compared to 2000–2009, based on Prskawetz *et al.* (2007) for output per working-age person (left-hand figure) and output per capita (right-hand figure)



Source: Authors' calculations.

⁷ France, Germany, Italy.

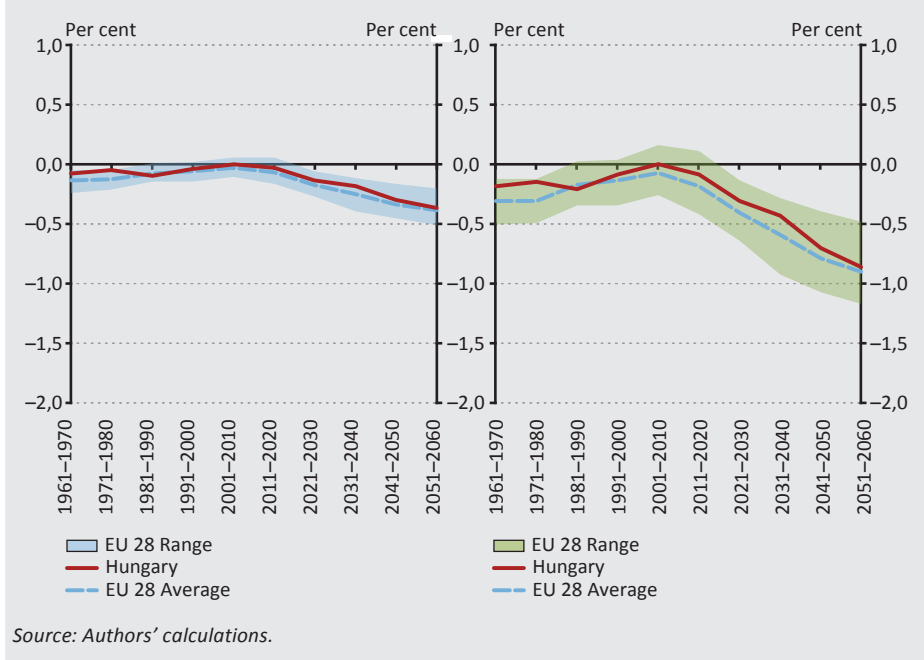
boost GDP per capita through higher labour productivity. The proportion of working-age persons within labour supply could drive potential output from the supply side.

Using the estimates of *Lindh and Malmberg (2007)* for Norway, which are based on a detailed breakdown by age group, developments in the composition of the Hungarian population will not significantly influence per capita growth. It is important to note that the estimate uses the proportion of age groups as the explanatory variable, rather than their absolute size. Consequently, it is unable to factor in the general decline in the size of age groups.

The estimates of *Prskawetz et al. (2007)* for India control for developments in the young and old-age dependency ratio and the size of the population. Based on their parameters, the growth rate per working-age person compared to the 2000s could decline by more than 1 percentage point, while per capita growth could decline by two percentage points in 2000–2060.

Using the estimates of *Bloom et al. (2007)*, in the coming decades the GDP growth rate could gradually decline by 0.2 or 0.3 percentage points compared to 2000–2009. No growth loss is expected at the beginning of the period until 2020, after

Figure 12.
Estimated change in GDP growth in the European Union and in Hungary (left-hand figure) and per capita growth (right-hand figure) compared to 2000–2009, based on Bloom et al. (2007 and 2010)



which point a gradual decline in GDP growth is expected. The estimate of *Bloom et al. (2010)* factors in the proportion of the working-age population and the developments in its size. Based on these findings, the per capita growth rate in the European Union gradually declines by approximately 0.8–1 percentage points compared to 2000–2009.

Based on a review of growth impacts, the majority of estimates point to deceleration in per capita GDP growth. The extent of the impact tends to increase over longer horizons. Compared to the 2000–2009 period, *per capita GDP growth may decrease by 0.5–1 percentage point in the coming decades as a result demographic effects*. The estimate of *Bloom et al. (2010)* projects a larger decline, as the model incorporates the impact of life expectancy. At the same time, the estimates yielding a stronger slowdown typically ignore the larger capital accumulation stemming from life expectancy and the ensuing extension in the years spent working. Accordingly, the expected degree of impact will probably be in the upper half of the range.

3.7. Fiscal impacts

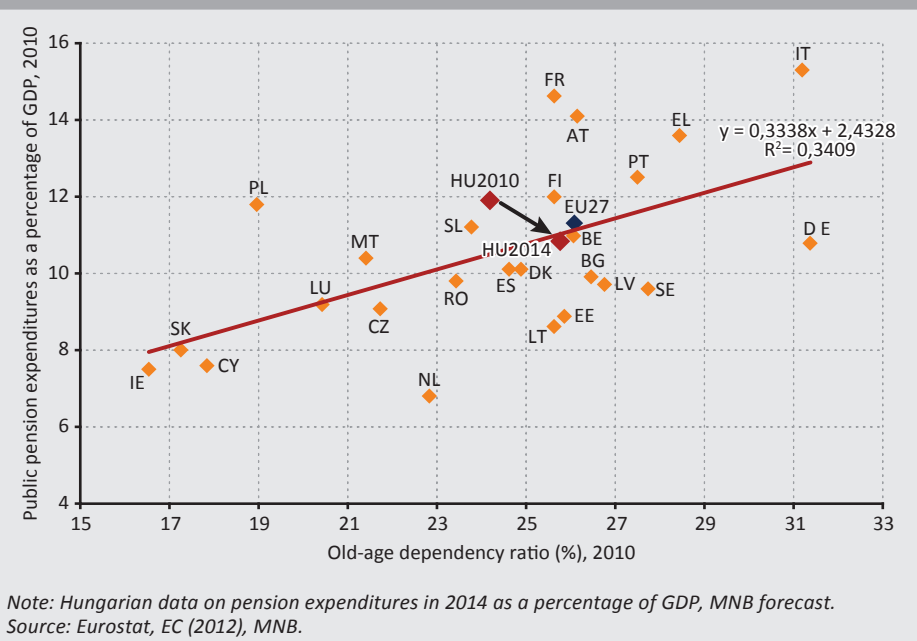
Changes in the population's age composition could have direct and indirect impacts on the fiscal balance. As a direct expenditure side impact, pension expenditures and healthcare expenditures in Hungary may jointly exceed their 2010 value by 2.8% of GDP in 2060, based on the AWG forecast (*EC 2012*). On the revenue side, assuming an unchanged regulatory environment and labour force participation rate, the shrinking working-age population could result in declining revenues related to wages. A dual pressure on the social security system may emerge, as shrinking social contribution revenues resulting from demographic processes will have to fund social security benefits payable to an increasing number of beneficiaries.

3.7.1. Pension expenditures

Pension expenditures are one of the major expenditure items for Hungary's central budget. In Hungary's pay-as-you-go pension system, the current social contributions of economically active persons fund retirement provisions for the elderly.⁸ The rate of public pension expenditures simultaneously depends on several factors, including pension system parameters (retirement age, service period, replacement ratio of new pensions, indexation of pension benefits) and the development of demographic trends. In European countries featuring higher old-age dependency ratios, public pension expenditures relative to GDP are generally higher (*Figure 13*). This statically shows that, if no measures are taken, adverse demographic trends (shrinking proportion of working-age persons and growing proportion of persons aged 65 and older) could result in a rise in the pension budget deficit.

⁸ This applies to the old-age type pension benefits paid from the Pension Insurance Fund as of 2012. Early-retirement benefits funded from the central budget are covered by the general budgetary tax revenues. A significant share of disability and rehabilitation benefits reclassified to the Health Insurance Fund was funded from central budget subsidies in 2012–2014.

Figure 13.
Public pension expenditures relative to GDP and the old-age dependency ratio in EU countries in 2010

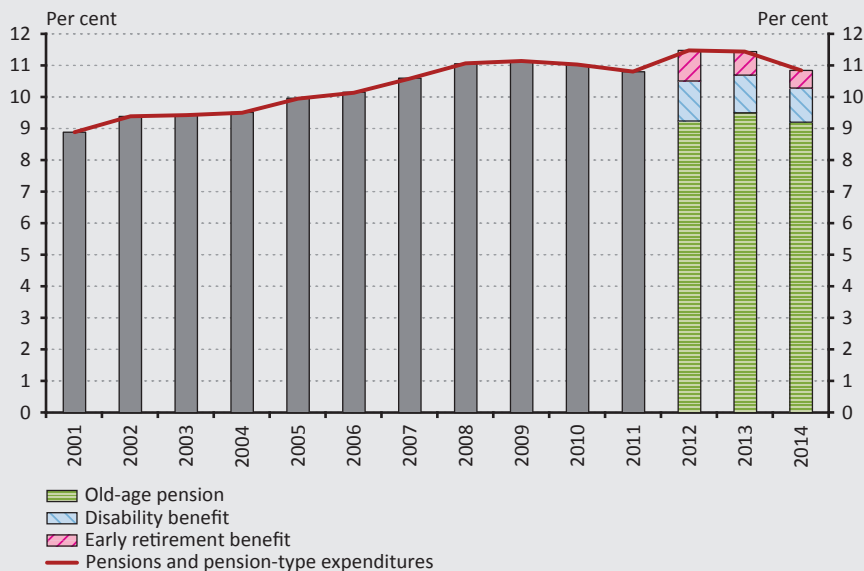


Population ageing points toward an increase in spending in the long run, based on the decomposition of pension expenditures. According to the forecast in the AWG report, pension expenditures relative to GDP could rise from 11.9% in 2010 to 13.6% by 2060 in Hungary (EC 2012), with this increase in expenditures slightly exceeding the average figure estimated for European Union countries (1.2 percentage points). The change in the old-age dependency ratio contributes the most to rising expenditures. The strongest demographic impact could occur in the 2010s and 2040s as the Ratkó generations enter retirement.

The impact of ageing may be partly offset by measures affecting the pension system. The official retirement age will increase gradually from 62 to 65 between 2014 and 2022. Alongside the increase in the retirement age, stricter rules for early retirement and disability pension benefits will also result in a rise in the effective retirement age. These factors could result in a decline in the ratio of recipients of pension and pension-like benefits to the number of people over the age of 65 from 176% in 2010 to 122% by 2060 (EC 2012). The decreasing proportion of beneficiaries could reduce pension expenditures to the greatest extent in the 2010s. Changes in the rules of indexation also support the sustainability of the pension system. A purely inflation-indexed pension increase rule has been in effect since 2012, on the basis of which at the start of the year the usual indexation of benefits

already determined follows the rate of inflation planned in the Budget Act. The rule ensures the preservation of the real value of pensions, while in case of economic growth, the indexation falling short of the rate of nominal GDP enables expenditure savings in the budget relative to GDP from one fiscal year to the next. On the whole, pension expenditures may have decreased by 0.6% of GDP from 2013 to 2014, as the joint impact of measures affecting the number of beneficiaries (for instance the increase in retirement age effective from 2014) and the rules of indexation (Figure 14). According to the pension projection of AWG, GDP-proportionate pension expenditures can further decrease (by 2030 to 10.4 % of GDP), therefore in the next 20–25 years, no imbalances are expected to occur in the Hungarian pension system. The impact of population ageing on the pension system may accelerate during the 2040s in particular, as the Ratkó grandchildren enter retirement.

Figure 14.
Developments in pension and pension-type benefit expenditures between 2001 and 2014 in Hungary
(as a percentage of GDP)



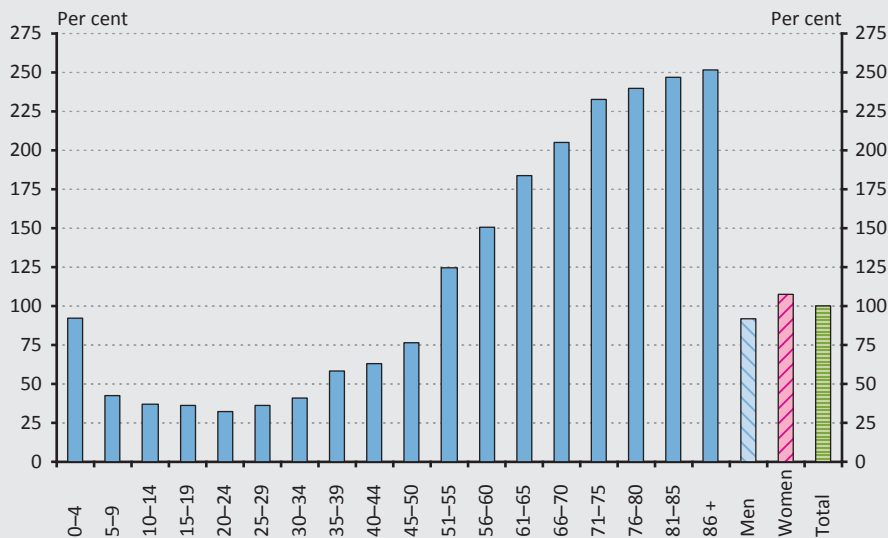
Note: The data for 2001–2011 present the pension-type benefit expenditures on the basis of the bills on the execution of the budget of Hungary, which do not correspond to the accounting system categories introduced from January 2012. Since 2012, the “old-age benefits” category includes old-age type benefits above the retirement age, disability benefits above the retirement age, service-dependent pension benefits available to women with 40 years of service time and survivors’ benefits. The data for 2012 and 2013 present the data from the bills on budget execution for the years 2012 and 2013. The figures for 2014 present our current forecast. The nominal GDP time series is based on the ESA-2010 methodology.

Source: MNB calculation, bills on the execution of the budget of Hungary.

3.7.2. Healthcare expenditures

The rise in life expectancy and the proportion of older persons within the population may also entail a gradual increase in healthcare expenditures based on the age profile of per capita healthcare expenditure. According to the forecast in the AWG report, public healthcare expenditures could rise from 5% of GDP in 2010 to 6.1% by 2060 in Hungary (EC 2012). In the version quantifying the impact of demographic changes,⁹ a 1.5 percentage point increase in spending is expected between 2010 and 2060, based on the AWG report. The expenditure increase in Hungary stemming from ageing may slightly exceed the 1.3 percentage point average increase estimated for the European Union member states, but the overall level of expenditures could remain well below the European Union average. Longer life expectancy will presumably increase demand for healthcare services, which are concentrated for the most part among the older segments of the population. Based on the age profile of per capita expenditures, healthcare expenditures over the age of 50 already exceed the unit value valid for the total Hungarian population, and per capita expenditure over the age of 65 is more than twice the population average (Figure 15). The level

Figure 15.
Age profile of in-kind health insurance services per capita in Hungary
2012



Note: Average expenditure per capita in 2012, as a percentage.

Source: MNB (2013).

⁹ The version quantifying the impact of demographic changes assumes that rising life expectancy will not increase the number of years spent in good health. In the reference version of the AWG report, public healthcare expenditures rise by 1.1 percentage point to 6.1% of GDP, as the version assumes that the half of the increased life expectancy will be spent in good health.

of public healthcare spending could be more favourable than estimated if increasing life expectancy coincides with a rise in the number of years spent in good health. At the same time, the majority of risks points towards a higher expenditure level: lower healthcare professional wages compared to the European average, convergence to the standard of care prevailing in more developed countries, and technological progress may require higher expenditures (EC 2012).

Several studies in the international literature¹⁰ argue that *higher life expectancy and population ageing only contributed slightly to the rise in healthcare expenditures observed over the past decades*, and therefore future changes in the population's age composition will not entail a significant rise in healthcare costs. The past rise in public healthcare expenditures was driven by technological progress, higher income levels and the expansion of health insurance (Breyer et al. 2010; Felder 2013). As healthcare expenditures are characteristically concentrated over the last years of a person's life, population ageing does not necessarily increase expenditures, but could even delay them if it coincides with an increase in the number of years spent in good health.

3.8. Monetary policy implications

As opposed to the customary economic shocks, demographic processes typically exert their impact over the longer run. Therefore demographic processes are primarily not shocks that need to be accommodated on the horizon of monetary policy. Nonetheless, demographic processes may gradually impact the value of key variables relevant for the conduct of monetary policy, as well as the effectiveness of transmission channels. For instance, they may affect the equilibrium interest rate by changing the consumption and savings ratio. As discussed above, demographic processes presumably lower both the savings and the investment ratio. At the same time, the sign of their effect is not straightforward, although there is a greater chance of a more pronounced decline in the investment ratio, resulting in a lower equilibrium interest rate in the longer run. We also discussed the potential impact of demographic processes on the degree of inflationary pressure. According to our calculations, disinflationary impacts may be predominant in the upcoming one to two decades. The lower equilibrium interest rate and the disinflationary pressure may erode the effectiveness of traditional interest rate policy, as monetary policy is more likely to meet the zero lower bound in this context. As a result, the value of new monetary policy instruments may increase compared to less effective traditional monetary policy instruments.

In terms of transmission channels, the wealth effect may increase as a result of demographic changes. Cohorts may accumulate greater wealth by old-age as a result of longer life expectancy, rendering consumption more sensitive to changes

¹⁰ For instance Breyer et al. (2010).

in interest rates. The role of stable inflation may gain value, especially if savings are channelled into long-term assets (pension savings), as inflation diverging from the expected rate could erode the purchasing power of savings. Preparing for retirement may be facilitated by a development in the securities market for long-term savings. The monetary authority can ensure the smooth functioning of this market by expanding its competence, applying adequate regulation, and fulfilling its supervisory functions.

In light of the foregoing, it is necessary to continuously monitor the macroeconomic impacts of demographic processes and to assess how the induced changes shape monetary transmission, in order to adequately conduct monetary policy.

4. Ageing societies: challenges and opportunities

4.1. Economic policy challenges

The expected change in the population's size and age composition will create significant challenges for society and economic policy. Population ageing may already accelerate in Hungary in the upcoming years as the Ratkó generation enters retirement, and thus the shrinking size of the working-age population, the slowing growth rate, and decreasing savings ratio may already create a challenge for economic policy-making in the near term. In addition, maintaining fiscal stability could also prove challenging as population ageing may result in a rise in the proportion of expenditure items sensitive to demographic change (such as pension expenditures, healthcare expenditures, social care).

Economic policy may spur economically active persons to remain actively employed throughout a longer career path through the tax and pension system, which could offset the adverse impact of demographic processes on labour supply and the fiscal balance. One possible tool for achieving this is to approach the effective and the statutory retirement age, or to gradually raise the statutory old-age retirement age in line with the increase in life expectancy, as already adopted by several western European countries (including Denmark and Italy).¹¹ Another solution could be to introduce more flexible retirement rules, which act as an incentive for continuing work beyond retirement age. Longer career paths simultaneously improve both the sustainability and adequacy of pension systems (*Schwan–Sail 2013*). Measures aiming to increase the number of economically active years could achieve success if they go hand-in-hand with increased demand for those remaining on the labour market.

¹¹ It should be noted that the declared objective of the second, capital coverage pillar introduced in 1998 was to mitigate the long-term fiscal burden arising from demographic processes, but the contribution revenues thus removed from the pay-as-you-go state pension system were so substantial that the reform was undone in 2011.

Further increasing the labour force participation rate could help mitigate the adverse impacts of population ageing. As a result of economic policy responses to demographic changes (raising the statutory retirement age, measures affecting the number of pension beneficiaries), the decline in the economically active population could fall short of the rate determined by demographic processes. At the same time, a further rise in the labour force participation rate, which remains low by international standards, could drive a further increase in the number of employed persons.¹² Fostering labour market participation in the long run may call for increasing certain budgetary expenditures: for instance, increasing healthcare expenditures could foster the continued employment of individuals beyond retirement age, and spending on education could also boost the probability of labour market activity. The employment rate of persons with higher education levels is characteristically higher in older age (*IMF 2014*); thus, (further) education of unskilled workers could improve their employment. Promoting lifelong learning may also boost employment within older age groups. In addition, economic policy can also foster preparation for old-age by incentivising savings and supporting early-start savings.

The migration trends observed in recent years could have a negative impact on the demographic situation, especially since emigration from Hungary is concentrated in more educated groups aged between 20 and 45 (*Bodnár–Szabó 2014; SEEMIG 2014*). Moreover, emigration may erode productivity and induce inflationary pressure through increasing labour market tightness. In the absence of accurate data on the emigrated Hungarian population, their potential return is difficult to forecast, and so it is important to prevent and reverse excessive migration. When emigrants return home, they may contribute to economic development with their experience acquired abroad (what is referred to as the ‘brain gain’). The various population projections assume that international net migration in Hungary will remain positive across the entire projection horizon, in other words that Hungary will be destination country in terms of migration.

Finally, economic policy can also foster an improvement in demographic trends by promoting the birth rate, albeit this can only yield a result over a horizon of several decades, and may thus temporarily increase the younger and the total dependency ratio. It is essential that as a result of economic policy measures the birth rate increase over the long term, instead of in the form of one-off demographic booms, such as the Ratkó generation, as such developments could put pressure on the educational and pension system.

¹² The expansion of the public employment scheme contributed to the rise in the labour force participation rate, alongside the reform of the labour market contributions system. Over the long run, it is important to ensure the greatest possible opportunities for public employment scheme participants to find work on the primary labour market. Developing the skills and increasing the mobility of these participants may help in attaining this objective.

4.2. Behavioural impacts

Besides the pivotal role of economic policy, a change in the behaviour of economic agents, i.e. adjustment, may also play a role in cushioning the negative macroeconomic impacts of ageing. The macroeconomics, fiscal and monetary impacts of ageing may be overstated if we do not factor in the autonomous response of individuals to the changed demographic environment.

Labour market

Better health and longer life expectancy could increase labour productivity and result in individuals working longer than earlier generations. A longer active career path enables higher consumption and yields a higher income level alongside the same savings ratio. Furthermore, the falling fertility rate could boost women's labour force participation rate, which is low by international standards, and thus result in higher labour supply. Certain economies may respond to labour shortages stemming from ageing by gradually increasing their capital/labour ratio: corporations may invest in assets that boost labour productivity.

Savings and consumption

A behavioural impact to counter the decline in savings due to ageing may consist of higher savings by individuals during their economically active years to prepare for longer life expectancy (retirement plans) in an effort to maintain their living standards. Accordingly, *Bloom et al. (2003)* argue that the increase in life expectancy is usually coupled with a higher savings ratio. There is consensus that consumption is on the rise as a result of ageing (*Erlandsen–Nymoer 2004; Masson–Tryon 1990*). Increased productivity on the one hand and the promotion of savings on the other hand could help cushion the slowdown in GDP growth.

Economic growth

The change in age structure may also impact economic growth through human capital investment. The decline in the fertility rate observed in past decades has improved education levels: parents are presumably able to spend more per child with fewer children. According to *Lee and Mason (2010)*, the productivity of the various age groups is also relevant in addition to the population's age distribution. If large, less productive cohorts are replaced by fewer, but more productive workers, standards of living may even increase (*Lee–Mason 2010*).

Another aspect is that the rising proportion of older persons within the population does not necessarily represent a burden for the economy and society. As the years spent in good health increase, individuals can continue working in a more productive manner. In terms of the fiscal balance, if the rise in life expectancy is paired with a rise in the number of years spent in good health, the higher ratio of

elderly within the population does not necessarily incur higher expenditures for the healthcare system. In addition, older persons often help out around the house and in childcare, and also provide financial support to younger generations.

At the same time, behavioural impacts may be substantively shaped by incentives such as the labour market and the institutional environment (e.g. the pension system). These could interact with demographic changes and yield diverging results from one country to the next (*Bloom et al. 2010*).

4.3. Opportunities

Population ageing may also spur demand for certain goods and services, or create new demand. Areas include demand for health preservation and healing. Demand for health preservation can take on various forms: healthy nutrition (across the entire food industry fruit and vegetable production, milk and meat industry, artisan and organic goods), healthy lifestyle (exercise, sports, health tourism, recreation), healthy living environments (construction, environmental protection, green energy industries). Greater demand for healing services could, over and above the direct impacts, also spur demand for healthcare training and medical technology. Health preservation and healing services and goods could also create a market with export capacity given the fact that European demographic processes will also bolster external demand for them. In addition, ageing generations may also increase demand for in-home services (home care, maintenance and repair services) or even create new demand for smart homes.

Rising life expectancy also increases demand for education. During a long lifespan, acquiring high value added know-how is even more profitable. This could boost demand for higher education courses and put greater emphasis on knowledge-intensive industries and R&D. For older persons, demand could grow for training courses aimed at spending time usefully or enabling activities generating supplementary income.

5. Conclusion

Hungary's population has been continuously shrinking since the 1990s. In addition to the decreasing population, the demographic processes are also characterised by population ageing. Declining birth rates and the gradual rise in life expectancy, although they fall short of the European Union average, will result in the proportion of persons aged 65 and older accounting for an increasingly large portion of the total population. In the upcoming decades, the ageing of the Hungarian and European population is expected to continue based on population projections, and the speed of ageing may accelerate. Population ageing results in a rise in the old-age dependency ratio, which could create a host of challenges for economic policy due to its fiscal impacts and its macroeconomic impacts. Population ageing may already

accelerate in Hungary in the coming years, mainly during the 2040s as the so-called Ratkó's grandchildren generation enters retirement. Thus, preparing for these demographic changes may already create a challenge for economic policy-making in the near future. Further fostering the birth rate will be the other key challenge. The population projections capturing expected developments in demographic processes assume a continuously rising fertility rate. If this does not materialise, the demographic and partly macroeconomic impacts discussed above may follow a more unfavourable path.

Based on the available projections, demographic processes may significantly decrease labour market supply in the coming decades. The Hungarian population aged 15 to 64 may shrink gradually from 6.7 million in 2014 to 5 million by 2060 based on the *Eurostats's population projection (2014)*. The labour supply of the shrinking working-age population may be boosted by the rising labour force participation rate, which nonetheless is relatively low in international comparison.

We quantified the impacts of demographic processes on the main macroeconomic variables using the estimates found in the literature. Although the estimates used are based on the data of decades shaped by more favourable demographic processes than the ones forecast for the future, the calculations do serve as a warning. According to our current knowledge, demographic processes are expected to significantly shape the development of key macroeconomic variables.

Based on these calculations, the consumption rate may rise and the savings ratio may decline in the coming decades, driven by the demographic processes. *Per capita growth could gradually decline by 0.5 to 1 percentage point.* Changes in the population's age composition could result in lower inflationary pressure compared to the past decade. Changes in the population's age composition could exert impact on the fiscal balance. Population ageing points towards rising pension expenditures and healthcare expenditures due to the higher life expectancy and the rising proportion of older persons within the population.

Population ageing may gradually change the value of key variables relevant to the conduct of monetary policy and may also influence the effectiveness of transmission channels. Looking forward, the equilibrium interest rate may decrease and inflationary pressure may become subdued. These two factors may erode the effectiveness of traditional interest rate policy, as monetary policy is more likely to meet the zero lower bound in this context. As a result, new instruments may become more valuable as compared to less effective traditional monetary policy instruments. Demographic processes may also affect the functioning of transmission channels. The market for long-term securities may increase as a result of higher life expectancy. The monetary authority can ensure the smooth functioning of this market by expanding its competence, applying adequate regulation and fulfilling its supervisory functions.

The adverse economic impacts of demographic processes can be cushioned with economic policy measures. For instance, economic policy may spur economically active persons to remain actively employed throughout a longer career path through the tax and pension system, and raising the effective retirement age could mitigate the increase in pension expenditures. Preserving and increasing Hungary's human capital will be an important task, which involves reversing the current unfavourable migration trends and attracting returning migrant workers, coupled with providing high standard education. Over the longer run, fostering the birth rate could also help improve demographic trends.

Besides the pivotal role of economic policy, adjustments in the behaviour of economic agents may also play a role in cushioning the macroeconomic impacts of ageing. Better health and longer life expectancy may increase labour productivity and extend the number of years spent on the labour market. Preparing for a longer retirement may foster higher savings, which could fuel the market for long-term securities. Longer life expectancy renders human capital investments even more profitable, which could boost productivity and innovative capacity.

Population ageing also represents economic opportunities which can be taken advantage of. Demand for certain goods and services may increase, and completely new demand might emerge. Areas include demand for health preservation and healing, a market with export capacity. Demand for education may also rise, fostering a shift in economic structure towards knowledge-intensive industries and R&D.

References

- Anderson, D. – Botman, D. – Hunt, B. (2014): Is Japan's Population Aging Deflationary? *IMF Working Paper, WP/14/139*.
- Bergantino, S. M. (1998): Life Cycle Investment Behaviour, Demographics, and Asset Prices. Massachusetts Institute of Technology, Department of Economics., <http://hdl.handle.net/1721.1/9667>
- Bloom, D. E. – Canning, D. (2004): Global Demographic Change: Dimensions and Economic Significance. *NBER Working Paper*, No. 10817.
- Bloom, D. E. – Canning, D. – Fink, G. – Finlay, J. E. (2007): Does age structure forecast economic growth? *NBER Working Paper* No. 13221.
- Bloom, D. E. – Canning, D. – Graham, B. (2003): Longevity and Life-cycle Savings. *Scandinavian Journal of Economics*, Vol. 105(3), pp. 319-338.

- Bloom, D. E. – Canning, D. – Hu, L. – Liu, Y. – Mahal, A. – Yip W. (2010): The contribution of population health and demographic change to economic growth in China and India., *Journal of Comparative Economics*, Vol. 38(1), pp. 17–33.
- Bloom, D. E. – Canning, D. – Mansfield, R. K. – Moore, M. (2007): Demographic Change, Social Security Systems, and Savings. *Journal of Monetary Economics*.
- Katalin Bodnár – Lajos Szabó (2014): The Effect of Emigration on the Hungarian Labour Market, MNB Occasional Papers 114.
- Börsch-Supan, A. (2006): Demographic Change, Saving and Asset Prices: Theory and Evidence, MEA, <http://www.rba.gov.au/publications/confs/2006/pdf/borsch-supan.pdf>
- Börsch-Supan, A. – Härtl, K. – Ludwig, A. (2014): Aging in Europe: Reforms, International Diversification, and Behavioral Reactions. *American Economic Review*, Vol. 104(5), pp. 224-229.
- Breyer, F. – Costa-Font, J. – Felder, S. (2010): Ageing, health, and health care. *Oxford Review of Economic Policy*. Vol. 26 (4), pp. 674-690.
- Chawla, M. – Betcherman, G. – Banerji, A. (2007): From Red to Gray: The “Third Transition” of Aging Populations in Eastern Europe and the Former Soviet Union. Washington, DC: World Bank.
- Erlandsen, S. K. – Nymoen, R. (2004): Consumption and population age structure. *Norges Bank Working Paper* No. 2004/22.
- European Commission (2012): The 2012 Ageing Report. Economic and Budgetary Projections for the 27 EU Member States (2010-2060).
- European Commission (2014): The 2015 Ageing Report. Underlying Assumptions and Projection Methodologies.
- Eurostat (2014): EUROPOP2013.
<http://epp.eurostat.ec.europa.eu/portal/page/portal/population/data/database>. Downloaded: 3 September 2014
- Felder, S. (2013): Managing the health care system – The impact of demographic change on health care expenditure. *CESifo DICE Report*, 1/2013.
<https://wwz.unibas.ch/fileadmin/wwz/redaktion/health/dicereport113-forum1.pdf>
- Fougere, M. – Mérette, M. (1998): Population Ageing and Economic Growth in Seven OECD Countries. *Economic Modelling*, Vol. 16. pp. 411-427.
- International Monetary Fund (2014): Fiscal Monitor – Back to Work: How Fiscal Policy Can Help. October 2014.

- Juselius, M. – Takáts, E. (2014) Can demography affect inflation and monetary policy? 23 September 2014 Bank for International Settlements.
https://wwz.unibas.ch/fileadmin/wwz/redaktion/forschung/Can_demography_affect_inflation_and_monetary_policy_0923.pdf
- Kim, H. J. (2014): Discussion of "Growth and Demographic aging in Europe: Reforms, International Diversification, and Behavioral Reactions. Presentation, The 2014 Bank of Korea International Conference, 2-3 June 2014.
- Hungarian Demographic Research Institute of the Hungarian Central Statistical Office (2013): Population projection 2013.
- Hungarian Central Statistical Office (2014a): Dependency ratios, ageing index (2000–2012).
https://www.ksh.hu/thm/2/indi2_1_2.html
- Hungarian Central Statistical Office (2014b): Total fertility rate (1990–2012).
https://www.ksh.hu/docs/hun/eurostat_tablak/tabl/tsdde220.html
- Lee, R. – Mason, A. (2010): Fertility, Human Capital, and Economic Growth over the Demographic Transition. *European Journal of Population*, Vol. 26, pp. 159-182.
- Lee, R. – Mason, A. – Cotlear, D. (2010): Some Economic Consequences of Global Aging. *HNP Discussion Papers*, No. 58408.
- Lindh, T. (1999): Medium-term Forecast of Potential GDP and Inflation Using Age structure Information. Submitted as working paper at Sveriges Riksbank.
http://www.riksbank.se/Upload/Dokument_riksbank/Kat_publicerat/WorkingPapers/WP_99.pdf
- Lindh, T. – Malmberg, B. (1998): Age structure and inflation – a Wicksellian interpretation of the OECD data. *Journal of Economic Behavior & Organization*, Vol. 36. pp. 19-37.
- Lindh, T. – Malmberg, B. (2007): Demographically based global income forecasts up to the year 2050. *International Journal of Forecasting*, Vol. 23. pp. 553-567.
- Ludwig, A. (2005): Aging and Economic Growth: The Role of Factor Markets and of Fundamental Pension Reforms. *MEA Discussion Paper*, No. 05094.
http://mea.mpsoc.mpg.de/uploads/user_mea_discussionpapers/x0abxfkrjeqc2jyc_Growth_25_02_05_mea.pdf
- Magyar Nemzeti Bank (2013): Elemzés az államháztartásról – Kivetítés a költségvetési egyenleg és az államadósság alakulásáról (2013–2027).
- Masson, P. R. – Tryon, R. W. (1990): Macroeconomic Effects of Projected Population Aging in Industrial Countries. *IMF Working Paper*, No. 90/5.

- McMorrow, K. – Roeger, W. (1999): “The economic consequences of ageing populations (a comparison of the EU, US and Japan)”, DG-ECFIN.
http://ec.europa.eu/economy_finance/publications/publication11151_en.pdf
- Meredith, G. (1995): Demographic Change and Household Saving in Japan, in “Saving Behaviour and the Asset Price “Bubble” in Japan”, *IMF Occasional Paper*, No. 124.
- Mosolygó, Zs. (2009): A népességnövekedés, a vagyonszugorodási hipotézis és a világgazdasági válság. *Economic Review*, Volume LVI, October 2009, pp. 866-880.
- OECD (2013): Pensions at a Glance 2013: OECD and G20 Indicators. *OECD Publishing*.
http://dx.doi.org/10.1787/pension_glance-2013-en
- Prskawetz, A. – Kögel, T. – Sanderson, W. C. – Scherbov, S. (2007): “ The Effects of Age Structure on Economic Growth: An Application of Probabilistic Forecasting to India”, *International Journal of Forecasting*, Vol. 23 (4), pp. 587-602.
- Schwan, A. – Sail, E. (2013): Assessing the economic and budgetary impact of linking retirement ages and pension benefits to increases in longevity. *European Economy, Economic Papers*, No. 512. December 2013
- SEEMIG (2014): Migráció és migrációs hatások kezelése Délkelet-Európában, Hírlevél 5, November 2014.
- Takáts, E. (2012): Ageing and House Prices. *Journal of Housing Economics*, Vol. 21, pp. 131-141.
- United Nations (2013a): World Fertility Patterns 2013. Department of Economic and Social Affairs, Population Division.
<http://www.un.org/en/development/desa/population/publications/pdf/fertility/world-fertility-patterns-2013.pdf>
- United Nations (2013b): World Population Ageing 2013. Department of Economic and Social Affairs, Population Division
- World Bank (2014): Health Nutrition and Population Statistics: Population estimates and projections. World DataBank.
<http://databank.worldbank.org/Data/Views/VariableSelection/SelectVariables.aspx?source=Health%20Nutrition%20and%20Population%20Statistics:%20Population%20estimates%20and%20projections>
Downloaded: December 2014

Appendix: A comparison of Hungarian population projections

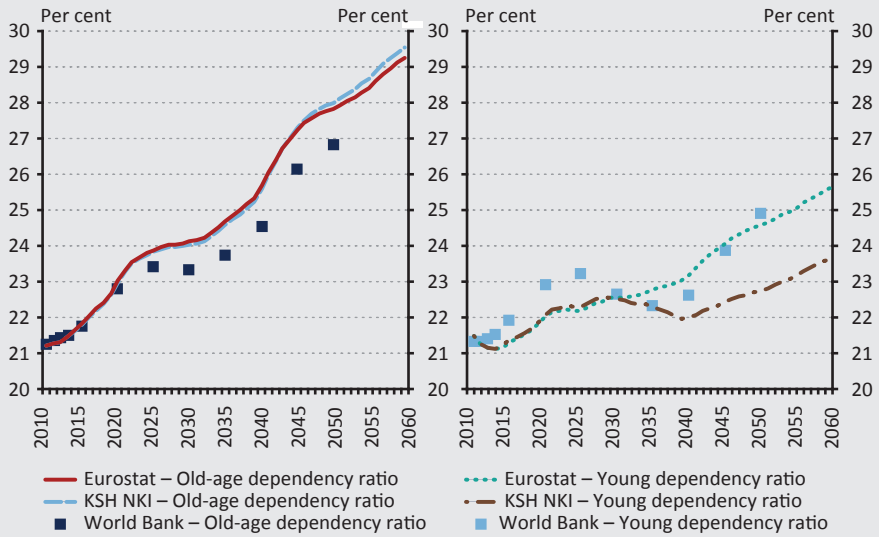
The population projections prepared by various institutions exhibit slight discrepancies, but presage similar demographic processes. Each projection assumes population ageing and thus a further rise in the old-age dependency ratio (*Figure 16*). When presenting demographic processes and quantifying macroeconomic impacts, we consider the *Eurostat (2014)* population projection, comparable on the European Union level, as the baseline scenario. In addition, two additional projections are available with respect to Hungary: the projection prepared by the Hungarian Demographic Research Institute of the Hungarian Central Statistical Office (CSO HDRI) and the World Bank.

The CSO HDRI's population projection presents the expected future developments in the size and composition of the Hungarian population. The projection baseline refers to the population structure prevailing at the time of preparation of the projection, and the future developments in the population are shaped by the assumptions on fertility rates, mortality rates and international net migration figures. The population projection presents three alternative scenarios (low, main and high variant). The main scenario assumes that in 2060, the fertility rate may stand at 1.6 alongside higher life expectancy and the net international net migration figure may stand at 10,000 individuals. As a result, the Hungarian population could shrink to 8 million by 2060, which is 1 million less than the population figure presented by the *Eurostat (2014)* as the baseline. The discrepancy may stem from a combination of lower life expectancy (80 years for men in 2060), lower fertility and the smaller immigration inflows. The slower increase in the young dependency ratio may be linked to the lower fertility rate (*Figure 16*).

The World Bank's population projection presages slightly more favourable demographic processes compared to the findings of the *CSO HDRI (2013)* and *Eurostat (2014)*. The World Bank projects developments in the populations of nearly 200 countries until 2050 for 5-year periods across the projection horizon, and uses 2010 census data as the projection baseline. The assumptions made in the World Bank's projection with respect to Hungary differ from the above to projections mainly in the area of net migration, as the total horizon assumes substantial net migration of 75,000 individuals per year. The old-age dependency ratio resulting from the projection is also lower compared to the other two projections.

Figure 16.
Dependency ratio projections for Hungary

2010-2060



Source: Eurostat (2014), CSO HDRI (2013), World Bank (2014)

Topology of the foreign currency/forint swap market

Ádám Banai – András Kollarik – András Szabó-Solticzky

In our study, we examine the network structure of the currency swap market, the volume of which amounts to several times the Hungarian GDP. With this paper, we aim to establish a complete picture of the market by complementing the results for the overnight market. Additionally, we can now analyse a longer time series than in our 2013 study. We look at the properties of the graphs in segments representing various maturities. We find that the properties of the graph derived from the overall market and the dynamics of those properties are identical to those of the short-term market, while trends differ for various tenors. The longer the maturities, the less the graphs satisfy the small-world property. The longest markets are increasingly closer to random graphs. Although the effect of shocks to large actors is smaller in such graphs, this change also suggests that counterparties trusted each other less as transactions became longer. This is also reinforced by the fact that following the onset of the crisis, the number of connected vertices gradually decreased in the networks of longer markets. In other words, weakening trust is also manifested in the decreasing number of counterparties. This is confirmed by the development of average degree and average path length, and by affinity functions.

Journal of Economic Literature (JEL) Classification: G01, G15, C45

Keywords: financial networks, FX swap, financial crisis, topology, centrality indices

1. Introduction and precedents in literature

The global economic crisis which erupted in 2007 hit Hungary severely, as the financial markets collapsed following the Lehman bankruptcy. In October 2008, a few weeks after the Lehman default, the key Hungarian money markets also froze up. The government securities market, the unsecured interbank forint market, and the currency swap market all came to a standstill for a few days, which hit the banking system severely as well. Banks are required to continuously renew their currency swaps, in order to close their on-balance sheet open foreign exchange

Ádám Banai is Head of Applied Research and Stress Testing Department at the Magyar Nemzeti Bank. E-mail: banaia@mnbb.hu.

András Kollarik is an economic analyst of the Monetary Policy Instruments and Reserve Strategy Department at the Magyar Nemzeti Bank. E-mail: kollarika@mnbb.hu.

András Szabó-Solticzky is a PhD candidate in Applied Analysis and Computational Mathematics at Loránd Eötvös Science University. E-mail: szabosolticzky@gmail.com.

positions off-balance sheet. If they had not been able to renew their expiring swaps, to meet their liabilities they would have been forced to purchase currency on the spot market, which would have placed the forint exchange rate under enormous pressure. In dealing with the problems on the swap market, a major role was played by parent bank commitment, and it was also necessary for the Magyar Nemzeti Bank to introduce new swap instruments.

This episode of the crisis highlighted the key importance of the operation of the FX swap market for financial intermediation in Hungary. Hungarian banks gain access to foreign currency funds partly through FX swaps, which are essential for closing their open positions resulting from their significant portfolios of foreign currency loans. Foreign actors are also particularly active in this market. They enter forward positions through FX swaps, which in many cases they also use to hedge the exchange rate risk of their forint assets. The FX swap market also deserves particular attention from a monetary policy perspective. Disruptions to the operation of this market may significantly reduce forint implied yields, making speculation against the forint cheaper.

The operation and role of the Hungarian currency swap market has been addressed by a number of studies. *Páles et al. (2010)* provide a highly detailed description of the role played by the market in Hungary's economy. They show how different the motivations of various actors (domestic banks, foreign actors) are for entering the FX swap market. The authors also give an overview of the changes which occurred in the market during the crisis. In the aftermath of the turmoil, in many cases limits for domestic banks were reduced, accompanied by an increased role of margin calls, which further intensified the demand for swaps. *Banai et al. (2010)* also address the problems experienced in the FX swap market during the crisis. They find that, prior to the escalation of the crisis in Hungary, it was local banks in particular that had accumulated extremely large stocks of FX swaps. Stock renewal and increasing margining posed a major problem at certain stages of the crisis, which called for the use of the MNB's instruments.

Analyses of the Hungarian FX swap market have mainly focused on the stock size and maturity, the development of implied yields, and the behaviours and strategies of the various actors. However, additional information about financial markets may be obtained through an exploration of the actors' network relationships. Research on the network characteristics of financial markets has gained prominence in the past decade, especially since the onset of the crisis. One of the first studies of this kind was *Lublóy (2006)*, which discussed the network structure of VIBER. According to the study, the network characteristics under review were stable in time. Additionally, the author identified the actors that were the most important for the stability of the network. Surprisingly, these institutions were not the largest banks of the banking system in terms of balance sheet total.

In this paper, we rely heavily on our previous study on the short-term FX swap market (Banai *et al.* 2013). In our analysis, we demonstrated that the overnight FX swap market also shares the small-world property characteristic of financial networks (for details, see Chapter 4 on methodology). Additionally, an examination of the dynamics of network indicators highlighted the significant decrease in the size of the short-term FX swap market after the Lehman bankruptcy. That is, many institutions either cut down on their activity in the market, or left it entirely. However, the exiting institutions were predominantly those with less relevance to the market. This is definitely beneficial in terms of stability. In turn, there is a greater risk from the increased role of the remaining institutions, i.e. the fact that the market has become more sensitive to the behaviour of particular actors.

The tools of network theory are used even more frequently in international literature to examine financial markets. In their research, Jazetta and Manna (2009) addressed the properties of the Italian interbank market. They explored the behaviour of a number of network characteristics. They found the connectivity of the network to be very low, similarly to real networks, and to be decreasing in time. Another key observation was that the entire network remained connected throughout the 222-month period under review. That is, with any pair of banks, it was possible to identify a path through which they could reach each other. Their third finding was that, although to a minor extent, the average shortest path increased within the network (for details, see Chapter 4 on methodology). They also found that the largest actors were dealing regularly and directly with counterparties playing smaller roles in the network. Finally, the authors demonstrated that the proportion of relatively large actors in the network had decreased, accompanied by an increase in the number of banks dealing only with a few counterparties. In their study, Iori *et al.* (2008) discussed the Italian overnight market. They demonstrated that banks that were large in terms of degree had a great number of small counterparties. The authors found this to increase the risks of contagion in the case of high-density networks (see details in Chapter 4 on methodology).

Soramäki *et al.* (2006) analysed the network properties of interbank payment data in the Fedwire Funds Service. They found this network also to be sharing the properties characteristic of real networks. Such features include scale-free degree distribution, a high clustering coefficient, and the small-world phenomenon, which was introduced by Watts and Strogatz (1998) and is generally characteristic of financial networks. They also found the properties of the networks under review to be stable in time.

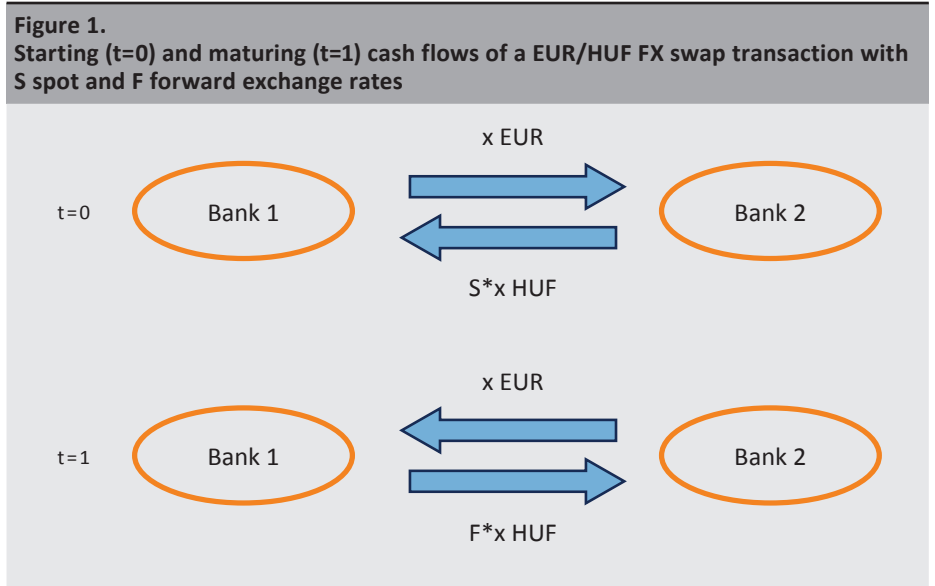
The above list is sufficient to show that in finance, network tools have primarily been used to analyse payment and settlement systems as well as unsecured interbank markets (although Markose *et al.* (2010) discussed the US CDS market). In neither the Hungarian nor the international literature have we found any papers providing

a network analysis of the FX swap market. What follows is our attempt at such an analysis. As we previously discussed the processes of the short-term market in detail (Banai et al. 2013), in this study our primary focus will be on longer markets and their relationship to the short-term market. In Chapter 2, we provide a more detailed description of the main characteristics of the Hungarian currency swap market. In Chapter 3, we discuss the data used and in Chapter 4, we describe the network theory methodology applied. Then, in Chapter 5, we present our results on the topology of the network. Finally, in Chapter 6, we summarise our findings.

2. The currency swap market

2.1. The FX swap

A foreign exchange swap (hereinafter: FX swap) is a derivative financial transaction consisting of two legs. On the start (or spot) leg of the transaction, the counterparties swap two different currencies with each other, which they will swap back on the maturing (or forward) leg. When entering into the transaction, they agree on both the spot and the forward exchange rate. FX swaps are also commonly called simple currency swaps, since no transaction takes place between the counterparties other than swapping nominal values, as opposed to currency interest rate swaps (CIRS), where the parties (also) pay interest to each other during the term. With FX swaps against the forint, the market convention is that the same foreign currency amount is traded on the spot and forward legs, and the two forint amounts payable are obtained as the forint value of that amount taken at spot and forward rates (Figure 1). The current exposure to a counterparty resulting from an



FX swap transaction as a secured loan (the net present value of the transaction) is an order of magnitude lower than that resulting from an unsecured deposit or loan transaction of the same nominal value.

FX swaps are used for various purposes in financial markets.

1. One widespread trading strategy involves an FX swap plus the purchase of a foreign currency asset (or the repayment of a foreign currency liability). In this case, the actor uses the liquidity acquired on the spot leg of the FX swap to purchase the foreign currency asset to be held (or to repay the foreign currency liability to be repaid), while the forward leg of the swap provides a hedge against the exchange rate risk of the foreign currency asset (or the foreign currency liability being repaid). Where the asset purchased and the swap mature at different times, the strategy also involves yield speculation. Foreign investors have a propensity to finance their forint government security purchases using FX swaps.
2. Another popular trading strategy is an FX swap and a foreign exchange spot market transaction of the opposite direction. This is equivalent to taking a forward foreign exchange position, since the spot transaction neutralises the spot leg of the swap, leaving only the forward leg effective. An actor may follow this strategy for both speculative (carry trade) and hedging purposes.
3. The third important strategy involves entry into two swaps of opposite directions, with the same spot value dates, but with different maturities. The strategy allows an actor to speculate on interest rate differentials. For instance, if they lend foreign currency in exchange for forints on the spot leg of the long swap, which is swapped back to foreign currency by a bank on the spot leg of a short swap of the opposite direction, then they may refinance the currency repayment upon maturity of the short swap through another short currency raising swap. In this case, profits will be generated for the bank if future short forint yields rise faster in relation to foreign currency yields than what is priced into long yields.
4. Another important role of FX swaps is to revolve maturing forward and FX swap transactions: the foreign currency funds acquired on the spot leg of the swap can be used to repay the foreign currency liability due, while the forward leg can be used to renew the off-balance sheet foreign currency debt.
5. Additionally, this type of transaction can be used solely to grant loans secured by the opposite currency.

2.2. The domestic currency swap market

Due to the limited data available, we will only analyse the segment of the domestic currency swap market where at least one of the counterparties to the transaction is a domestic bank. We have nothing more than anecdotal evidence that in London, foreign actors also enter into foreign currency/forint swap transactions (*Balogh–Gábor 2003*). The FX swap market is a less strictly regulated OTC (over-the-counter) market, where foreign currency/forint transactions are typically traded through brokers in London, which means that direct bilateral contacts and market making are not common (*Csávás et al. 2006*). At the same time, in the segment of less than one month, by virtue of exclusive access to the MNB's forint market instruments, domestic banks may be considered to be market makers. *Table 1* provides a summary of the key properties of the market.

Table 1.	
Key characteristics of the domestic currency swap* market	
Indicator	Value
swap turnover among CHF, EUR and USD relative to HUF/FX swap turnover (2005–Nov. 2014)	44%
daily average turnover of HUF/FX swap market (2005–Nov. 2014, HUF bn)	525
gross HUF/FX swap stock of Hungarian banking system against foreigners (both directions, 1 Dec. 2014, HUF bn)	6006
ratio of interbank transactions to total turnover (2005–Nov. 2014)	95%
ratio of cross-border transactions to total turnover (2005–Nov. 2014)	84%
average transaction size (2005–Nov. 2014, HUF mn)	5474
*Currency swaps are understood in the broad sense, so we have taken into account FX swaps as well as CIRSs for our calculations. By default, we are describing the foreign currency/HUF market. Source: Own calculations based on MNB data.	

Given the very high ratio of the volume of swaps between cross-currencies and in the foreign currency/forint segment, which points to the possibility of free movement from one foreign currency to another through swaps, the swap markets of various currencies against the forint are treated collectively as a general foreign currency/forint in the rest of this paper, without making a distinction between the USD/HUF and the EUR/HUF segments, for example.

The annual volume of the foreign currency/forint swap market amounted to approximately 5 times the Hungarian GDP in the sample period between 1 January 2005 and 1 December 2014. At the end of the period, the gross foreign currency/forint swap stock of the Hungarian banking system against foreign actors, despite the continuous decrease of the stock of foreign currency loans, amounted to 18% of the balance sheet total of the banking system. These two figures also point to the significant role of the swap market in the domestic economy. Underlying this, in addition to the versatile applications of the transaction, there are macroeconomic

factors as well. Prior to the financial crisis starting on 15 September 2008 with the failure of Lehman Brothers, the country's net external debt and simultaneously the reliance of the banking system on foreign funds had increased significantly. Net external debt equals the sum of the long open forint foreign exchange positions taken by each economic sector (*Páles et al. 2010*), which means that the open forint position had to be taken by one economic actor or another. Foreign actors were less willing to do so, and therefore, most of the position was undertaken by the domestic private sector through the balance sheet of the banking system, which opened banks' on-balance sheet foreign exchange positions. Pursuant to an earlier government decree and the CRR, however, the banking system had to allocate capital to its entire foreign exchange position,¹ which gave it incentives to close the open position off-balance sheet. Typically, banks close their open on-balance sheet foreign exchange positions through currency swaps, using strategies 2 and 4 above (*Páles et al. 2010*).

2.3. The financial crisis and its effect on the currency swap market

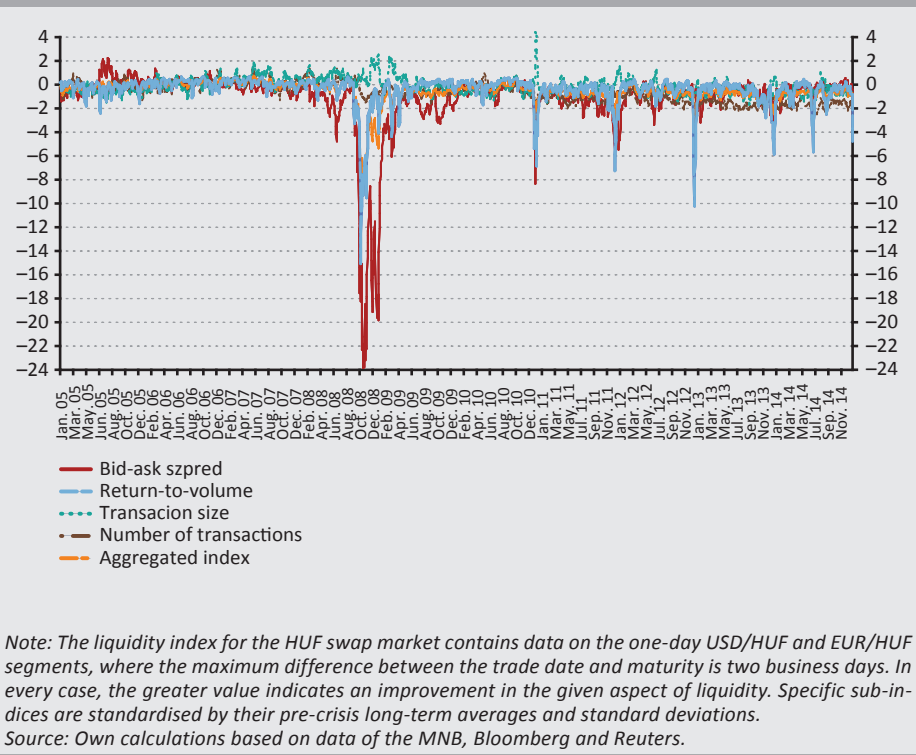
Although the costs of funding in Hungarian markets had been increasing from mid-2007 as the subprime mortgage credit crisis unfolded, and a brief turbulence evolved in the government securities market in March 2008, the global financial crisis essentially escalated in Hungary following the collapse of Lehman Brothers on 15 September 2008. The most intensive phase of the crisis lasted from autumn 2008 to spring 2009. In the autumn of 2008, the cost of liquidity skyrocketed first in foreign currencies and then in forint as market players restricted their partner limits vis-à-vis one another. The turnover of the currency swap market became rather volatile, and the share of intra-group transactions also became unstable. While previously the maturity of swaps had gradually increased, this trend came to a standstill during the crisis, and new swaps became perceivably shorter. Additionally, the euro also replaced the dollar, which had previously played the dominant role in the swap market (*Páles et al. 2010*).

The overnight market dried up, and the aggregate liquidity index measuring market liquidity fell to -8 by the end of October 2008 (*Figure 2*). This means that market liquidity was 8 standard deviations below the long-term average of the period preceding the crisis.² Meanwhile, swap spreads increased considerably. The spreads of around zero measured before the crisis widened to several hundred basis points. Consequently, in this period forint loans (secured by foreign currency) were available through swaps at rates several percentage points below the reference money market yield.

¹ Where the entire foreign exchange position exceeds 2% of total own funds, the own funds requirement for foreign exchange risk is 8% of the open foreign exchange position.

² For more details on the aggregate liquidity index, see *Páles–Varga (2008)*.

Figure 2.
Liquidity indices of the one-day EUR/HUF and USD/HUF FX swap markets
 (exponential moving averages)



3. Data

We calculated individual network indicators for longer segments (maturities of 3 days to 1 month, 1 to 3 months, and above 3 months), as well as for the graph derived from the overall market. The study will focus on the development of these (Tables 2 and 3). Due to its significant volume weight, in our analysis we also consider the 1–2 day segment as defined above. We do so because the above definition is consistent with the segment, the development of which is described by the aggregate liquidity index. However, while the aggregate liquidity index is calculated by the central bank only for the segment comprised of USD/HUF and EUR/HUF transactions, we also considered CHF/HUF transactions.

Table 2.

Volume of the foreign currency/forint swap market by currency

	USD	EUR	CHF	together
proportion in turnover (%)	83	15	2	100
proportion in turnover corrected by tenor (%)	38	49	13	100

Note: Based on the forint value of the spot leg of the transactions. In adjustments for maturity, we multiplied the transaction value by the maturity.

Source: Own calculations based on MNB data.

Table 3.

Volume of the foreign currency/forint swap market by maturity

	1-2 days	3 days-1 month	1-3 months	>3 months	together
proportion in turnover (%)	76	14	6	4	100
proportion in turnover corrected by tenor (%)	13	8	11	69	100

Note: Based on the forint value of the spot leg of the transactions. In adjustments for maturity, we multiplied the transaction value by the maturity.

Source: Own calculations based on MNB data.

We examined the transactions completed between 1 January 2005 and 1 December 2014. The actors selected to represent the vertices of the graphs included both domestic and international actors, whereas the MNB was excluded. Our analysis concerned only credit institutions, as a result of which we ignored transactions with the non-financial corporate sector, for instance. Domestic banking groups were included in the graphs on a consolidated basis, i.e. members of banking groups were represented by a single vertex standing for the entire banking group. By contrast, we had no means to consolidate all of the foreign banking groups, neither did we intend to cleanse the database from transactions within cross-border banking groups; consequently, we included each member of foreign or cross-border banking groups separately in the database. The edges between the vertices were derived from the transactions between them (and not from existing stocks). For 1–2 day transactions and the entire network, we created the matrices to describe the graphs by aggregating transactions at intervals of 5 business days. Additionally, for the sake of comparability we also created the graphs at a monthly frequency. This was needed because with segments longer than 1–2 days, we only examined monthly graphs. The main reason for that was that the number of transactions is far lower in such segments, and the size of the networks obtained through 5-day aggregation proved to be too small. We examined transactions longer than overnight in three groups: 3 days to 1 month, 1 month to 3 months, and transactions exceeding 3 months. We established each group by taking two important aspects into account. On the one hand, we needed a sufficient number of vertices for our analysis, while

we also needed to consider, to some extent, the different roles of the transactions with different maturities. We added up the signed forint values of the spot legs of the swaps among the individual actors, assigning a positive value to a transaction where the bank received currency on the spot leg, and a negative one in the opposite case.

4. Methodology

In this chapter, we briefly explain the network theory tools that we used in our analyses (the methodology is identical to that used in our previous paper (*Banai et al. 2013*)). Our aim is to provide a straightforward definition of the indicators characteristic of the network, occasionally at the expense of mathematical precision. Specific results concerning the FX market will be discussed in the next chapter.

4.1. Adjacency matrices and components

Let us assume N banks to be given, and W to be an $N \times N$ matrix wherein element $W_{i,j}$ indicates the forint amount given by bank i to bank j on the spot leg. In fact, W is a matrix including *bilateral exposures* in forint. Each element of the matrix W is non-negative and it is not necessarily symmetric, and we assume every element along its main diagonal to be zero. The matrix thus obtained defines a weighted and directed graph without loops,³ where the weight of each edge determines the size of the claim, and the direction determines the direction of the cash flow. Note that where banks i and j have mutual claims on each other, we use a netted claim obtained as a signed sum of the claims. In analysing the network, the question is often simply whether two actors are connected or not, the size and direction of their connection is less important. This is because the formation of a connection in itself may provide relevant information, while facilitating the understanding and interpretation of the indicators. Additionally, it is important to consider the fact that FX swaps are secured transactions. Consequently, direction is less significant than with commonly analysed unsecured markets.

Let A be an adjacency matrix representing an undirected and unweighted network, i.e.

$$A_{i,j} = \begin{cases} 1, & W_{i,j} + W_{j,i} > 0 \\ 0, & \text{otherwise} \end{cases} \quad (1)$$

The inequality $W_{i,j} + W_{j,i} > 0$ in the above definition will be satisfied exactly when an edge leads from i to j or from j to i , i.e. matrix A truly represents an undirected network. For example, with the 1–2 day market, the matrices were created by

³ Loop: an edge starting from and ending in the same vertex.

aggregation at intervals of 5 business days, i.e. by obtaining a signed sum of the daily transactions. For aggregation purposes, we did not consider bank holidays in the USA, Switzerland and Europe to be business days because the volume of trade is significantly lower on such days. In calculating the network indicators discussed below, we generally require the network to be connected in some sense.

4. 2. Network indicators

Network size

One of the most general characteristics of the network is its size, which indicates the number of banks participating in at least one transaction in a given period either as borrowers or lenders.

Degree

In a directed graph, the indegree (outdegree) of a vertex i is understood as the number of edges leading to (from) that vertex.

With undirected networks, the degree of i is the number of vertices connected to it. More precisely, if the degree of vertex i is indicated by $f(i)$, then

$$f(i) = \sum_{j=1}^N A_{i,j} \quad (2)$$

Degree is commonly included among centrality indicators, i.e. characteristic quantities which are supposed to describe the importance of the role that a given vertex plays in the network. Another key quantity is degree distribution. This function indicates the frequency of a given degree value. In networks occurring in reality, degree distribution often follows power law. More precisely, if the frequency of degree k is indicated by $p(k)$, then

$$p(k) = ck^{-\gamma} \quad (3)$$

where c is a normalising constant and γ is a positive number, mostly in the interval of [2,3]. Such graphs are called scale-free networks (*Barabási–Albert 1999*). Networks occurring in reality mostly include a large number of low-degree vertices and few higher-degree vertices.

Average path length, diameter and mass function

The distance between vertices u and v is understood as the sum of the weights of the edges along the shortest path between them. In our analyses, we will always consider the largest connected component where we want to use the shortest distance or some of its functions. In the rest of this paper, let $d(u,v)$ indicate distance. In an unweighted graph, $d(u,v)$ will indicate the minimum number of steps required to be taken to get from u to v . Average path length is defined as the

average of such distances, and the diameter of the network as the maximum of such distances.

We also introduce a measure called mass function, which indicates the proportion, relative to all shortest paths, of the shortest distances that will be less than or equal to a given constant k ($k=2, 3, 4, 5$). Obviously, the function increases in the k parameter, and where k equals the diameter of the network, the result will be 1, since every shortest path is either less than or equal to the diameter.

Closeness⁴

The closeness of a vertex u is the inverse of the length of the path to vertex v , which is at the greatest distance from it. More precisely, if closeness is indicated by $c(u)$, then

$$c(u) = \frac{1}{\max_v d(u,v)} \quad (4)$$

The $\max_v d(u,v)$ quantity itself illustrates the number of steps required to get from u to any vertex. Inversion is necessary because we want the closeness of a vertex to be the higher the more central the vertex is to the network, i.e. the fewer steps are required to get to any vertex from it. It is for this property that closeness is considered to be a centrality indicator as well.

Betweenness

Betweenness indicates the number of shortest paths that include a given vertex. We do not count the shortest paths starting from or ending in the vertex concerned. In order to compare betweenness indicators across networks of different sizes, we need to divide the indicator by the maximum number of shortest paths, which for N vertices will give

$$\frac{(N-1)(N-2)}{2} \quad (5)$$

The above formula will determine the maximum number of shortest paths that may include a given vertex without starting or ending in that vertex.

Density

Density indicates the ratio of the number of edges to the number of all possible edges. The number of all possible edges in an undirected network of N vertices is

$$\frac{N(N-1)}{2} \quad (6)$$

⁴ We also calculated another version of the average closeness indicator. In that indicator, we inverted the average of the shortest paths rather than their maximum. However, we obtained similar results in both cases.

as every vertex may be connected to a maximum of $N-1$ vertices, but that would include all edges twice. Note that in the case of a directed network, the above formula is modified to $N(N-1)$.

Clustering coefficient

The clustering coefficient of a given vertex shows the ratio of the number of edges between its neighbours to the possible number of edges between its neighbours. In other words, the average clustering coefficient determines the probability of the neighbours of any vertex being connected with one another as well.

Affinity function

The affinity function indicates the average degree of the vertices connected to vertices of a given degree. That is, the function assigns a number to every degree occurring in the network. If the function increases monotonically, vertices of a higher degree will also be connected to vertices of a higher degree, i.e. the key actors will be directly connected to one another. Otherwise vertices of a higher degree will only be connected to vertices of a lower degree, i.e. larger actors will only deal directly with smaller banks.

The small world property

In networks exhibiting the small world property, the average shortest path between vertices is low relative to the size of the network. Additionally, the average shortest path is proportional to the logarithm of network size, i.e.

$$\text{Average shortest path} = c \cdot \log(N)$$

where c is constant.

4.3. Random graphs

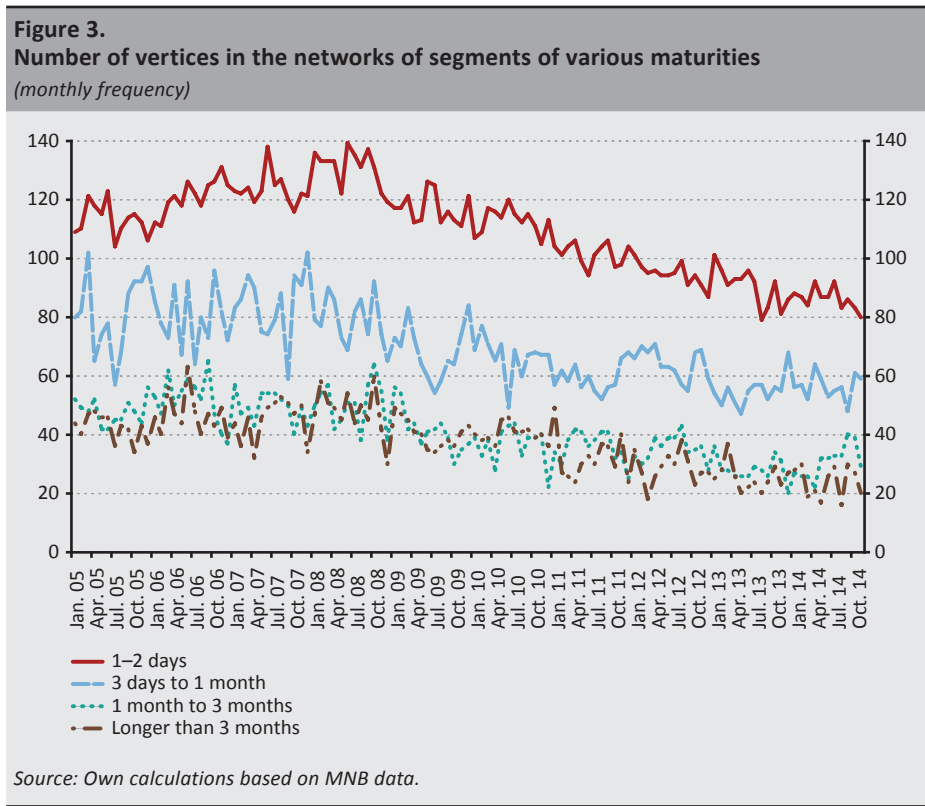
One of the longest established and most studied random network models is the so-called Erdős–Rényi graph (*Erdős–Rényi 1959*). The scheme involves a fixed N number of vertices, where two different vertices will be connected with a probability of p and will not be connected through an edge with a probability of $1-p$. Primarily, we would like to use the Erdős–Rényi network to compare its average clustering coefficient with that of the graph obtained by us. If the two indicators are close, i.e. their ratio ≈ 1 , we may conclude that our network has no meaningful structure. The question arises how we should construct an appropriate Erdős–Rényi model for a given graph. Obviously, the number of vertices must be identical, and the value of p should be selected as follows:

$$p = \frac{\text{average degree}}{N-1} \tag{7}$$

Since our database only includes transactions reported by Hungarian actors, we will slightly adjust the above model because in our network the probability of an edge between two foreign counterparties is zero. Let us consider the sub-graph that only includes domestic actors and the edges between them. Let G_{DD} indicate the Erdős–Rényi graph belonging to this network. Additionally, let us create another Erdős–Rényi model for a bipartite graph representing domestic–foreign relationships. A bipartite graph includes two disjoint sets of vertices (domestic and foreign actors), where the edges may only connect domestic and foreign vertices, but neither two domestic nor two foreign vertices. The random graph scheme is modified in that we will only try to connect i and j vertices with a probability of p where i is a domestic actor and j is a foreign actor. Finally, let us unite the network so obtained and graph G_{DD} . In the rest of this paper, we will refer to the graph created this way as a modified Erdős–Rényi network.

5. Results

In the analysis of the overnight market, several findings raised the possibility that the dynamics observed may be caused by the increased prominence of using longer markets (Banai et al. 2013). Further analyses suggested that probably this was not



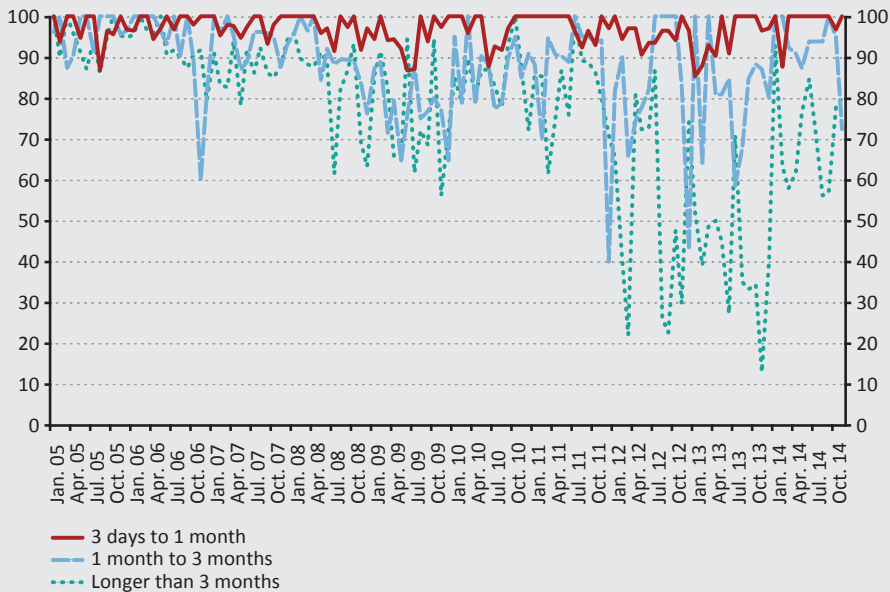
the case, but in the following we explore the specific features of the overall market in detail. In the previous chapter, we described the mathematical tools that we used to map the network structure of the currency swap market. The set of indicators enable us to gain an understanding of the key properties of our network and their development over time. In our calculations, we also examined each indicator separately for segments of various maturities. Additionally, our results include the development of network statistics that ignore maturities and thus describe the overall market.

Our analysis of short markets showed that network size, i.e. the number of banks trading in the given period, is far from being constant (*Figure 3*). For a while, size was perceptibly growing as foreign currency lending took off. From summer 2007 onwards, a series of crisis events could be read from size dynamics. The bankruptcy of Northern Rock caused a break, the so-called decoupling period brought growth, and then the Lehman failure led to a fall. From the second half of 2010, another downward trend emerged, which continued to the end of the period observed. In the networks of segments of longer maturities, the number of vertices fell significantly short of the 1–2 day segment, despite the longer frequency. At the beginning of the period, size exceeded 100 in the 1-2 day network and was still at 70 at the end of the period at a weekly frequency. At a monthly frequency we obtained even higher values, with a maximum at 140 and a size approximating 100 even at the end of the period. This is consistent with the need for actors to renew shorter transactions significantly more frequently. It is seen that in autumn 2008, the number of vertices suddenly dropped in all three long segments. Late 2009 and early 2010 marked the beginning of a more spectacular downward trend. That is, in periods when the size of the short market contracted, a similar trend emerged in longer markets as well. This disproves the possibility that the increased prominence of transactions with longer maturity may have caused the size of the short market to contract. At the same time, it supports the position that many actors were forced to exit the foreign currency/forint FX swap market by an increase in risks, despite credit risk remaining low. It is worth noting that the transactions entered into with the MNB in accordance with the forint conversion announced in November 2014 did not result in any significant changes in the number of actors in November. Only the 1 to 3-month market showed some increase. This may be due to the fact that counterparties will receive currency from the MNB, which they can use to close their market swaps among other things, with a delay, between 2015 and 2017. Consequently, the size of the market is expected to contract only later.

In terms of our research, the first and most striking network property of the FX swap market is that the graph obtained is often not connected. When we consider the network formed on a single trade day, the network is found to be disintegrating into several (in some cases more than 10) separate parts. For our analysis, it is

important to obtain a connected network, since the calculation of certain centrality indicators only makes sense if we do. It was an important question in the case of the 1–2 day market as well to find the sufficiently short frequency where a connected network is formed. Due to the small size, this problem becomes even more significant with longer segments. We decided to use a monthly frequency in such cases. A lower frequency would already “conceal” many events, and as such would not be a suitable choice. However, it is apparent that, especially with transactions exceeding 3 months, in extreme cases the largest connected component is comprised of only 20 to 30 percent of the actors. That is why a higher frequency is not recommended either (Figure 4).

Figure 4.
Ratio of the vertices in the largest weakly connected component to the size of the entire network in longer markets



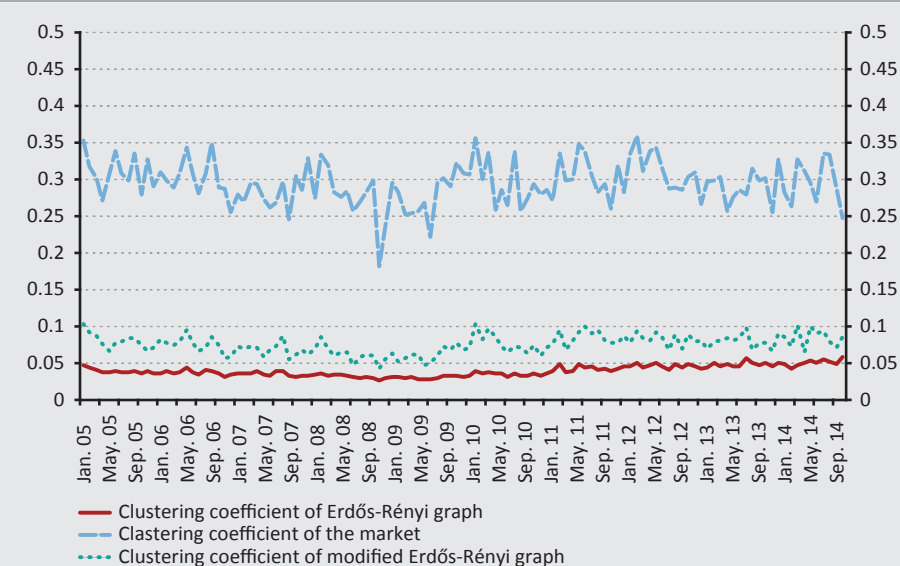
Source: Own calculations based on MNB data.

A key question is what causes this disintegration. In the literature, we have found several references to examples of markets which were not completely connected as networks (e.g. *Berlinger et al. 2011; Bech–Atalay 2008*). Such a level of disintegration may be explained by the fact that a major part of the actors are foreign banks. In many cases, foreign actors mostly trade with their own local subsidiary banks. When the relationship is mutually exclusive, the two vertices will break away from the rest of the network. A further obvious explanation may be the fact that we are unable

to see a part of the network (transactions between foreign actors). Naturally, at progressively higher frequencies, the decrease in the number of transactions in itself increases the probability of separate bank pairs, triangles, etc. being formed. It is important to note that from the beginning of the crisis and particularly from autumn 2008 onwards, the absence of connectivity became increasingly prominent. With the exception of the 1–2 days market, the ratio of the largest connected components to the entire network gradually diminished in every segment. This points to increasing mutual distrust, which motivated participants to enter into longer transactions only with a small group of counterparties. Transactions of longer maturities also involve increased risk, which is why it is reasonable to select counterparties even more rigorously in longer markets.

Although it is possible to calculate some of the indicators even with the network disintegrating, the calculation of most centrality indicators requires at least weak connectivity. For that reason, we will consider the largest connected component throughout the rest of our investigation. As seen above, in some exceptional cases, the greater part of the network falls outside of the greatest connected component. Consequently, with the longest markets the conclusions that can be drawn from the network indicators are limited. In the rest of this paper, such conclusions will primarily be used to support the conclusions drawn in the short market.

Figure 5.
Average clustering coefficient of the entire swap market graph and the random Erdős–Rényi graphs of equivalent average degree

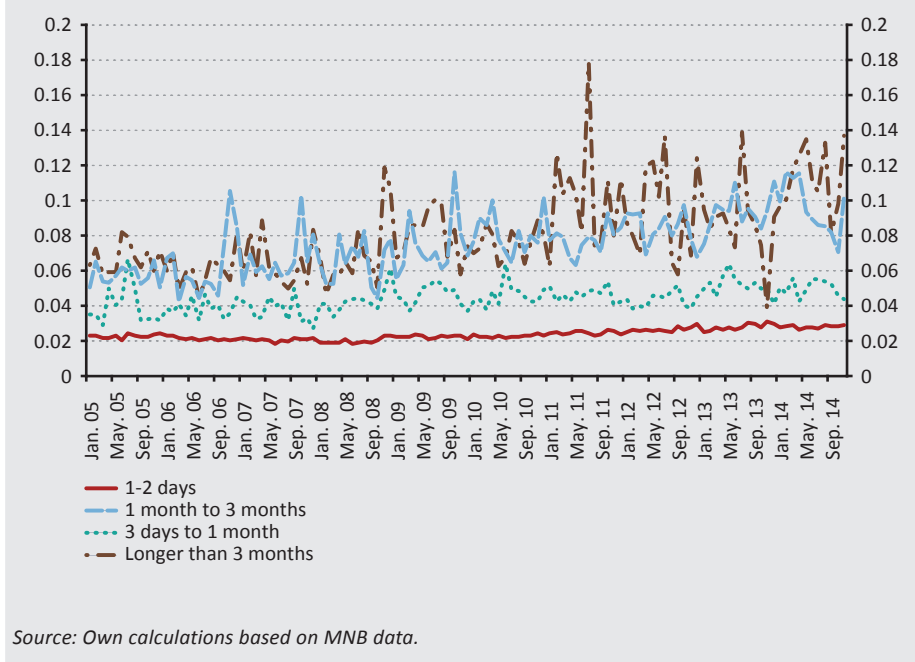


Source: Own calculations based on MNB data.

We examined the extent to which the graph can be considered random. For this purpose, we compared the graph of the swap market to random graphs generated using two methods. On the one hand, we compared it to a random Erdős–Rényi graph, the average degree of which was identical to that of the swap market graph. On the other hand, we also considered a modified random Erdős–Rényi graph, where we assigned varying probabilities to the edges between domestic–domestic, domestic–foreign and foreign–foreign vertex pairs. In the modified random graph, a connection is established between two foreign vertices with a probability of 0.

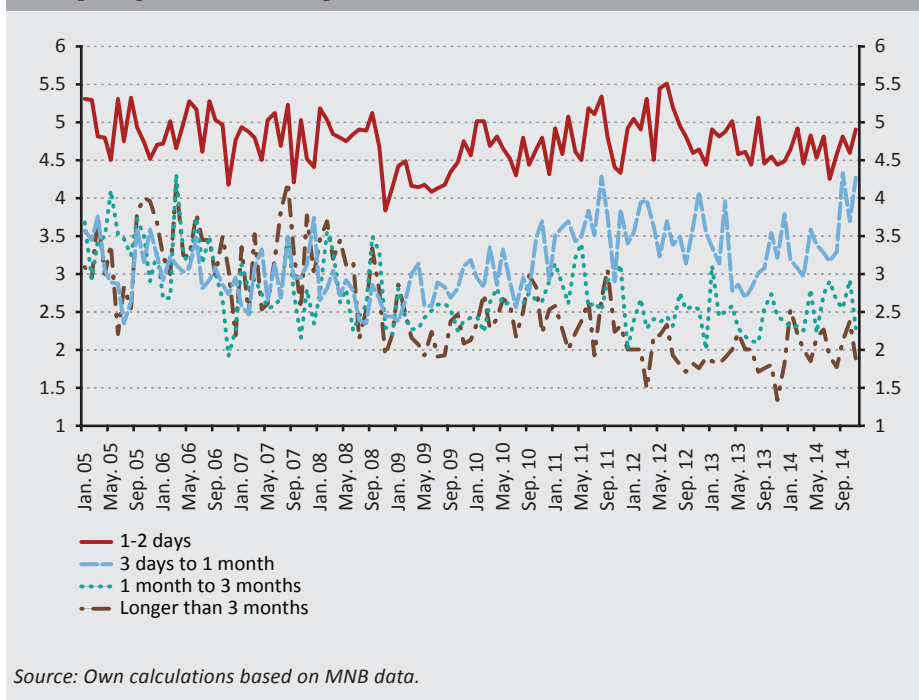
We calculated the average clustering coefficient for all four graphs. We found that the level of clustering in the swap market graph significantly exceeded the level of clustering in both random graphs for all maturity segments (overall market: *Figure 5*, short market: 3 times larger clustering on average; 3 days to 1 month: 3 times larger clustering; 1 month to 3 months: 2 times; above 3 months: 2 times). Consequently, the swap market network cannot be considered to be random (although the clustering coefficient approximates that of the random graph as maturity increases), and as such it is worth examining in more detail.

Figure 6.
Ratio of average path length to size in individual segments



Banai et al. (2013) have demonstrated that the network of the 1–2 day market may be referred to as a scale-free network. Accordingly, the degree of individual vertices approximately follows power law. If k denotes individual degrees, then the power function $53 \cdot k^{-2}$ will give a fairly good approximation of degree frequency. As a result of the distribution following a power function, the graph includes many low-degree and few high-degree vertices. The small world property may also be captured through the development of specific network indicators. One of them is the ratio of average shortest path length to network size. A low ratio will indicate the small world property. The small world property is also indicated by a clustering coefficient exceeding that of the random graph, or an average shortest path length proportional to the logarithm of network size (Pető–Békési 2009; Newman, 2003). Clearly, the first indicator shows significant differences with segments of various maturities (Figure 6). In the case of the 1–2 day market, the average shortest path length amounts to a mere 3% of the network size in general. However, the indicator significantly increases with longer maturities (3 days to 1 month: 4.5% on average; 1 month to 3 months: 7.5%, above 3 months: 8%), showing an approximation to so-called lattices (Pető–Békési 2009). This is confirmed by the ratio of the average shortest path length to the logarithm of network size. The longer the segment being considered, the less constant the indicator became. Overall, it appears that the

Figure 7.
Average degree in various segments

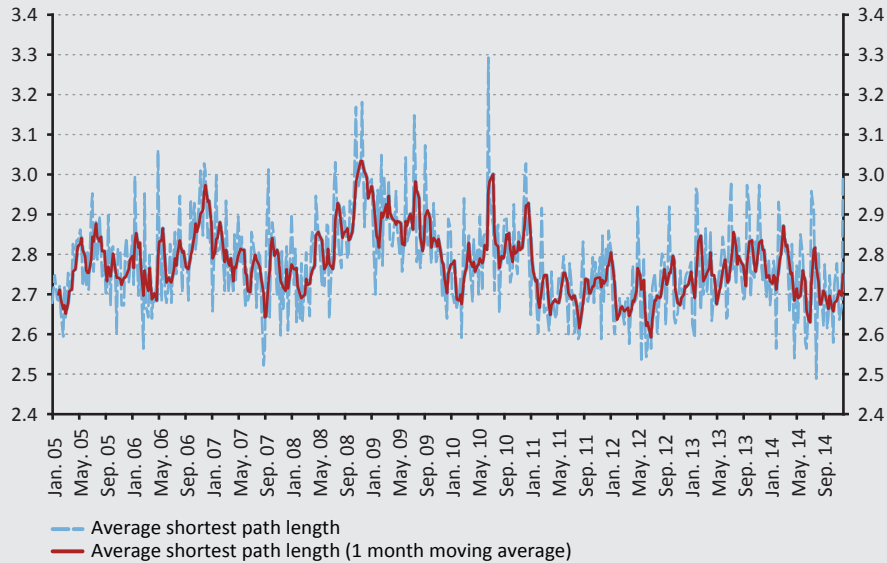


longer the maturities, the less the network can be considered to satisfy the small world property. In networks, the small world property poses a stability risk. Namely, such networks respond drastically to shocks affecting the largest actors, although shocks to small actors have no significant effect (*Albert et al. 1999; Newman 2003*). In times of crisis, central actors tend to amplify and accelerate contagion (*Markose et al. 2010*). Conversely, with random graphs shocks to the largest actors have a smaller effect. The longer the markets, the smaller the chance of contagion. This also follows from the gradually decreasing ratio of elements that are part of the largest component. An analysis of the entire swap market as a single network shows that the two indicators behave similarly to the 1–2 day segment, i.e. the small world property is also satisfied in this respect. This is explained by the fact that within the overall market, 76% of all transactions were made in the overnight segment.

Throughout the period under review, the average degree of the network varied significantly across segments in terms of both trends and levels (*Figure 7*). In the shortest market at a weekly frequency, a change in the indicator could be observed at both turning points of the financial crisis, i.e. in summer 2007 and autumn 2008 as well. In mid-2007, for a brief period there was a significant decrease in the average degree of the network, and then the indicator moved at previous levels right up to the Lehman bankruptcy. In turn, after the Lehman bankruptcy, the indicator remained below previous levels for an extended period, which was followed by a continuous increase from autumn 2010 (*Banai et al. 2013*). At a frequency of one month, the change in the 1–2 day segment was also striking at the time of the Lehman bankruptcy and from the second half of 2010. However, the picture is different with the rest of the segments. On the one hand, as we expected, the level of average degree is significantly lower due to differences in size. On the other hand, we also found differences in trends. While the segment of 3 days to 1 month behaved similarly to the shortest market, the graphs derived from transactions exceeding 1 month moved in the opposite direction. With the former, the average degree reached its peak by the end of the period, which means that the weight of relatively important banks increased across the network. With the latter, however, the average degree decreased. This may also indicate banks' increased tendency in the aftermath of the crisis to select the counterparties with which to enter into longer transactions.

Not surprisingly, average shortest path length moved in the opposite direction to average degree. This was also observed for the 1–2 day market (*Banai et al. 2013*), but also applied to the graph including all of the transactions regardless of maturity. Due to the fact that individual actors enter into transactions with an increasing number of counterparties, new edges allow the formation of additional and shorter paths between two vertices. Obviously, the opposite is also true. Fewer counterparties mean fewer variations of possible paths, causing the average shortest path to increase (*Figure 8*). With segments longer than 2 days, average shortest path

Figure 8.
Average shortest path for the entire swap market

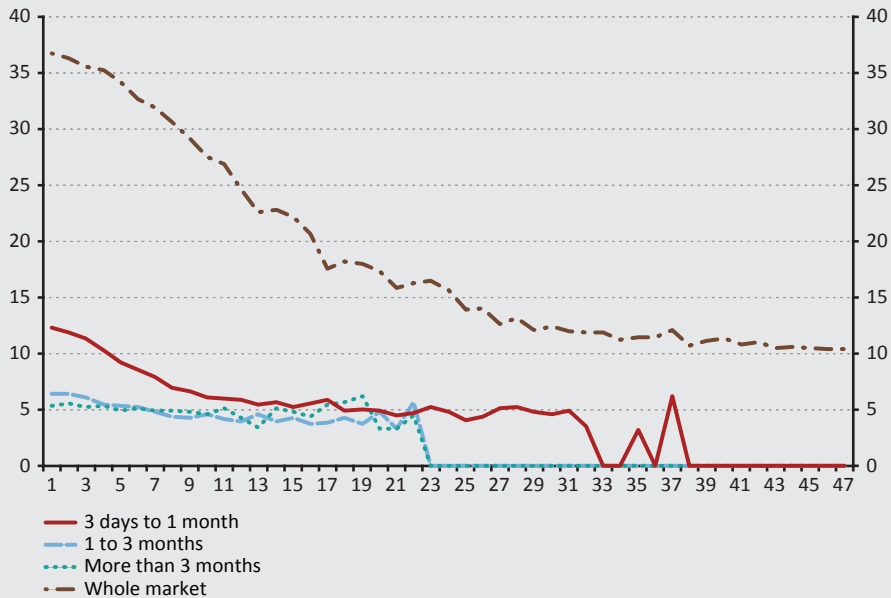


Source: Own calculations based on MNB data.

length was around 3 in the period under review. The obvious trends and turning-points seen in the overall market were increasingly less prominent there. It was apparent particularly in the longest segment that although the indicator was highly volatile, no trends could be established in its movements.

An important question relating to the development of degrees is the degree which the neighbours of vertices with various degrees have themselves (*Figure 9*). In financial networks, banks with a high degree typically deal with counterparties that have a low degree (the phenomenon has been described in *Iori et al., 2008; Iazzetta et al. 2009*). This was so in the case of the Hungarian 1–2 day FX swap market (*Banai et al. 2013*), and is also observed in the graph derived from the overall market (*Figure 9*). One reason for this is the high number of small actors in the network, which drives the most active actor to also become connected to actors with few counterparties. On the other hand, account should be taken of the fact that the actors considered small in terms of the domestic currency swap market include many banks that are prominent internationally as well. This disassortativity is also characteristic of longer markets (*Newman 2003*), but to a smaller extent. The downward sloping affinity function is still clearly visible in the segment shorter than 1 month; however, in longer segments counterparties have much more homogeneous average degrees. This may indicate that a central role is played by a few actors to a smaller extent.

Figure 9.
Affinity functions of longer segments and the overall graph

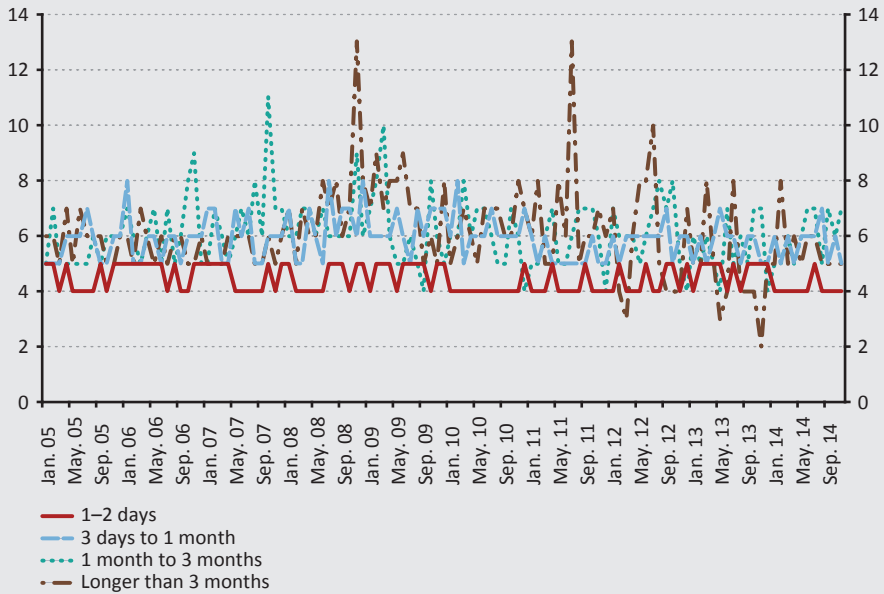


Note: Axis x shows the degrees of individual vertices, whereas axis y shows the average degrees of neighbouring vertices. For example: in the overall market the vertices neighbouring vertices with a degree of 1 had an average degree of around 37.
Source: Own calculations based on MNB data.

The size of network diameter may be dominant in the spread of shocks. As a rule of thumb, in social networks the small world property means a maximum diameter of 6 (Newman 2003). In the 1–2 day FX swap market, diameter was found to be rather stable in time. Throughout the period under review, average diameter was 5.2 at a weekly frequency and 4.4 at a monthly frequency. Moreover, at a monthly frequency the lowest value was 4 and the highest was 5, i.e. the indicator hardly changed over time. In longer segments, diameters averaged around 6 and increased as maturities became longer (3 days to 1 month: 5.9 on average, 1 month to 3 months: 6.1, above 3 months: 6.1). Apart from this, longer maturities also involved higher volatility. In such turbulent times as autumn 2008, the diameter of certain graphs exceeded 10 (Figure 10). In other words, fewer and fewer connections were formed between banks. While this obviously reduces the risk of contagion, it also means that certain banks would not be able to enter into transactions with a sufficient number of counterparties. As a result, they may have been forced to rely excessively on a single counterparty in longer markets.

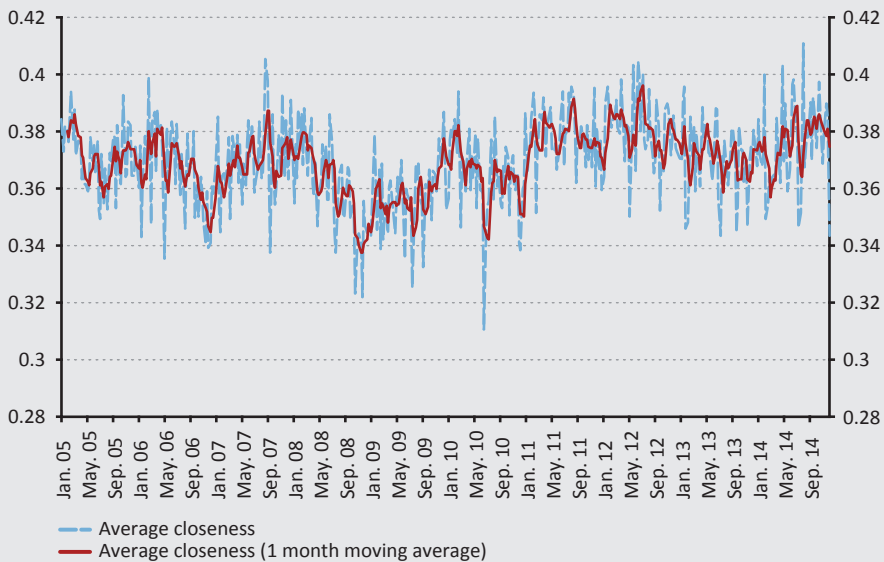
In the case of the unsecured forint interbank market, the indicator of average closeness was the quickest to respond to the crisis. Although from a rather high level

Figure 10.
Diameter in specific segments



Source: Own calculations based on MNB data.

Figure 11.
Average closeness in the overall market



Source: Own calculations based on MNB data.

of 0.5, it started to decline as early as in 2006, and already moved around 0.4 in early 2009 (*Berlinger et al. 2011*). All of the networks in our analysis deviated from this in terms of both trends and levels. In the graph of the overall market, the network indicator perceptibly changes as problems develop. We could see an increase from late 2006 to spring 2008, followed by a decrease, which was intensified by the Lehman bankruptcy. Therefore, in this case the trend changed earlier than in the 1–2 day market. The sharp decline around the Lehman bankruptcy coincided with that seen in the 1–2 day market, just as the continuous increase from 2010. The two graphs differ primarily in terms of levels. In the network of the overall market, the highest average exceeds 0.4, which is significantly higher than the maximum of around 0.3 measured for the 1–2 day segment (*Figure 11*).

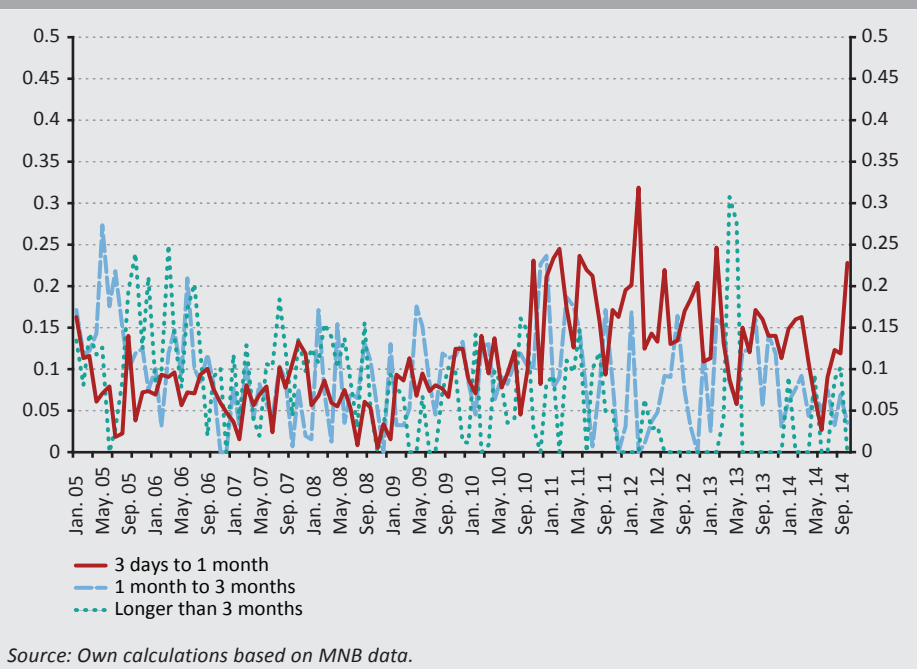
In longer segments, a decrease in average closeness was also felt in autumn 2008 (3 days to 1 month: 0.29 on average, 1 month to 3 months: 0.2, above 3 months: 0.2). On aggregate, however, the time series appeared stable without any significant changes. This suggests that the periphery of the network exited the market mostly in shorter segments (*Banai et al. 2013*). In the rest of the segments, it is not clear how important exiting actors had been for the network concerned.

The clustering coefficient is a key indicator in terms of stability both at systemic and individual levels. Its movements aptly describe the extent to which cliques are formed in the given market, and how typical it is for the partners of specific banks to enter into transactions with one another. In the period under review, major crisis events led to significant drops in the indicator. For most of the period, the indicator moved between 0.1 and 0.2 in the 1–2 day market, hitting a low of 0.05 at the time of the Lehman bankruptcy (*Banai et al. 2013*).

Not surprisingly, with longer segments the level of clustering decreased (*Figure 12*). This is also indicative of institutions being more rigorous in the selection of their counterparties as maturities become longer. Transactions below 1 month still showed the tendency seen in the 1–2 day segment that clustering increased from mid-2010; however, longer segments behaved differently. Apparently, above 1 month and in particular with maturities exceeding 3 months, values around 0 are not uncommon. In other words, triangles or cliques are not formed in the graph. The clustering coefficient also indicates that the longer the maturities, the less the graphs are characterised by the small world property. The average of the average clustering coefficient in longer segments was as follows: 0.11 for 3 days to 1 month, 0.09 for 1 month to 3 months, and 0.07 above 3 months. In this regard, longer markets are more similar to the random graph. In autumn 2008, a decline in clustering was observed in all maturity segments.

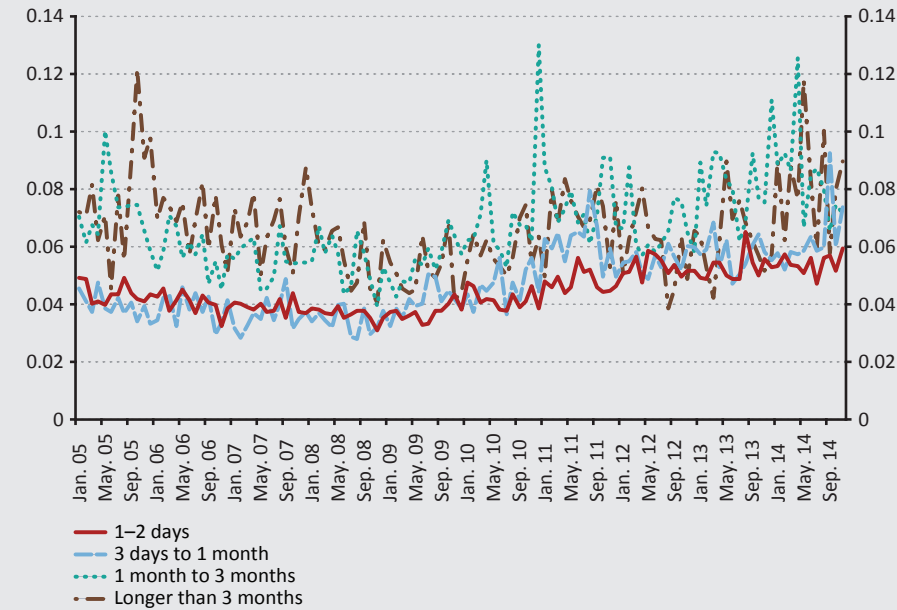
Changes in network structure are also well characterised by the dynamics of the density function. In the 1–2 day segment, at a weekly frequency the indicator remained relatively stable right until summer 2010. As with the other indicators

Figure 12.
Average clustering coefficients in longer segments



examined so far, the second half of 2010 also marked a turning point here. The significant increase in density may be attributed primarily to the loss of vertices with low degrees. This is because in such cases, while there is hardly any change in the number of connections formed (the numerator), the number of possible connections (the denominator) decreases significantly. The same result is obtained from an analysis of the 1–2 day market at a monthly frequency (*Figure 13*). The indicator is relatively low at around 4%, which is not uncommon with financial networks. The densities of the networks with various maturities hit their respective lows at the time of the Lehman bankruptcy, which means that the smallest number of connections relative to the possibilities were formed at that time. Subsequently, however, longer segments show significant differences versus the 1–2 day market in terms of both levels and appearance. Most strikingly, the level of density increases as maturities get longer. This is attributable to the fact that as a result of a decrease in size, the number of potential connections, i.e. the nominator will be significantly smaller. Although transactions within 1 month still show some stability, the indicator moves on an upward trend from 2010 in this segment as well. Moreover, the indicator is much more volatile than with the shortest transactions. A gradual increase was also observed for the two longest segments towards the end of the period under review, but the level reached by the end of the period is not outstandingly high in a historical comparison. In other words, the ratio of the connections formed was not

Figure 13.
Density in specific segments



Source: Own calculations based on MNB data.

particularly high even with the contraction in network size, despite the fact that the number of possible connections increases at a rate of the size squared. This may be another indication that trust weakened in longer segments as well.

6. Conclusion

During the economic crisis that started in 2007, serious disruptions occurred several times in the operation of various financial markets. Certain markets dried up completely, and central bank intervention was needed to ensure that the consequences of their loss caused a minimum amount of damage for the banking system. One particular feature of the crisis was that serious disruptions occurred worldwide even in the secured FX swap market. For that reason, central banks entered into a series of bilateral agreements with one another, temporarily assuming the role of the market. As *Banai et al. (2013)* demonstrated in the context of the short-term FX swap market, in Hungary the disruptions were clearly shown by the network structure of the market in addition to commonly used market indicators such as implied yield, liquidity indices, and turnover. The particular structural characteristics of the graph of the short-term market occasionally exhibited strong volatility during the crisis. In their analysis of the largest connected component, the authors found that the properties generally satisfied for financial markets were also

characteristic of this market. Like other markets, the one-day FX swap market exhibits the small world property, i.e. it is possible to reach any vertex from any vertex in a relatively small number of steps. We have seen that the degree distribution of the network follows power law. Most participants have a relative small number of connections, and there are only few large actors with outstandingly high degrees.

In this study, we aimed to develop an understanding of the properties of networks derived from FX swaps of longer maturities (see the Appendix for a comparative table), and to obtain a picture of the overall market. This also provided us with a more complete picture of the short-term market. Regarding the short market, one of our findings was that the number of participants decreased significantly, with a particular decline in the activity of marginal actors. Through an analysis of the overall market, we confirmed that this was not attributable to longer transaction maturities, since graph sizes decreased following the start of the crisis in longer markets as well. With the longest markets, however, the type of exiting actors is not certain.

In the one-day market, we have seen that the network was not connected at a daily frequency, and that there were isolated parts even at a weekly frequency. This property was intensified with longer transactions despite the monthly frequency used. At a monthly frequency, often only 60–70% of the vertices formed a connected component. With the longest transactions exceeding 3 months, occasionally only 30% of the actors were connected. During the crisis, this property became particularly pronounced in the case of the longest transactions, which indicates that certain banks had the confidence to enter into long transactions only with a very small group of institutions.

In the case of the short-term market, we have seen the network to exhibit the small world property that is characteristic of financial networks. This also means that the market is especially sensitive to the behaviour of a few actors, which presents a stability risk (*Albert et al. 1999; Newman 2003*). The analysis of longer networks showed this small world property to be less prominent. It definitely applied to networks derived from transactions between 3 days and 1 month; however, the graph of transactions above 3 months increasingly approximated a random graph as the crisis developed. As the number of actors decreased, the network became less and less clustered, and groups gradually disappeared. This may indicate increasing distrust among the actors.

In our study, we paid particular attention to the network derived from the overall market regardless of maturities. Although a distinction between maturities was required due to differences in functions, we were also curious to see the behaviour of the graph of the overall market. As expected, the trends observed here followed those of the one-day market, since a vast majority of the transaction volume is associated with that market. This confirmed our assumption that a segmentation of the overall market was reasonable. This enabled us to identify different trends for transactions of different maturities.

Appendix: Comparative table of the graphs for specific segments

	1-2 days	3 days-1 month	1 month-3 months	>3 months
Size (monthly graph)	<ul style="list-style-type: none"> • minimum 94 • 116 on average • „Decoupling“ visible • decreases from Autumn 2008 • usually >90% 	<ul style="list-style-type: none"> • minimum 50 • 73 on average • „Decoupling“ visible • decreases from Autumn 2008 • usually >90% 	<ul style="list-style-type: none"> • minimum 22 • 44 on average • „Decoupling“ not visible • decreases from Autumn 2008 • usually >60% • once decreases to 40% 	<ul style="list-style-type: none"> • minimum 18 • 41 on average • „Decoupling“ not visible • decreases from Autumn 2008 • usually >60% • twice falls under 30%
Proportion of largest connected component	<ul style="list-style-type: none"> • usually >90% 	<ul style="list-style-type: none"> • usually >90% 	<ul style="list-style-type: none"> • usually >60% • once decreases to 40% 	<ul style="list-style-type: none"> • usually >60% • twice falls under 30%
Type of graph	<ul style="list-style-type: none"> • small world property • degree distribution follows power law • shortest path/size small • shortest path/log(size) constant • downward sloping affinity (disassortative) • diameter (5 on average) • mass function, high ratio of short paths • average clustering high 	<ul style="list-style-type: none"> • small world property • shortest path/size small • shortest path/log(size) constant • downward sloping affinity (disassortative) • diameter (6 on average) • mass function, high ratio of short paths • average clustering high, but lower than of 1-2 days 	<ul style="list-style-type: none"> • small world property less satisfied • according to shortest path/size it is closer to lattice • according to average clustering it is closer to random graph 	<ul style="list-style-type: none"> • no small world property
Effect of crisis	<ul style="list-style-type: none"> • degree dropped in Summer 2007 and Autumn 2008 • distances grew (shortest path, diameter, mass function, average closeness) • clustering fell • size decreased in Autumn 2008 • direction of cash flow between residents and non-residents changed in 2009 	<ul style="list-style-type: none"> • the graph is smaller and denser from 2008 • distances increased in Autumn 2008 (shortest path, diameter, mass function, average closeness) 	<ul style="list-style-type: none"> • diameter increased in Summer and Autumn 2007 	<ul style="list-style-type: none"> • distances increased in Autumn 2008 • average degree and mass function increases since 2007 already • direction of cash flow between residents and non-residents changed in 2010
Exit of the actors on the periphery	<ul style="list-style-type: none"> • visible • size • degree • shortest path • mass function • average closeness • average clustering • vertices of clustering of 0 and 1 • density 	<ul style="list-style-type: none"> • visible • size • degree • shortest path • mass function • average closeness • average clustering • vertices of clustering of 0 and 1 • density 	<ul style="list-style-type: none"> • visible • happens earlier (from end-2008 to end-2010) 	<ul style="list-style-type: none"> • not visible

References

- Albert, R. – Jeong, H. – Barabási, A. L. (1999): *Error and attack tolerance of complex networks*. Nature, Vol. 406, pp. 378-382.
- Balogh, Cs. – Gábrriel, P. (2003): *Bankközi pénzpiacok fejlődésének trendjei*. Magyar Nemzeti Bank Műhelytanulmányok 28. szám, 2003. november.
- Banai, Á. – Király, J. – Nagy, M. (2010): *Az aranykor vége Magyarországon, Külföldi szakmai és lokális tulajdonú bankok – válság előtt és válság után*. Közgazdasági Szemle, 57. évf. 2. sz.
- Banai, Á. – Kollarik, A. – Szabó-Solticzky, A. (2013): *Az egynapos FX-swap piac topológiája*. Magyar Nemzeti Bank Tanulmányok 108., 2013. november
- Barabási, A. L. – Albert, R. (1999): *Emergence of Scaling in Random Networks*. Science, Vol. 286.
- Bech, M. L. – Atalay, E. (2008): *The Topology of the Federal Funds Market*, Federal Reserve Bank of New York Staff Reports, 354. szám 2008. november.
- Bergsten (2008) <http://blogs.ft.com/economistsforum/2008/07/trade-has-saved-americafrom-recession/>
- Berlinger, E. – Michaletzky, M. – Szenes, M. (2011): *A fedezetlen bankközi forintpiac hálózati dinamikájának vizsgálata a likviditási válság előtt és után*. Közgazdasági Szemle, 58. évf. 3. sz.
- BIS (1998): *Report on OTC Derivatives: settlement procedures and counterparty risk management*. CPSS Publications 27. szám, 1998. szeptember.
- Cocco, J. F. – Gomes, F. J. – Martins, N. C. (2003): *Lending relationships in the interbank market*. (<http://ssrn.com/abstract=568704i>.)
- Csávás Csaba – Kóczán Gergely – Varga Lóránt (2006): *A főbb hazai pénzügyi piacok meghatározó szereplői és jellemző kereskedési stratégiái*, Magyar Nemzeti Bank Tanulmányok, 54. szám.
- Csávás, Cs. – Szabó, R. (2010): *A forint/deviza FX-swap szpredek mozgatórugói a Lehman-csőd utáni időszakban*, Hitelintézetek Szemle 2010. 6. szám.
- Erdős, P. – Rényi, A. (1959): *On Random Graphs. I*, Publicationes Mathematicae 6: 290–297.
- Fábián, G. – Mátrai, R. (2012): *A nemkonvencionális jegybanki eszközök magyarországi alkalmazása*, MNB-Szemle 2012. június.
- Iazzetta, I. – Manna, M. (2009): *The topology of the interbank market: developments in Italy since 1990*, Banca d'Italia Working Papers 711. szám, 2009. május.

- Iori, G. – De Masis, G. – Precup, O. V. – Gabbid, G. – Cadarelli, G. (2008): *A network analysis of the Italian overnight money market*, Journal of Economic Dynamics & Control 32. szám, 259-278. old.
- Lublóy, Á. (2006): *Topology of the Hungarian large-value transfer system*. Magyar Nemzeti Bank Tanulmányok, 57. szám.
- Markose, S. – Giansante, S. – Gatkowsk, M. – Shaghghi, A. R.(2010): *Too Interconnected To Fail: Financial Contagion and Systemic Risk In Network Model of CDS and Other Credit Enhancement Obligations of US Banks*. COMISEF Working Paper 033. szám.
- Newman, M. E. J. (2003): *The Structure and Function of Complex Networks*. SIAM Review 45. szám, 167-256.
- Páles, J. – Kuti, Zs. – Csávás, Cs. (2010): *A devizaswapok szerepe a hazai bankrendszerben és a swappiac válság alatti működésének vizsgálata*, Magyar Nemzeti Bank Tanulmányok, 90. szám.
- Páles, J. – Varga, L. (2008): *A magyar pénzügyi piacok likviditásának alakulása – mit mutat az MNB új aggregált piaci likviditási indexe?*, MNB-Szemle 2008. április.
- Pető, R. – Békési, L. (2009): *Az Európai Unió grafológiája: az Európai külkereskedelem elemzése a gráfelmélet segítségével*, Tudományos Diákköri Konferencia dolgozat.
- Soramäki, K. – Bech, M. L. – Arnold, J. – Glass, R. J. – Beyeler, W. E. (2006): *The Topology of Interbank Payment Flows*, Federal Reserve Bank of New York Staff Reports, 243. szám.
- Watts, D. J. – Strogatz, H. S. (1998). *Collective dynamics of 'small-world' networks*. Nature, Vol. 393, No. 6684.

Bounded rationality and altruism: behaviourism in economics

József Golovics

This essay is intended to respond to the criticism of economic science that it builds its models on unrealistic assumptions from the start. Perfect rationality and the axiom of self-interest are indeed two of the main tenets of neoclassical economics. In this paper, however, we argue that the application of these doctrines is far from exclusive. Indeed, with the achievements of the behaviourist approach and behavioural economics, the theory of bounded rationality was accepted as early as the last century in this scientific area, along with the recognition of altruistic behaviour. Many of these achievements have been more or less integrated into mainstream thinking by now, and once applied, by relying on more psychologically realistic assumptions they may significantly contribute to improving the forecasting power of economic models.

1. Introduction

The 2008 crisis had massive repercussions, not only on the real economy but also on economic thinking,¹ and triggered profound changes in the approach to economic science and the public's view of the discipline. It has become commonplace to “blame” economics for its failure to either forecast or adequately cope with the recession. At times, this attitude prompts the lay public to call into question the justification for the very existence of economics, claiming that the models and conclusions of the discipline are rooted in axioms that are false even in their basic assumptions.

Providing an exhaustive response to these criticism – including a description of the specificities of modelling and a detailed account of the “trade-off” relationship between the models in terms of manageability – is beyond the scope of this paper. Accordingly, this paper focuses solely on the two main premises of economic science: the topics of perfect rationality and self-interest. As a response to the criticism of the science of economics, we argue that the application of these axioms

József Golovics is a PhD student at Corvinus University of Budapest and a research fellow at the Pallas Athena Domus Scientiae Foundation of the Magyar Nemzeti Bank. E-mail: jozsef.golovics@uni-corvinus.hu.

A previous version of this essay was written as a course paper within the framework of studies at the Pallas Athena Domus Scientiae Foundation.

¹ Compare, for example, writings, lectures and statements by Nobel Laureates Joseph Stiglitz and Paul Krugman before and after the crisis.

is not exclusive, even within mainstream economics. Indeed, the acknowledgement of altruism and the assumption of bounded rationality were not unknown to economics – at least to some of its schools – even in the previous century.

In this paper we attempt to confirm our propositions by outlining the succession of the relevant paradigms. Reflecting on the criticism that the core subject of economic analysis is an idolised person rather than a real individual, we open our essay with an overview of behaviourism, an approach that places human behaviour at the centre of interest, and summarise the main achievements of behavioural economics. We then proceed to the topics of bounded rationality and altruism, concepts that present certain traits of human behaviour within the theoretical framework of positivism, based on empirical behaviour patterns. Undoubtedly, these concepts have called into question the two most basic tenets of neoclassical economics. However, they did so not by a complete rejection of the previous theory, but by resolving certain simplistic assumptions; in other words, instead of destroying the neoclassical framework, they merely intended to supplement and enhance it further.

Obviously, this does not imply that the classical human model of homo oeconomicus is no longer considered the cornerstone of economic science. However, in contrast to the frequently voiced lay criticism, economic science is undeniably familiar with and uses the concepts of bounded rationality and altruism. It is also a fact that several achievements of behavioural economics have now been unquestionably integrated into mainstream theory, which, in many cases, may improve the forecasting power of models and contribute to capturing reality with more precision.

2. Behaviourism in social sciences

Social studies, by nature, have never been entirely separable from the human being – the performer of actions – or human behaviour. Human behaviour has therefore always been considered in all social disciplines. The approach of behaviourism, however, has done so with far more emphasis: it attempted to understand social trends by placing the systematic study of human behaviour at the centre of focus, and demanded behavioural evidence for the verification of any hypothesis as a matter of course (*Graham 2010*).

Behaviourism first appeared in political science between the world wars. As opposed to the prevailing institutionalist approach which focused on the political establishment, its novelty was in its endeavour to analyse the political behaviour of the individual. In this particular form, behaviourism in political science represented a non-judgemental, positivist, descriptive trend, seeking to study various phenomena, as all other natural sciences, by relying on general theories (*Tóth–Török 2003*).

In psychology, instead of cerebral processes and the conscious mind, behaviourism put behaviour under scientific scrutiny. The rationale behind this approach was the fact that, while the former is open to subjective interpretation in many regards, behaviour is a “public” and visible phenomenon, with the required data and information readily available. According to behaviourist psychology, human behaviour depends largely on environmental conditions and stimulations; consequently, it attempts to capture different phenomena by the stimulus-response model (Atkinson *et al.* 2005; Csépe *et al.* 2007).

Similar trends began to evolve in economic science as well. Although the appearance of the positivist approach in economics is traditionally attributed to *John Neville Keynes (1890/1999)* and the detailed description of its methodology is associated with *Milton Friedman (1953)*, even the classical school was committed to observing human behaviour, and the methodological impact of natural sciences left its mark on marginalists. A behaviour-oriented approach manifests itself in the work of *Marshall (1920)* as well, who defined political economy and economics as “a study of mankind in the ordinary business of life” in the introduction to his book. Although from a different perspective, the two Nobel Laureates, *Stigler and Becker (1989:111)* had a similar approach to the issue. In their opinion, “the economist continues to search for differences in prices or incomes to explain any differences or changes in behaviour”. *Simon (1959: 253–254)* – another Nobel Prize winner who unquestionably belongs to the behaviourist school based on his work – in turn, defines economics as “the science that describes and predicts the behaviour of several kinds of economic man”.

On the whole then, it is indisputable that even though different schools of economics place different phenomena at the centre of their studies (e.g. exchange, institutions, macroeconomic trends), they cannot disassociate their work from human behaviour. The significance of this thought is underpinned in *Becker (1976)*: “What most distinguishes economics as a discipline from other disciplines in the social sciences is not its subject matter but its approach. [...] I contend that the economic approach is uniquely powerful because it can integrate a wide range of human behaviour, [...] the economic approach is a comprehensive one that is applicable to all human behaviour” (quoted in *Hámori 2003a:8*). It is this general approach to human behaviour that has inspired, in recent decades, references to “economics imperialism”; in other words, the application of the approach and methodology of economics to a broad range of social sciences (*Hirshleifer 1985*).

3. Behavioural economics

Beyond a fundamentally positivistic and behaviour-centred attitude, behaviourism proceeded on a unique path within the realm of economic science and, to a certain

degree, bypassed the concepts described above. This led to the evolution of behavioural economics. Although it initially came into being as a heterodox school, it has now increasingly been integrated into the mainstream to become an extension of traditional economic analysis (*Koltay–Vincze 2009*). One of the novelties of behavioural economics is that it is based on a human model distinctly different from that of the neoclassical school: it dispenses with some of the characteristic features of the traditional homo oeconomicus. Some of them are basic premises constituting the backbone of neoclassical economics, while others are “less cardinal”; most of them, however, simply consider the natural constraints of the individual. The intention is to increase the realism of the psychological underpinnings of economic analysis in order to generate theoretical insights that are verifiable in practical terms, improving the quality and reliability of predictions and policy recommendations (*Camerer–Loewenstein 2004*). Thus, as regards its subject, behavioural economics point beyond *Stigler and Becker’s (1989)* aforementioned definition by observing human behaviour not only in terms of prices and incomes, but also in relation to other, “more human” factors. As such, behavioural economics is not a radical challenger of traditional theories; it is more like an amendment to them that helps expand the horizons opened up by its predecessors and hence, allows even the mainstream to integrate some of its results.²

We can state overall that in examining the behaviour of individuals and the drivers of their decisions, the trend relies heavily on the premises of neoclassical economics; however, it often supplements them with psychological insights, psychologically grounded features and emotional motives (*Camerer–Loewenstein 2004; Méréő 2010; Rabin 2002*). Thus, behavioural economics can be viewed, in certain regards, as the borderline between economics and psychology.

In respect of its methodology, behavioural economics draws heavily on empirical studies, including experiments. In contrast to natural sciences, however, economics cannot be regarded as an experimental science, as many economic phenomena (e.g. a crisis or decision on the base rate) cannot be exactly reproduced multiple times under controlled conditions. In recent decades, however, parallel to – or, to a certain degree, overlapping – behavioural economics, experimental economics (*Smith 1989, 1994*) has also gained significant ground in academic circles. Designed to model certain decision-making situations, these experiments pointed out that in certain situations people tend to systematically deviate from behaviour patterns considered rational by economics (*Hámori 2003a; Méréő 2010*). To a large degree, therefore, both experimental and behavioural economists base their assertions on empirical results (*Sontheimer 2006*). However, while experimental economists

² It follows from this that behavioural economics does not form a uniform school; in many cases, the authors express fundamentally different opinions. This is precisely why it is so difficult to provide a fully comprehensive overview of the trend.

define themselves explicitly along the lines of this method, behavioural economists are not committed exclusively to experiments; they merely use experiments as a research tool (*Camerer–Loewenstein 2004*).

In addition to psychological considerations and empirical results, the findings of neuroeconomics also provide assistance to behavioural economists. This area seeks to understand human decisions and make behavioural predictions from the workings of the brain, using neuroscience (*Camerer 2007; Camerer et al. 2005*).

All of this demonstrates that the “toolset” and “subject pool” of behavioural economics is broader than those available to the neoclassical approach, and behavioural economists explicitly seek to replace unrealistic assumptions with better grounded premises. As a result, researchers in this area have arrived at results such as the description of benchmarks, sunk costs, commitment, packaging and validity bias, representativeness bias, alternative cost or the certainty effect (*Camerer–Loewenstein 2004; Hátori 2003a, 2003b*). A common trait of these results is that they dispense with such neoclassical axioms as the theory of perfect rationality or the assumption of exclusive self-interest (*Vanberg 2006*). In the next part of the paper we focus on these two topics, examining their presence in neoclassical economics and taking account of the alterations introduced by the behavioural school.

4. Rationality in neoclassical and behavioural economics

One of the core assumptions of the neoclassical tradition is the rationality of economic agents (*Vanberg 2006*). This cannot be separated from the maximisation paradigm, a concept already present in the classical school. At that point, however, it was merely interpreted as “preferring more rather than less”, and even this assumption was primarily used to capture the production side. The next full step forward – the application of this theory to consumers – was taken by the marginalists: their rationality hypothesis was manifested in utility maximisation subject to budget constraints. And this approach, due to the anatomy of the demand curve, demanded the knowledge of the prices of all products on the market (*Arrow 1986*).

Subsequently, several versions and definitions of the rationality assumption were formulated; however, elaborating on them is beyond the scope of this essay (for more details, see *Rubinstein 1998; Schiliró 2012; Simon 1955*). Overall, it can be said that they mainly identify requirements in relation to consumer preferences, such as the criteria of completeness, transitivity, reflexivity and comparability (*Hirshleifer et al. 2009; Varian 1991*). Without their detailed overview, this paper is limited to the presentation of the main elements of more general definitions.

Stigler (1987) identified three criteria of rationality: (i) consumers have stable preferences; (ii) they perform the correct cost calculations; and (iii) they make utility-maximising decisions. *Koltay and Vincze (2009)* set similar requirements for rational consumers: (i) they have intrinsic, consistent and complete preferences; (ii) they select the most beneficial option subject to their own physical and information constraints; and (iii) the assessment of their opportunities is only limited by their own lack of information. These criteria are profoundly reflected in the premise of instrumental rationality (rational tool selection). In essence, the concept of instrumental rationality asserts that – regardless of their objectives – decision-makers are assumed to choose the best tools to achieve their goals (*Kolodny–Brunero 2013*).

This rationality assumption of neoclassical economics has received much criticism. An example is related to the work of one of the most acclaimed pioneers of behavioural economics, *Herbert Simon (1947, 1955, 1959, 1972, 1986, 1991)* and his bounded rationality theory. This may be because *Simon's (1959)* approach to economics was behaviouristic in the first place: he criticised normative microeconomics for wanting to know how economic agents “ought to behave, not how they do behave”. In addition, even his personal experiences motivated him to develop the theory of bounded rationality. As a fresh graduate, he landed his first job at the local public administration. He was astonished to find that none of his economics training was put to use at the workplace: rather than comparing the marginal benefit of a proposed expenditure with its marginal cost, decisions were made on the basis of entirely different considerations (*Simon 1999*).

The approach that recognised that economic agents were bound to face uncertainties and risks in their decisions did a great deal to soften the model of perfect rationality in itself (*Jones 1999; Simon 1972*). Thus, since the actor has incomplete information about the consequences, in order to maximise the expected return, he must make a choice by assigning probabilities to individual options (according to the “hard” approach, this is still performed completely rationally).

The theory of bounded rationality moves beyond this approach by asserting that the individual faces a number of constraints in making practical decisions (*Simon 1972*). The lack of individuals’ information on the alternatives, the cognitive limitations of their minds and the finite amount of time they have to make decisions are examples of such constraints (*Schiliró 2012*). These factors are also interrelated. The premise of neoclassical microeconomics, which presumes the presence of “search goods” in the economy (commodities on which all information is readily available with no additional cost), fails to work in practice (*Weimer–Vining 2011*). In reality, gathering information is an expensive and potentially time-consuming process; consumers therefore are not tempted to collect all relevant information in support of their decision. They would not have a chance to do so in any case, given the time

constraints and the natural cognitive limitations of the human mind. Thus, according to *Simon (1955)*, the theory of bounded rationality underpins the practical, rather than the logical impossibility of perfect rationality.

The strength of the theory is demonstrated by the fact that its statements raise serious questions even in the most basic situations of neoclassical microeconomics. An example for that is the case of the pure monopoly which, in practice, would have to amass an enormous amount of complex information in order to understand the demand curve for its product and hence maximise its profit. It further complicates the monopoly's predicament that any new pricing decision on its part will prompt other companies to follow suit. This in turn will have a repeated impact on the demand for the monopoly's product, and the monopoly will have to start gathering information again (*Arrow 1986*). It is easy to see that this would be rather cumbersome in practice, if possible at all.

Due to its empirical orientation, the theory of bounded rationality has found ready acceptance in political science, whereas the theoretical discipline of economics largely ignored it (*Jones 1999; Simon 1999*). It has become clear, however, that economics cannot afford to ignore the notion of bounded rationality for long. Indeed, it is not only embraced by the behavioural school today, but it has also proven itself in the mainstream.

The theory of bounded rationality is accepted even by authors who do not use it as a point of reference. They often cite the "as if" argument (see for example, *Friedman 1953*); namely, they profess to focus on the behaviour of decision-makers (and the results thereof), and are not concerned about how agents make their decisions. From this perspective, it is enough if the individual acts "as if" his decisions were perfectly rational, even though it is not the case in reality (*Conlisk 1996; Rubinstein 1998*).

In addition to the above, the theory of bounded rationality was an excellent starting point for studying human behaviour and decision-making, enhancing academic thinking and connecting the insights with other topics. Noteworthy topics include, for example, the "Two Systems" theory (*Kahneman 2003*), which is closely related to cognitive sciences and describes the two modes of decision-making, and the rational ignorance theory, which models the political votes of voters (*Downs 1990*). The theory of *March (1991; 1994)* and *March and Olsen (2004)* about the "logic of appropriateness" i.e. rule-following modelling human decision-making is also worth mentioning. As opposed to the model of rational decision-making, in their paper the authors propose a framework where, faced with the complexity of the problems to be solved, instead considering a rational cost-benefit analysis the individual makes his decision by trying to answer the following question: "What does a person such as I do in a situation such as this?" In addition to this, the theory of bounded rationality

– or more precisely, *Simon (1991)* himself – largely contributed to the understanding of organisational behaviour and the decision-making processes of organisations by laying the foundations of procedural rationality. Indeed, the limited cognitive abilities of individuals may explain why, rather than maximising, organisations tend to adopt task performance rules, which give rise to complex role structures and routinise the decision-making mechanisms of the organisation (*Jones 1999*).

It is apparent that the workings of human decision-making are far more complicated than the rationality model of neoclassical economics envisaged. This, however, does not imply the inevitable rejection of the classical rationality postulate, nor does it suggest that we should surmise the irrationality of economic agents from the deterioration of rationality. Quite the contrary: the theory of bounded rationality underscores that, while economic agents intend to be rational in their decisions, they fail to do so in practice (achieve perfect rationality) because of their cognitive limitations (*Jones 1999*).

The recognition of the limitation of rationality benefited mainstream economics itself, while providing a basis for extensive research in behavioural economics as well. Its gradual integration into mainstream thinking facilitates a more realistic approach to the problems arising, encouraging the use of multiple perspectives and potentially less simplification. Thus, although the behavioural school has questioned a core assumption of neoclassical economics, by developing the bounded rationality model it complemented, rather than destroyed its results and opened up new avenues for exploration.

5. Self-interest in neoclassical and behavioural economics

Besides rationality, another basic premise of economics is self-interest. The concept appeared initially in *Adam Smith's The Wealth of Nations (1776)* and subsequently crystallised in *Edgeworth³ (1881)*. The assumption of an economic agent's self-seeking – which initially served as a countervailing force to passion (*Hirschman 1998*) – did an excellent service to economics. It can be used to capture different economic trends by means of “well behaved” and easy to calibrate models. However, the empirical results of behavioural and experimental economics demonstrated that people are far from being self-seekers in all situations.

Before presenting an overview of the criticism, it is important to stress that self-interest is a neutral attitude, far from being identical with resentment, jealousy or malevolence (*Hámori 2003a*). Of course, this does not mean that these categories are unknown to behavioural economics. Their inclusion in the theory, however,

³ Although *Edgeworth (1881:16)* asserts that “The first principle of Economics is that every agent is actuated only by self-interest”, some of his models may well be considered the forerunners of the use of social incomes, to be outlined below in the context of Becker.

is made possible precisely by a broadening of perspective which paved the way for studying – in addition to neutral self-interest – goodwill, altruism or any other emotional motivation.

Initially, the economic school that presumes strict self-interest could not interpret altruism at all, even though its existence had been proved time and time again by everyday observations and by the research of experimental economics (see for example, *Rose-Ackerman 1996; Gächter et al. 2012*). The economists who presumed the existence of some benevolence, considered it to be a part of human nature (*Becker 1976*), and associated it with given preferences (*Stigler–Becker 1989*). That notwithstanding, the phenomenon of altruism has now been examined by several authors, based on various approaches and interpretations. Since their full presentation is beyond the scope of this paper, we limit our comments to a few general characteristics and two more profound interpretations of altruism.

Although the literature does not offer a precise definition of altruism, its different manifestations can be classified into the following three categories: selfish altruism, reciprocal altruism and pure altruism (*Hámori 2003a*).

We talk about selfish altruism when a person behaves as if he was acting unselfishly, while in reality he is driven by his own interests. In practice, this type of altruism is not very different from pure self-interest, and the ostensibly altruistic action is all but a tool to maximise profit. Reciprocal altruism can be best described by the concept of “gift-exchange” (*Gächter et al. 2012*). In essence, the person exercises altruism because some day he expects to be rewarded in kind. This differs from selfish altruism in the sense that the reciprocal altruist does not expect reciprocity in the same transaction, from the same person he benefited. He merely counts on receiving the same generosity in a similar situation from another member of society. In this regard, reciprocal altruism does not represent a mutually beneficial transaction between two persons, as is the case in market exchange; it merely expects good deeds to be reciprocated over the long run at the level of society. Beyond all this, pure altruism is the phenomenon when a person exercises altruism toward others truly unselfishly, without hope for some future reward⁴ (*Hámori 2003a*).

From the perspective of evolution, the dominance of self-interest was a notion broadly advocated by natural sciences as well; at the same time, similar to their peers in economics, some biologists and geneticists asked themselves the following

⁴ Critics of the category often argue that even pure altruism can be traced back to a form of self-love (*Hámori 2003a*). They claim that good deeds done for others by an altruist imply a utility increment benefiting the altruist himself; ergo, his behaviour can be practically attributed to self-seeking utility maximisation. Although below we will touch upon an interpretation where the usefulness of other persons is also included in the utility function, for the purposes of this paper, we will not attempt to provide justification for the existence of this category.

question: if self-interest has the highest survival value, why can we observe altruistic behaviour among animals as well as human beings? In other words: why should altruistic behaviour – which, by definition, reduces the individual's chances of survival – also survive? Sociobiology sought an answer to this question by building models with group selection. They propose that altruism can be observed between kin, i.e. individuals sharing the same gene pool. According to this approach, although the altruistic deed reduces the chances of survival for the altruist himself, it improves the genetic fitness of his kin. At the group level, then, altruism is a rational behaviour (*Becker 1976; Hirshleifer 1978*).

According to *Becker (1976)*, this altruism interpretation can be also applied to economics. He built a two-person model in which he introduced, as a new category, the altruist's social income which, besides his own income, also includes the income of the beneficiary partner. As a result, an altruistic attitude can be reconciled with the features of the self-seeking homo oeconomicus by inserting the utility (or income) of the beneficiary partner into the utility function maximised by the altruist. Thus, the positive effects deriving from connecting different utilities may be sufficient to dominate the direct disadvantages of being altruistic.

Besides incorporating altruism into his theory by relying on the orthodox tools of economics and describing altruism as a rational activity, Becker's model yielded additional positive results. Most importantly, by using his model involving an altruist and a related egoist, he pointed out that, due to the linkage between their utility functions, the behaviour of the altruist may be an incentive for the egoist to act as if he himself were an altruist. Thus, in some cases, even the egoist will refrain from steps that would reduce the income of the altruist or, in other cases, may even tolerate the reduction of his own income if it sufficiently increases the altruist's. *Becker (1974)* described the practical manifestation of this theory using a multi-player family model as an example and by outlining the "rotten-kid theorem". *Fehr and Schmidt (1999)* used a similar method – inserting relative income distribution into the utility function – to provide evidence that economic agents do not necessarily prefer inequality; in some cases they tend to have a preference for altruism even to the detriment of their own utility. Similarly, *Charness and Rabin (2002)* build their model along the lines of social preferences (consideration for others' social welfare) demonstrating that subjects are more willing to take sacrifices to increase the payoffs for low-payoff recipients.

Despite these positive results, the approach presented above is also open to theoretical criticism: the application of interdependent utility functions may be challenged. While the existence of group-level rationality might be acceptable in sociobiological arguments, it is not necessarily true from the perspective of economics, a science firmly rooted in individual-level rationality. Indeed, the application of interdependent preferences (*Pollak 1976*) violates the core

assumption of the discipline, the principle of methodological individualism (*Frey–Stutzer 2000*), rendering the preferences of players instable (*Hámori 2003a*). That notwithstanding, the method is undeniably good: in certain situations, it captures the behaviour of individuals better than the neoclassical approach; thus, subject to methodological reservations, its existence within the discipline can be justified.

In contrast to the above, *Simon (1990, 1991, 1993)* relied on the theory of bounded rationality to derive the operating logic of altruism. He maintained that, instead of perpetually performing cost-benefit calculations, in certain decision situations individuals are inclined to act on the basis of learned patterns (cf. *March 1991, 1994; March–Olsen 2004*). According to Simon, these patterns may derive from other members of the society and, given that altruism – as sociobiologists found – benefits the entire society at group level, society itself may be inclined to encourage easily influenced (docile) individuals for altruism.

In summary, it is apparent that altruism has numerous interpretations and methodological approaches, even within the behavioural paradigm. This suggests that we are faced with an existing phenomenon. We may not be able to explain altruism with one hundred per cent precision, but we cannot ignore the phenomenon, especially in view of its capability of improving the predictive power of economic models and the accuracy of forecasts.

6. Summary

This essay was intended to demonstrate that, as early as the previous century, the science of economics was aware of and to a certain degree acknowledged the theories of bounded rationality and altruism. This is all the more true in light of the heterogeneous nature of economics: outside of the realm of the uniform mainstream, there are numerous heterodox schools, different in approach, methodology and assertions alike. This paper has focused on one of them, behavioural economics, and responded to the criticism of “economics as a whole”.

As we pointed out, one of the main aspirations of the behavioural school was to use the approach of behaviourism to build its theories on more realistic benchmark assumptions. Important building blocks in this endeavour included the recognition of the individual’s cognitive limitations and altruistic attitudes towards others, and the insertion of these elements into the modelling of human nature. Since most of these results have now been accepted into mainstream economics, it would be a mistake to assume that the science of economics (whether in general, or limited to certain schools) is unaware of these categories.

Nevertheless, the science of economics – including its conclusions – should always be open to criticism, all the more so as this is a good incentive for researchers

to capture reality better. Such challenges may have ultimately led to the results presented above and integration of most of the achievements into the mainstream. Thus, as we pointed out, critiques asserting that the discipline only recognises the rigorous human model of homo oeconomicus can be refuted. In this paper we provided evidence to the contrary by demonstrating that a far more extensive range of tools is available to researchers, modellers and forecasters, and henceforth, the utilisation of these tools hinges only upon their responsible decisions and available resources.

References

- Arrow, K. J. (1986): *Rationality of Self and Others in an Economic System*. The Journal of Business, Vol. 59., No. 4., pp. S385-S399.
- Atkinson, R. L. – Hilgard, E. – Smith, E. E. – Nolen-Hoeksema, S. – Fredrickson, B. L. – Geoffrey, L. R. (2005): *Pszichológia*. Osiris Kiadó, Budapest.
- Becker, G. S. (1974): *A Theory of Social Interactions*. The Journal of Political Economy, Vol. 82., No. 6., pp. 1063-1093.
- Camerer, C. F. (2007): *Neuroeconomics: Using Neuroscience to Make Economic Predictions*. The Economic Journal, Vol. 117., No. 519., pp. C26-C42.
- Camerer, C. F. – Loewenstein, G. (2004): *Behavioral Economics: Past, Present, Future*. In: Camerer, C. F. – Loewenstein, G. – Rabin M. (eds.): *Advances in Behavioral Economics*. Princeton University Press, Princeton, pp. 3-51.
- Camerer, C. – Loewenstein, G. – Prelec, D. (2005): *Neuroeconomics: How Neuroscience Can Inform Economics*. Journal of Economic Literature, Vol. 18., No. 3., pp. 9-64.
- Charness, G. – Rabin, M. (2002): *Understanding Social Preferences with Simple Tests*. The Quarterly Journal of Economics, Vol. 117., No. 3., pp. 817-869.
- Conlisk, J. (1996): *Why Bounded Rationality?* Journal of Economic Literature, Vol. 34., No. 2., pp. 669-700.
- CSÉPE, V. – GYŐRI, M. – RAGÓ, A. (2007): *Általános pszichológia II. Tanulás – Emlékezés – Tudás*. Osiris Kiadó, Budapest.
- Downs, A. (1990): *Politikai cselekvés a demokráciában: egy racionális modell*. Közgazdasági Szemle, Vol. 38., No. 9., pp. 993-1011.
- Edgeworth, F. Y. (1881): *Mathematical Psychics: An Essay on the Application of Mathematics to the Moral Sciences*. C. Kegan Paul & Co., London.

- Fehr, E. – Schmidt, K. M. (1999): *A Theory of Fairness, Competition, and Cooperation*. The Quarterly Journal of Economics, Vol. 117., No. 3., pp. 817-868.
- Frey, B. S. – Stutzer, A. (2000): *Maximising Happiness?* German Economic Review, Vol. 1., No. 2., pp. 145-167.
- Friedman, M. (1953): *The Methodology of Positive Economics*. In: FRIEDMAN M.(ed.): *Essays In Positive Economics*. University of Chicago Press, Chicago, pp. 3-43.
- Gächter, S. – Nosenzo, D. – Sefton, M. (2012): *The Impact of Social Comparisons and Reciprocity*. The Scandinavian Journal of Economics, Vol. 114., No. 4., pp. 1346–1367.
- Graham, G. (2010): *Behaviorism*. In: ZALTA E. N. (ed.): *The Stanford Encyclopedia of Philosophy*. Downloaded: <http://plato.stanford.edu/entries/behaviorism/> (Accessed: 2014.12.22.)
- Hámori, B. (2003a): *Érzelemgazdaságtan. A közgazdasági elemzés kiterjesztése*. Kossuth Kiadó, Budapest.
- Hámori, B. (2003b): *Kísérletek és kilátások. Daniel Kahneman*. Közgazdasági Szemle, Vol. 50., No. 9., pp. 779-799.
- Hirschman, A. O. (1998): *Az érdekek és a szenvedélyek. Politikai érvek a kapitalizmus mellett annak győzelme előtt*. József Műhely Kiadó, Budapest.
- Hirshleifer, J. (1978): *Competition, Cooperation, and Conflict in Economics and Biology*. The American Economic Review, Vol. 68., No. 2., pp. 238-243.
- Hirshleifer, J. (1985): *The Expanding Domain of Economics*. The American Economic Review, Vol. 75., No. 6., pp. 53-68.
- Hirshleifer, J. – Glazer, A. – Hirshleifer, D. (2009): *Mikroökönómia. Árelmélet és alkalmazásai – döntések, piacok és információ*. Osiris Kiadó, Budapest.
- Jones, B. D. (1999): *Bounded Rationality*. Annual Review of Political Science, Vol. 2., No. 1., pp. 297-321.
- Kahneman, D. (2003): *Maps of Bounded Rationality: Psychology for Behavioral Economics*. American Economic Review, Vol. 93., No. 5., pp. 1449-1475.
- Keynes, J. N. (1890/1999): *The Scope and Method of Political Economy*. Batoche Books, Kitchener.
- Kolodny, N. – Brunero, J. (2013): *Instrumental Rationality*. In: ZALTA E. N. (ed.): *The Stanford Encyclopedia of Philosophy*. Downloaded: <http://plato.stanford.edu/entries/rationality-instrumental/> (Accessed: 2014.12.22.)
- KOLTAY, G. – VINCZE, J. (2009): *Fogyasztói döntések a viselkedési közgazdaságtan szemszögéből*. Közgazdasági Szemle, Vol. 56., No. 6., pp.495-525.

- March, J. G. (1991): *How Decisions Happen in Organizations*. Human-Computer Interaction, Vol. 6., No. 2., pp. 95-117.
- March, J. G. (1994): *A Primer on Decision Making. How Decisions Happen*. The Free Press, New York.
- March, J. G. – Olsen, J. P. (2004): *The logic of appropriateness*. ARENA Working Papers, 04/09. Downloaded:https://www.sv.uio.no/arena/english/research/publications/arena-publications/workingpapers/working-papers2004/wp04_9.pdf (Accessed: 2014.11.12.)
- Marshall, A. (1920): *Principles of Economics*. Macmilland and Co., London.
- MÉRŐ, L. (2010): *Az érzelmek logikája*. Tericum Kiadó, Budapest.
- Pollak, R. A. (1976): *Interdependent Preferences*. The American Economic Review, Vol. 66., No. 3., pp. 309-320.
- Rabin, M. (2002): *A perspective on psychology and economics*. European Economic Review, Vol. 46., No. 4-5., pp. 657-685.
- Rose-Ackerman, S. (1996): *Altruism, Nonprofits, and Economic Theory*. Journal of Economic Literature, Vol. 34., No. 6., pp. 701-728.
- Rubinstein, A. (1998): *Modelling Bounded Rationality*. The MIT Press, Cambridge.
- Schiliro, D. (2012): *Bounded rationality and perfect rationality: psychology into economics*. Theoretical and Practical Research in Economic Fields, Vol. 2., No. 1., pp. 99-108.
- Simon, H. A. (1947): *Administrative Behavior*. Macmillan, New York.
- Simon, H. A. (1955): *A Behavioral Model of Rational Choice*. The Quarterly Journal of Economics, Vol. 69., No. 1., pp. 99-118.
- Simon, H. A. (1959): *Theories of Decision-Making in Economics and Behavioral Science*. The American Economic Review, Vol. 49., No. 3., pp. 253-283.
- Simon, H. A. (1972): *Theories of bounded rationality*. In: MCGUIRE, C. B. – RADNER, R. (eds.): *Decision and Organization*. North-Holland Publishing Company, Amsterdam, pp. 161-176.
- Simon, H. A. (1986): *Rationality in Psychology and Economics*. The Journal of Business, Vol. 59., No. 4., pp. S209-S224.
- Simon, H. A. (1990): *A Mechanism for Social Selection and Successful Altruism*. Science, Vol. 250, No. 4988., pp. 1665-1668.
- Simon, H. A. (1991): *Bounded Rationality and Organizational Learning*. Organization Science, Vol. 2., No. 1., pp. 125-134.

- Simon, H. A. (1991): *Organizations and Markets*. The Journal of Economic Perspectives, Vol. 5., No.2., pp. 25-44.
- Simon, H. A. (1993): *Altruism and Economics*. The American Economic Review, Vol. 82., No. 2., pp. 156-172.
- Simon, H. A. (1999): *The potlatch between political science and economics*. In: ALT, J. E. – LEVI, M.– OSTROM, E. (eds.): *Competition and cooperation: Conversations with Nobelists about economics and political science*. New York: Russel Sage Foundation, New York, pp. 112-119.
- Smith, A. (1776): *An Inquiry into the Nature and Causes of the Wealth of Nations*. W. Strahan and T. Cadell, London. Magyarul megjelent: SMITH, A. (1992): *Nemzetek gazdagsága: E gazdagság természetének és okainak vizsgálata*. Közgazdasági és Jogi Kiadó, Budapest.
- Smith, V. L. (1989): *Theory, Experiment and Economics*. Journal of Economic Perspectives, Vol. 3., No. 1., pp. 151-169.
- Smith, V. L. (1994): *Economics in the Laboratory*. The Journal of Economic Perspectives, Vol. 8., No. 1., pp. 113-131.
- Sontheimer, K. (2006): *Behavioral Versus Neoclassical Economics*. Paradigm Shift or Generalization? In: Altman, M. (ed.): *Handbook of Contemporary Behavioral Economics. Foundations and Developments*. M. E. Shape, New York, pp. 237-256.
- Stigler, G. J. (1987): *The Theory of Price*. Macmillan Publishing Company, New York.
- Stigler, G. J. – Becker, G. S. (1989): *De Gustibus Non Est Disputandum*. In: Stigler, G. J. (ed.): *Piac és állami szabályozás*. Közgazdasági és Jogi Könyvkiadó, Budapest, pp. 111-139.
- Tóth, Cs. – Török, G. (2003): *Elméletek a politikatudományban*. In: Gallai Sándor – Török Gábor (eds.): *Politika és politikatudomány*. Aula Kiadó, Budapest, pp. 45-70.
- Vanberg, V. J. (2006): *Rationality, Rule-Following and Emotions: On the Economics of Moral Preferences*. Papers on Economics & Evolution, 0621.
Downloaded: <http://www.econstor.eu/bitstream/10419/31835/1/52254746X.pdf> (Letöltve: 2014. december 22-én.)
- Varian, H. R. (1991): *Mikroökonómia*. Közgazdasági és Jogi Könyvkiadó, Budapest.
- Weimer, D. L. – Vining, A. R. (2011): *Policy Analysis*. Longman, Boston.

The leaven of growth

Tamás Rózsás

David Ricardo, a prominent economist at the turn of the 19th century, argued for free trade against mercantilists by pointing out the possible gain arising from the comparative advantages of countries through the international division of labour and specialisation. In addition, this comparative advantage contributes to narrowing the formidable income gap between rich and poor countries. Indeed, if these underdeveloped countries export products that can be produced by low-skilled labour force, demand for low-skilled workers will rise, reducing income inequality in the given country.

This model worked fairly smoothly during the first wave of 18th century globalisation both in Europe and in America. Recent events, however, appear to challenge the validity of the model. World Bank data indicate that global inequality, as measured by the distribution of income between rich and poor countries, declined in the period of 1988–2008. However, the picture is far less rosy when we look at inequality within individual countries: inequality has widened in many poor economies. The widening gap observed in developing countries suggests that Ricardo's theory needs updating. Harvard University Professor and Nobel laureate (2007) Eric Maskin attempted to do so at the Lindau Meeting on Economic Sciences.

According to his theory, unskilled workers can be more productive when matched with skilled ones. Assigning a manager to a group of workers can improve the group's performance better than just adding another worker. Maskin classifies workers into four categories: high-skilled workers in rich countries (*A*); low-skilled workers in rich countries (*B*); high-skilled workers in poor countries (*C*); and low-skilled workers in poor countries (*D*). Importantly, Maskin claims that the *B*s are likely to be more productive than the *C*s.

Before the current wave of globalisation started in the 1980s, high-skilled and low-skilled employees worked together in developing countries, which improved the productivity of unskilled workers (*D*s) and thus, narrowed the income gap. However, the latest bout of globalisation has put a spanner in the works: high-skilled workers in developing economies can now work more easily with low-skilled workers in rich countries. As a result, the *C*s working with *D*s end up earning more, while the *D*s are left on the sidelines with shrinking income.

Tamás Rózsás is an analyst at the Magyar Nemzeti Bank. E-mail: rozsast@mnb.hu.

This review is based on the article entitled "Revisiting Ricardo", published in the 23 August 2014 issue of *The Economist* and summarized in the first issue of the *Global Monetary Observer* of the Magyar Nemzeti Bank.

The booming trade in intermediate goods heightens the demand for skilled workers in developing countries. In Mexico, for instance, wages offered by export-oriented firms are 60 per cent higher than those paid by non-exporting companies. In Indonesia, white-collar workers of foreign-owned companies earned 70 per cent more than their peers working for locally owned firms.

The weakness of Maskin's argument is the lack of data to back up his theory that skilled workers indeed benefit from the process. If he is right, however, the advocates of globalisation will have to figure out how to reap the rewards without leaving the poor employees of poor countries behind.

There is a lesson to be learned in Hungary from Maskin's propositions, as well. On the one hand, incentives should be found to keep high-skilled employees in Hungary, because this would improve the chances of the Hungarian unskilled labour force to increase its productivity and income. On the other hand, efforts should be made to ensure that high-skilled Hungarian workers work together with their low-skilled Hungarian peers rather than with the low-skilled employees of countries more developed than Hungary. Domestic industrial projects – which can engage low-skilled Hungarian workers easily – offer a good opportunity in this regard. Finally, with Maskin's results in mind, it might be rewarding to consider the reinforcement or renewal of Hungarian management training as well: if assigning a manager does more for the performance of a group than the mere adding of another worker, then Hungary will be in need of well-trained managers. Their presence in the workforce may well be the leaven of growth.

Response to the comment of András Simonovits

József Banyár

First of all, I would like to express my pleasure that one of the greatest figure of the Hungarian pension insurance profession reacted to my study (*Banyár, 2014*) within such a short time. Below, following the order of sequence and numbering of the exposition by András Simonovits, I try to react to each of his statements.

1. Child-rearing and pension in the OLG model

In two short paragraphs, Mr Simonovits formulated the following statements with regard to my writing:

- a) “it can really be argued for that families with children should receive higher pensions or pay less for social security contributions than those with no children.”
- b) “he ignored the fact that the model mentioned as his own work also appeared in writings of Gale (1974) and Augusztinovics (1983, 1992).”

With regard to statement *a*), I think it is important to note that in my writing I do not argue that households with children should pay less contributions or receive higher pensions. On the contrary, I say that every person should pay the same amount of contribution, but for this amount nobody can have a claim to any pension because this is only the settlement of their debt. A pension is only payable to those who reared children and thereby contributed to the maintenance of the contribution payment capacity. Everything that is attributed to me has been said by other persons with regard to the issue rather than by me.

As regards *b*), I really use the term “my model” in two places, but only in order to make difference between the original model of Samuelson and the way in which I had supplemented his model. This can really be misunderstood and I apologise for that; now I say it more precisely: I do not think that I have created an independent model; the model remains the ownership of Samuelson, and I only supplemented it in a point, namely: I added another simple, linear equation to Samuelson’s simple, linear equations. I myself do not call it a modelling performance. The performance of the article is the conclusions that had been drawn by me and this is a novelty; neither Gale nor Augusztinovics go in this direction. However, I myself also discuss

in the summary at large (but not expansively at all), how many people had already tried to explicitly include child-rearing in the OLG model. Of course, the excellent articles cited by Simonovits should also have been included in this study (together with many other articles); I need to apologise for that as well.

2. The tax on childlessness and its problems

Here, Simonovits objected that I do not study how the costs of child-rearing can be compensated outside of the pension system. He is right in the respect that I did not analyse this aspect in this article, but I reviewed all of the problems he raised in this point in one of my other articles (*Banyár 2012*).

There is a simple reason why I do not discuss here what he missed: it was not a preconception on my side that the problem of child-rearing must be solved within the pension system and I did not want to find arguments for that. Instead, I checked what the problem was in the pension systems built on Samuelson's principles and I faced the problem of child-rearing and I explained that in my article. However, I admit (as I did both in my article written in 2012 and in another article under publication) that the problem of child-rearing costs can theoretically be solved outside the pension system as well. It is another question that if we try to do so, we find such problems which are mentioned by Simonovits (and are also discussed by me) and the tax level should be increased in general very significantly, while, if it is solved within the pension system, the pensions should be reduced for certain segments; consequently, the solution within the pension system seems to be much more feasible.

3. The role of child-rearing and pension in my writings

According to Mr Simonovits, in my article I placed his earlier writing in a false light (*Simonovits 2002*). I wrote the following: "Samuelson's article influenced the modelling of pension in another way as well. Based on his model it became a common view that, in relation to the pension, the human career starts in the active age and they entirely disregarded the upbringing of people and its costs (this approach is followed in the Hungarian pension theory, for example, by the works of Simonovits – see, for example (*Simonovits 2002*))." Namely:

1. I mentioned the book written in 2002 as an example of a common phenomenon and Simonovits also admits that basically this was the guideline followed by the book.
2. On the other hand, I mentioned him as the person who had already taken into consideration these problems in his recent writings.

Despite these facts, I could have formulated my text in relation to the book even in a more differentiated way. In a more differentiated approach I would have had to emphasise that everyone, including both of the works of Simonovits cited by me in the article, takes Samuelson's AI history as a basis.

4. Which is the better: the Pay-as-you-go or the capitalised pension system?

In this point, Simonovits largely agrees with me. On the other hand, he makes an allusion in the last paragraph that can be understood as if I proposed that the work-based pension systems should be liquidated and instead a funded system should be introduced. Indeed, I have some writings of this type (e.g. *Banyár–Mészáros 2003*) where I propose that solution in the last resort. However, my article analysed by Mr Simonovits is not of this ilk; here, I propose the introduction of the pay-as-you go pension system based on another history than that described by Samuelson, i.e. not a funded or only a partially funded one (for childless persons). Basic state pension is not mentioned in my article at all.

Thus, in my article I do not propose that work-based systems be terminated (even though after the proposed change, the application of the word "work" will not be justified any more) or reduced to the basic state pension and I do not propose either that it should be funded. Instead, I propose that we should declare: contributions are due to the previous generation for having reared us and nothing is due to us for paying the contributions; i.e. if we want to have pension in the future, we should either rear children or set aside the money saved on not having reared children and this will be the source of our pension.

It is also important to emphasise that I do not disregard migration and immigration; what is more, I worry that, for this reason, the situation will be still worse in our country than currently because people will mainly migrate (I held an exposé on this issue in the autumn of 2014). On the other hand, I much prefer the flexible retirement age; it is absolutely necessary (I have already written that in several works) even in the system proposed in this article, simply because it makes any pension system unsustainable that the continuous increase in life expectancy appears only in the increase of the years spent as a pensioner and the active life phase is unchanged or (due to the longer period of education) it may even decrease.

References

- Augusztinovics, M. (1983): *Emberek és gazdaságok*, Közgazdasági Szemle, Vol. 30, pp. 385–402.
- Augusztinovics, M. (1992): *Towards a Theory of Stationary Populations*, manuscript, KTI, Budapest (earlier version: IEHAS, Discussion Paper, 1991).
- Augusztinovics, M. (1993): *Egy értelmes nyugdíjrendszer*, Közgazdasági Szemle, Vol. 40, pp. 415–431.
- Banyár, J. – Mészáros, J. (2003): *Egy lehetséges és kívánatos nyugdíjrendszer*, Budapest, Gondolat.
- Banyár, J. (2012): *Gyereknevelés és nyugdíj – összekapcsolható, vagy sem?*
(In: Kovács, E. (Ed.) (2012): *Nyugdíj és gyermekvállalás*. Tanulmánykötet. Gondolat Kiadó, Budapest, 180 p.
- Banyár, J. (2014): *A modern nyugdíjrendszer kialakulásának két története*, Hitelintézeti Szemle, Vol. 13. Issue 4. http://www.hitelintezetiszemle.hu/Root/MNBSzemle/tartalom/cikkenkent/7_Banyar.pdf Downloaded: 17 December 2014.
- Gale, D. (1973): *Pure Exchange Equilibrium of Dynamic Economic Models*, Journal of Economic Theory, Vol. 6, pp. 12–36.
- Kovács, E. (Ed.) (2012): *Nyugdíj és gyermekvállalás tanulmánykötet – 2012*, Gondolat Kiadó, Budapest, 180 p.
- Simonovits, A. (2002): *Nyugdíjrendszerek: tények és modellek*, Budapest, Typotex.

Why and how we cheat?

György Dávid Csikós

Dan Ariely:

The (Honest) Truth About Dishonesty (How we lie to everyone – especially ourselves)
USA: Harper Perennial, Reprint edition, 2013, p. 336
ISBN-10: 0062183613 (paperback)

Dan Ariely is a professor of psychology and behavioural economics at Duke University in the United States. In his book *“The (Honest) Truth About Dishonesty”* published in 2013, he wants to find an answer to the question why and when we cheat, how we lie even to ourselves and how our motivations can influence our judgement. The author also lists practical tools that can help us to restrain dishonesty. In order to support his arguments, Ariely presents a number of experiments, and for the purpose of deeper understanding, he provides anecdotes from his own life as examples, of which I only highlight a few.

Immediately at the beginning of the book, the author refutes the model entitled ‘Simple Model of Rational Crime (SMORC)’ from the Nobel laureate economist, Gary Becker. According to Becker’s theory, only rational factors drive our actions, i.e. when making decisions, we only compare benefits and costs. It follows from the theory that the number of crimes can be reduced if the potential cost of perpetrators is increased (stricter punishment is anticipated). According to his experiments,¹ Ariely claims that, as against the model and the intuition, neither the expected benefit nor the probability of getting caught determines the quantity of fraud. In his opinion, a much more complex thing is the case here as compared to what is supposed by a standard economist.

According to Ariely’s theory, when considering their decision, the people are balancing between two contrasting motivations: on the one hand, they would like to see themselves as sincere and honest persons and, on the other hand, they would like to benefit from the advantages provided by dishonesty. However, both

György Dávid Csikós is an employee at Magyar Nemzeti Bank. E-mail: csikosgy@mnbb.hu.

Allegedly, Becker’s theory was inspired by a personal event. One day, he was in delay from a meeting and he was only able to park illegally. When making his decision, he only took into consideration the fact whether the benefit (arrive at the meeting in time) exceeds his cost or not (he might be fined). He did not consider what “the right or wrong behaviour” would have been.

¹ To quantify the dishonesty, the persons participating in the experiment had to solve simple mathematical tasks under different conditions (participants were allowed to cheat in various ways).

of these contradictory desires may be fulfilled at the same time if we are able to exculpate our acts or to explain our wrong action to ourselves. The interpretation of the experiments performed by Ariely was that every participant cheated practically to the same extent, but always just a little and the number of persons who had cheated to a great extent was only minimal. According to the statement by the author, as long as people cheat only “a little bit”,² they can enjoy its advantages while they can retain a positive image for themselves.

A second important finding by Ariely is that people cheat or steal more easily if it is not money that is involved, but, let’s say, copy paper, a pen or a can of cola left in the common refrigerator of the residential college. The editor draws attention to the fact that the more we move to the cash-free world, the more we can expect the spread of dishonesty.

On the basis of his research, Ariely states that similarly to viruses dishonesty can also be contagious. A finding of his experiment carried out at the Carnegie Mellon University (CMU) was that the participants cheated more when they saw that a student belonging to their group (a CMU student) cheated, as compared to the case in which the cheating was by a student outside of their group, i.e. by a student from a rival university. In the editor’s opinion, minor offences must not be overlooked because they may easily become contagious and can lead to more serious transgressions.

In his book, the editor also presents how favours influence our decisions. In the experiment he presents, the participants were divided into two groups: one part was told that the experiment was sponsored by the “Third Moon” Gallery and the other part that it was sponsored by the “Lone Wolf”. Afterwards, they had to evaluate 60 paintings and the logo of the gallery where the picture can be purchased was indicated in the corner of each picture. The participants evaluated the pictures of the gallery with a better mark in the case when they saw the gallery’s logo and thought that this gallery sponsored the experiment. Another interesting discovery by the researchers was that preference for the pictures of the “sponsor” increased proportionally with the payment due for participation in the experiment. The editor stated that, in case someone makes a favour or gives a gift to us, then it influences our decision without noticing it. Otherwise, the large pharmaceutical companies understood and successfully apply these techniques. Frequently, they attempt to encourage doctors to recommend or prescribe the products of the relevant company to their patients by giving smaller gifts or an invitation to dinner.

On the other hand, lies have not only a shady side but have also a positive role for the purpose of the operation of the society. Ariely brings forward his own history as an

² On the other hand, it is important to note that the “aggregate” value of a lot of little cases of dishonesty exceeded that of a few large ones.

example. In his young age, he suffered third degree burns affecting 70% of his body and therefore, he had to undergo a number of operations. Nurses encouraged him saying that the operations would not cause pain (which proved to be a lie later) and in this way, he spent at least the period remaining to the operation calmly.

At the same time, based on the experiments, Ariely proposes solutions as well for the “prevention” of dishonesty as well as for hindering non-ethical behaviour. If we are, directly or indirectly, reminded of the rules of ethics, then we will cheat less. This reminder may even be the Ten Commandments (the recalling of which was sufficient for the participants in the experiment not to cheat) or the signing of a declaration (Honour Code), in which the participants agreed not to cheat in the future.

In his book, Ariely listed a number of factors about which we would think that they influence our decisions, which, however, do not affect us decisively in reality, while there are many circumstances and impacts, about which we would not think that they influence us but they still do.

The Death of Money

Zsolt Kovalszky

Jim Rickards:

*The Death of Money – The coming collapse of the international monetary system
USA: Portfolio/Penguin, 2014, p. 368
ISBN: 978-1-59184-670-3 (paperback)*

According to financial expert James Rickards, the collapse of the global monetary system is imminent. “Don’t look for snowflakes,” warns Rickards. “Watch out for the avalanche.” In his book “The Death of Money”, Rickards forecasts that events worse than the 2008 financial crisis will surely materialise. Russia’s and China’s efforts to shed the US dollar as reserve currency are just one indicator of this inevitable event. Rickards’s book on the fall of the dollar was published in April with an apocalyptic title. The author is surprised that a lot of the things he talks about in the book are happening much faster than he would have expected. Rickards claims that the fall of the dollar may trigger the collapse, as the greenback is the foundation of the entire system. Countries wielding real power such as Russia, China, Iran, and India do not base their national security on the US, and therefore the weakening of the US economy would be to their advantage, so they are trying to shed the dollar-based system.

Rickards deems that the collapse seems increasingly likely, and there are three major international players putting great pressure on the dollar: Russia, China, and Saudi Arabia. The threats to the dollar come from multiple directions. The only chance to repay the USD 1.7 trillion government debt would be inflation, which would, however, put off all other protagonists from the dollar. At the same time, the substantial increase in Russia’s and China’s gold reserves suggest a shift towards a new reserve asset.

Although the book is riveting and offers several arguments worth considering, it often takes on the form of an overly apocalyptic vision and most of the solutions proposed seem extreme. In terms of its structure, the book progresses rather slowly along its logical course. The first part interprets the events of September 11. The author then discusses the current state of the world and the global economy, and how the 2008 financial system crisis emerged. The book focuses mainly on a China,

Zsolt Kovalszky is an analyst at the Magyar Nemzeti Bank. E-mail: kovalszkyzs@mnk.hu.

Europe, emerging economies, and the US. The author holds outdated models responsible for the crisis and the slow recovery, which are no longer suitable for addressing economic developments. Rickards asserts that economists and decision-makers are turning a blind eye to reality, which puts markets in a perilous position and may ultimately lead to the collapse of the financial system.

In the author's judgement, the world is currently based on fiat money (currency that is not backed by a physical commodity besides a government guarantee), which is only as good as confidence in the dollar. The current financial system is based on the global supremacy of the dollar, with the dollar acting as the de facto central currency. Rickards's basic theory holds that because the Fed, the American central bank, and government administration are managing the dollar's global market position poorly, the dollar, which had functioned as the global currency in the past, will lose this status. The collapse of the dollar may result in collapsing confidence in the purchasing power of the global currency, which could sweep across the central banks of the world and the business players using the dollar. The loss of confidence in the dollar could then inevitably lead either to the inflationary environment that prevailed in the 1970s, causing the depreciation of capital stock, or trigger a deflationary spiral as seen in the US in the 1930s or faced by the Japanese economy for the past decades. According to the scenario presented by the author, the dollar will have become irrelevant by around 2020 and our notion of money will have radically changed. Thus, the book addresses the demise of the current financial system and consequently, the dollar, rather than the death of money. Needless to say, Rickards cannot predict the future with certainty, and therefore he leaves unanswered the question of whether it will be deflation or hyperinflation that causes the demise of the current financial system.

As a real historian, Rickards's book presents modern economic history in a flowing narrative style focusing on facts. As a result, the book is free of any factual errors. Rickards argues that as a result of the US government's poor management of the dollar and increasing financial imperialism, many countries have started searching for a way to cut their reliance on the dollar. China, Russia, and the states of the Persian Gulf have starting forming alliances sharing economic, military, foreign policy, and financial interests. One of the key areas facing significant structural challenges is currently the European Union. Rickards deems that – under the strict supervision of the Bundesbank – the euro area functions as a synthetic gold standard regime, as the monetary union strips member states of their capacity to generate new fiat money, and therefore a possible solution to the issue raised by the author could be the fiscal centralisation of European countries. Of course, there remains one solution for the US and thus for the maintenance of the current financial system (that the author does not see as unrealistic): a drastic cut in and regulation of public sector spending, which the author regards as a politically unfathomable scenario.

The economic curse of great powers – Is US dominance threatened?

Attila Méhes

Glenn Hubbard – Tim Kane:

Balance – The economics of great powers from ancient Rome to modern America

Simon & Schuster, 2013, p. 368

ISBN: 1476700265

Glenn Hubbard and Tim Kane's book published in 2013 by Simon & Schuster, entitled "Balance: The Economics of Great Powers from Ancient Rome to Modern America" examines the great empires of the past that have risen and then fallen into decline from a purely economic perspective.

The authors analyse the economic and institutional drivers behind the rise and subsequent fall of ancient Rome, the Chinese, Spanish, and Ottoman empires, Japan, the UK, the European Union and California. At the end of the book, the authors address the current situation of the United States and formulate recommendations for the US on how to avoid meeting the same fate, that is, inevitable collapse.

Although the rise and fall of great powers has been discussed by many and in many ways in the past, for instance in Paul Kennedy's 1986 book "*The rise and fall of the Great Powers*", the great powers have not been analysed from an economic perspective, giving rise to many flawed conclusions about their demise.

The authors argue that the fall of every great power was triggered by internal economic and institutional imbalance, as the weight of great powers stems primarily from their economic dominance and only indirectly from their military force or geographic size, which is more apparent to the world at large. For instance, the demise of the Roman Empire was far more attributable to its economic faltering than its excessive geographic expansion, which was long considered by many as the reason for its fall. The decline that unfolded in the 3rd century resulted from a flawed economic policy that weakened the military and rendered it unable to face Barbarian invasions.

The flawed economic policies of great powers always stemmed from the institutional systems that enabled their rise, but were incapable of accommodating change or

Attila Méhes is a former economic analyst at the Magyar Nemzeti Bank. E-mail: mehes.attila@padocbudapest.hu.

reacted inadequately to such change. Late or flawed reforms generally resulted from a lack of knowledge or pressure from groups interested in maintaining the prevailing institutional system. Staying on the topic of the Roman Empire, policy-makers had no means of foreseeing the negative impact of a depreciating currency on the economy, chiefly on the all-important field of commerce, as economics had not yet emerged as a discipline at the time, and inflation or mechanisms of monetary policy were simply unknown. At the time, continuously depreciating the currency seemed entirely logical and rational, generating increasingly larger volumes of tax revenue for rulers, which they used to attempt to fund the growing state and military expenditures. However, they did not (and could not) predict the long-term adverse impacts.

The aforementioned great powers all followed a similar path, encountering difficulties in reforming the institutional system that had fostered their rise, either due to a lack of knowledge or action by interest groups.

The solutions to the current issues facing the United States due to its indebtedness are not unbeknownst to politicians, but the political institutional system chooses to short-change the future to focus on short-term success, i.e. securing re-election. This institutional system will not allow political decision-makers to take steps in the near future that could lead to long-term success at the price of short-term political sacrifices.

The book asserts that the demise of the US is not imminent, as its productivity and capacity for innovation will continue to support its leading position, its economic institutions remain the best in the world, and rivals can only hope to approach its level of development. History has proven that a bout of political stagnation may render smoothly functioning institutions outdated, which could give rise to serious risk. The great powers of the past show that the US cannot eternally stay on a path of political polarisation and budget imbalance. Congress will have to make difficult decisions in the face of fiscal challenges to prevent them from becoming an even bigger issue in future.

Is China a real world power?

Rékási Róbert

*David Shambaugh:
China Goes Global-Partial Power
Oxford University Press, 2013, p. 432
ISBN: 9780199860142 (hardcover)*

In his book “China Goes Global-Partial Power”, David Shambaugh, professor at George Washington University, addresses a topic and related matter that appears to warrant a straightforward “yes” in reply, namely whether China can be regarded as a global power (the author answers the question in the title).

The author dissects the global role and presence of China from multiple perspectives, from the economy to security policy and culture through diplomacy, and examines China’s image of itself and its own global role.

Over the past decades, China has gone from a peripheral nation to one of the leading global powers thanks to its carefully governed process, the Reform and Opening-up policy. It is China’s firm objective to not only be strong in one, but several dimensions of power, including technology, the economy and education, fostering its effort to become a total power. Shambaugh deems that China’s global presence is superficial, in that although it is ubiquitous, its presence is characterised by a passive and reactive attitude rather than the attitude of leader that would be necessary for it to attain its desired status.

Its own identity is also contentious for China, which is facing a sort of identity crisis. There is no homogenous identity, but rather several parallel or rival identities. The supporters of certain beliefs favour the maintenance of national autonomy and are suspicious towards the outside world, particularly Western countries and regard the above-mentioned Reform and Opening-up policy as a stain on China and its culture. Today, the predominant current aims to shore up China (its economy and military) and protect its interests, but some proponents of this approach stress the importance of diplomacy and culture, while others would emphasise focus on the great global powers and are calling for involvement only in matters relevant to China.

Róbert Rékási, CFA, is a head of department at the Magyar Nemzeti Bank. E-mail: rekasir@mbn.hu.

China has emerged from total isolation four decades ago to become a global diplomatic factor. However, diplomacy is an area where China remains only a partial power. For one, China, as a global power, is a permanent member of the United Nations Security Council and a participant at all key diplomatic summits. However, China is mainly driven by its strict national interests (economic development, geographic integrity) and is less active in terms of global issues. Chinese diplomacy is characterised by behaviour fluctuating between extremes, being at times pragmatic, cooperative, proactive and globally oriented, while being at other times assertive or even aggressive.

As China continues to gain strength as a great power and see its global impact increase, Western democracies are increasingly demanding that it play its part in international matters. However the term “global governance” has only recently been added to the Chinese vocabulary. The Chinese regard this demand for greater international responsibility by Western countries with suspicion, and see it as a potential ensnarement or trap. China fears that after colonisation, this is just another way to restrict China’s opportunities by diverting resources from its domestic economic development. The majority of China’s citizens focus on local issues and fail to see the necessity and importance of taking part in the resolution of global issues. In addition, the Chinese consider the current international system unfair, and therefore China is unlikely to become a committed participant in international matters.

The economy is where China’s power and international presence is the most conspicuous. The Chinese economy is the second largest economy in the world after the US and is likely to become the largest one in the upcoming decade. But despite what is suggested by numerous statistics of this kind, China’s international position is not as strong as it appears. Although China is a great power in terms of commerce, bottom-shelf manufactured goods comprise the lion’s share of its exports, while the proportion of financial services and knowledge-intensive goods is very low. In addition, only a handful of Chinese firms have risen to the status of industry leaders on a global scale, and the international perception of the quality of Chinese goods is also poor. These factors attest to the fact that China is also a partial power in the economic domain.

After accumulating global power, China realised the importance of its own image and of cultural power, but there is no unified opinion on what elements it can use to achieve this. Some propose values rooted in ancient Chinese culture, also regarded as universal values: peace and harmony, morality, etiquette and good faith. Others support the capacity and legitimacy of the Chinese political system as the foundations of cultural power. The third approach proposes basing China’s cultural power on its development and economic convergence. In a nutshell, China’s cultural power and cultural attractiveness is currently very low and is not set to change in

the near future until China realises that it must concentrate on earning cultural power using the opportunities available rather than buying it.

It may first come as a surprise that China, which has the world's largest army, is not a global military power, but much rather a regional power. Despite having the largest army (with a strength of 2.3 million), its level of technical equipment falls short of the US army. In addition, China is not a member of alliance systems and has no foreign military bases, which means that its army can only implement military operations in areas located close to China. The Chinese military is expected to catch up with the US by the 2020s, but its involvement in global security policy is likely to remain shaped by national interests (economic interests and irredentist efforts), in spite of international demands.

Invisible predators

Tamás Rózsás

Michael Lewis:

Flash Boys

A Wall Street Revolt

USA: W. W. Norton & Company, 2014, p. 274

ISBN: 978-0-393-24466-3

When we try to find samples for real, intensive market competition in relation to the economy, the stock markets come to our mind as one of the first things. On stock markets everything is public, the information flow is fast, everybody has the same information at the same time, and consequently the chances are balanced. Here indeed, those win who are better, since equal conditions are provided by strict regulation and the evenness of competition is also proven by the lively rhythm of the stock exchange as the need for being quick arises from the fact that competitors are always very close to each other in tight competition.

However, there is a world hidden for simple investors where quickness and, through it, the public information flow providing the same guidance for everyone also receive different interpretation. The book of Michael Lewis presents this world, the world of high frequency trading.

In this world the largest investors, professional investment funds, huge pension funds and, in a certain sense, even the large banks of Wall Street are vulnerable to small but very fast, new type predators who are mostly invisible to the others and who mainly came from mathematics, computer technology, atomic physics or other sciences rather than the financial world. In this world, time is measured in millionth of seconds and in the interest of that, astronomical amounts are spent on technology. Paradoxically, this world was established as a result of a regulation aimed at the equality and balanced character of the conditions of electronic trading that just began at the stock markets in the 1980s and became exclusive since that time.

Learning from the experiences of earlier abuses, in order to eliminate them, the US Securities and Exchange Commission tightened the rules of electronic trading in 2005. The regulation on the National Market System made the acceptance of the

Tamás Rózsás is an analyst at the Magyar Nemzeti Bank. E-mail: rozstas@mnbb.hu.

best priced offers compulsory and ordered to build a central system for collecting, processing and publishing all buy and sale bids of the different stock exchanges. However, it has not specified how fast this central system must be. Thereby, building faster information processing systems, it facilitated high frequency traders in reaping the benefits from the speed to come before the other operators of the market in the manner that, making use of the requirement of compulsory acceptance of the best offers, they receive information on their intentions as well. Thanks to this deadly mixture created by the otherwise good-intentioned regulation, the new type operators who build faster and faster systems, increase the volatility and risk of the markets by their abstruse strategies, who meanwhile basically do not assume any own risk pick billions of dollar from investors' pockets.

However, the book of Michael Lewis shows not only the establishment, operation and special internal rules as well as the harmful effects of this world, but also the work of a small but enthusiastic team of Wall Street professionals acting against them and, through it, also the possible solution. The group organised around Brad Katsuyama who left his well-paid executive job at the Royal Bank of Canada, a Canadian bank considered to be a small player on Wall Street, and composed of professionals who, similarly to Brad Katsuyama, had left the safety of their well-paid Wall Street jobs confront the predators who dominate the market and also have strong political relations. Initially, searching the causes of phenomena disturbing their own trading or just their technical work, they gradually explore the world of high frequency trading and finally, they decide to confront it. They seek allies in the investors injured by the system that has evolved and, assuming serious risks, they establish their own stock exchange that allow investors and brokers to avoid the system contaminated by the high frequency trade. For this purpose, they partly apply their own weapon, speed, against them, and partly they create conditions under which extraordinary fastness cannot become a source of an unfair advantage.

The story ends with the establishment and the first successes of the new stock exchange, however, the fight for restoration of the fairness of the competition on the stock markets and for change does not end.

The book of Michael Lewis is an interesting and exciting reading for those who are interested in the backstage of stock exchanges, the possibilities of technology, or the difficulties of regulating the capital markets. Despite the exciting and maybe unsettling topic, the book is also an enjoyable read; the bestselling author does his best in it.

Situations at the time of political changes

Zoltán Siklósi-Dutkay

*Adam Burakowski – Aleksander Gubrynowicz – Paweł Ukielski:
1989 – The Final Days of the Communist Regime in East-Central Europe
Warszawa: Instytut Studiów Politycznych Polskiej Akademii Nauk, 2014, p. 455
ISBN: 978-615-5475-03-0 (Hardback)*

Former Chinese premier Zhou Enlai famously replied to the enquiry of a foreign journalist that it was “too early” to assess the implications of the French revolution of 1789. This unique Eastern wisdom helps shed some light on the dilemma of whether the quarter of a century that has elapsed since the collapse of communism, which was astoundingly rapid according to many, can be regarded as a historical perspective.

The three authors of the book, highly erudite historians, political scientists and lawyers of nearly the same age, experienced themselves during their early teens how time, sluggish until then, suddenly sped up and gave way to many changes that occurred during a single year. A world system believed to be sound fell apart, pulling down the communist ideology along with it. The ideological fundamentals upheld for decades crumbled and red-clad party member books ended up in the wastebin.

The flowingly written and excellently edited book, featuring notes and commentaries, was first published in Polish six years ago and addresses the history of the transition from state socialism to capitalism in each affected country – Poland, Hungary, Czechoslovakia, the German Democratic Republic, Romania, and Bulgaria – without any trace of nostalgic tones and in great depth. The political changeovers of Albania, Yugoslavia, and the USSR, the leader of the Eastern Bloc, are not discussed in the book due to their different form compared to the aforementioned countries. The expanded and updated Hungarian version of the book follows events until the 2010s with great professionalism, while still remaining accessible.

The triumvirate of authors asserts that the crisis of the communist world system accelerated unstoppably from the mid-1970s and Western loans – over and above the exploitation of the USSR’s rich raw material resources – contributed significantly to the protraction of the agony caused by economic unviability. The authors identified the following as drivers of the inevitable collapse of the totalitarian

Zoltán Siklósi-Dutkay is a chief expert at the Magyar Nemzeti Bank. E-mail: siklosiz@mnbb.hu.

regimes covered in the book: the chronically unviable centrally controlled economy, the low level of innovative capacity holding back technical development, the arms race between the two world systems, the growing social crisis coupled with growing economic woes and the resulting demoralisation of the population, and the spread of crime, alcoholism, and apathy.

The key strength of the book, showcasing a unique perspective, is that it refrains from the platitudes typical of studies of this topic. It does not treat the Central and Eastern European region as a uniform entity and presents the situation of the various countries at the time of the political changeover in a nuanced manner, discussing the idiosyncratic events in each country. The book also features rich descriptions, for instance the passage about the disgraceful fall of the Genius of the Carpathians, Nicolae Ceausescu.

The most relevant chapter for Hungarian readers will be the analysis of the events that unfolded in Hungary, written by co-author Gubrynowicz and entitled “From a soft dictatorship to a protracted political changeover”. The chapter paints an accurate picture of the trend so typical of the region, characterised by timid reforms that only managed to delay the coming to light of the internal contradictions of the regime, but were entirely incapable of stopping the collapse. Kadarism longed for subjects different from those of other socialist countries. It withdrew politics from people’s day-to-day lives, did not impose communist ideology, was less patriotic and wary of nationalism, while attempting to improve the welfare of ordinary people, pitiful by Western standards, who were not interested in the past or the future. Thanks to the relative welfare fuelled by loans, Hungary did not experience strikes even in the 1980s, and the launch of the second economy, i.e. economic activities outside state employment, alleviated the social tensions, which were on the rise in other states within the Eastern Bloc, for some time.

While we map the path that led to the demise of the Eastern Bloc with the help of the authors, many questions come to mind. Did the former countries of the Eastern Bloc manage to definitively eradicate the heavy heritage of communism or is this process nowhere near over? Are we taking nationalism, Central and Eastern Europe’s century-old curse, repressed for decades and now rearing its head, seriously enough? Was the political changeover a success or a failure? These are the unanswered questions that render the political changeover, often seen as a hypocritical, a weighty heritage for more than 100 million Eastern Europeans.

The fact that three general secretaries of the USSR passed away over the course of a short period in the early 1980s can be regarded as symbolic. The funeral ceremonies were broadcast in the satellite countries and some suspected that the actual funeral of the communist leaders will shortly be followed by the allegoric funeral of the communist regime.

It is an undeniable fact that 1989 represents the end of an era, a milestone, a psychological turning point or, as some recall with some pathos, an *annus mirabilis*, or year of wonders. The region shed not only communism, but also a foreign power, artificially created states fell apart, geopolitical power relations definitively changed, deep reforms started to unfold in the post-Soviet states, and most importantly, despite all arguments: 1989 brought freedom, making the year similar to 1848.

In 1989, the unfathomable occurred.

Money should stay the means, not the end

Zsigmond Pálvölgyi

*Andrea Tornielli – Giacomo Galeazzi:
Pope Francis: This Economy Kills
(Transl. by Csaba Török)
Jezsuita Kiadó, Budapest, 2015, p. 231
ISBN-13: 978-9638014771*

The authors, two renowned Vatican experts, compile the thoughts of Pope Francis about today's economic and social situation as well as the relevant criticism, thereby explaining the comments of the Pope that might often seem too radical. The Bishop of Rome has been severely criticised for the remarks he made in his encyclical, *The Joy of the Gospel* (Evangelii Gaudium) published in the year of his election: phrases such as “the new tyranny of capitalism” or the “idolatry of money” have received considerable attention not only among economic actors but also within the Catholic Church. Some have labelled the Pope a Marxist, others have called him incompetent or a man looking for a third way between capitalism and socialism. The authors reflect on these designations, and present Pope Francis' thoughts on the economic and social situation through interviews and his speeches.

The book, just like the Pope's views, centre on the need for the church to turn towards the poor: Pope Francis' goal is to build a “poor Church for the poor”. This is reflected by his choice of name that he adopted in honour of Saint Francis of Assisi, the patron saint of the poor, as well as his first apostolic journey, during which he visited refugees on Lampedusa, an island between Africa and Europe. The authors frequently assert that the Pope's focus on the poor was heavily influenced by his experiences in Buenos Aires, where he was repeatedly faced with the hopelessness of those living in the slums. Based on the poverty and the widening income gap he encountered in Argentina, Pope Francis has criticised the present system of capitalism and the trickle-down theory, which has been strongly denounced in the English-speaking press, especially in the United States.

The authors give a detailed overview of these opinions that mainly lambast the Pope's incompetence and his flawed generalisation. According to the extensively quoted criticism of Michael Novak, an American Catholic philosopher, Pope Francis

Zsigmond Pálvölgyi studies in the Master's programme in Economic Analysis at the Corvinus University of Budapest. E-mail: zsigmond.palvolgyi@stud.uni-corvinus.hu.

only met a disfigured form of capitalism in Argentina, whereas in the United States, free markets and the protection of private property were the very reasons that enabled the masses of immigrants to rise. Novak, just like other critics of the Pope, believe that the social teachings of John Paul II lend legitimacy to capitalism, and, according to Novak, denouncing capitalism is tantamount to questioning the thoughts of the former Pope. The authors underline that the universality of capitalism had already been called into question by the predecessor of Pope Francis, Benedict XVI, in his encyclical, *Caritas in veritate*, published immediately after the eruption of the economic crisis in 2008. That work received similar criticism from the followers of American conservative Catholicism.

A separate chapter is dedicated to the financial sector that, according to the Pope, has departed from its original function due to the belief in the absolute autonomy of the markets; speculation does not serve the interest of the people, which was clearly demonstrated by the spike in global food prices at the onset of the crisis. Back then, in search of greater yields, capital flowed from the bond and equity markets to commodities markets. This, without any true reason that could be explained in terms of the real economy, resulted in the doubling of wheat and maize prices between 2008 and 2009, which later returned to their original levels. Guided by similar events depicted in the book that directly affect the poor, Pope Francis has taken a stand against the autonomy of the market and financial speculation, which he considers directly responsible for preserving poverty.

A recurring phrase in the book, the “idolatry of money”, best exemplifies the Pope’s criticism against the money-centred economic system. Pope Francis argues that people in today’s societies focus too much on gaining material goods, which results in major distortions both at the social and at the individual level. The Pope pays special attention to work, which should provide a decent, fair income if poverty is to be tackled. However, economic decision-makers have moved a sizeable share of the production of developed countries to developing countries in order to ensure the continuous increase in profits. As a result, masses of low-skilled, low-income workers have been made redundant, while often the new jobs created in developing countries do not provide the income levels securing livelihoods. Due to globalisation and the swift mobilisation of liquid assets, capital has increasingly grown in importance, which should be addressed by political decision-makers by (instead of constantly increasing production) guaranteeing appropriate working conditions and state-regulated, fair wages.

At the personal level, the “idolatry of money” is displayed by the single-minded pursuit of financial assets; the priority of providing material comfort leads to the alienation of the individual from the community, and the emergence of social indifference. The latter is illustrated by the Pope’s oft-repeated adage that if the stock market drops by two points, it makes the news, but nobody cares about the

homeless person in the neighbouring street freezing to death. Social indifference increases with income inequality, even though decreasing individuality and boosting solidarity might well be the solution to reducing the current social disparities. Pope Francis suggests that the endless pursuit of self-interests and banning morals from economic life has produced a “throw-away” culture: our society is centred too much on competition, and those in power not only suppress the weak but also force them out of society. Because of the decline in solidarity, less attention is paid to the unemployed, the poor and the old who are increasingly stripped of their human dignity due to the unchanging circumstances.

The book repeatedly mentions that the Catholic Church does not intend to analyse the current economic system or to provide alternatives: the Pope has merely voiced his concern about the present deficiencies of capitalism, in line with the social teachings of the Church. In an interview at the end of the book, Pope Francis stresses that he does not make his comments as an economic expert, and that his thoughts, apart from the one concerning trickle-down theory, had already formed part of the Church’s teachings. The book often quotes from the encyclical of Pope Pius XI issued after the 1929 global economic crisis, in which the “international imperialism of money” is condemned, and frequently mentions the teachings of the ancient fathers of the church, whose thoughts about putting an end to poverty seem radical today.

In view of the above, the book should not be read as a damning criticism of capitalism but rather as a guideline. The thoughts of Pope Francis do not provide specific solutions for easing social tensions, but promote a more liveable, human-centred world by pointing out problems. According to the main message of the book, in order to tackle social injustice, morals should play an increasingly dominant role in economic governance so that economic life is again centred on people instead of money.

Thoughts about the euro-area crisis

Norbert Szijártó

Lorenzo Bini Smaghi:

Austerity – European democracies against the wall

Center for European Policy Studies (CEPS), 2013, p. 151

ISBN: 978-94-6138-330-3

As a former member of the Executive Board of the European Central Bank, Lorenzo Bini Smaghi¹ was able to closely follow the impacts of the global financial crisis on euro-area Member States and its transformation into a sovereign debt crisis in the euro area. Ten years after the establishment of the Economic and Monetary Union, the euro area was shaken by a crisis that jeopardised the future of the single currency and the European Union as a whole. In spite of the reinforcement of the European institutional framework (mainly the economic framework), a number of EU summits and crisis meetings as well as the conventional and unconventional interventions by the European Central Bank, the crisis is still unresolved. A complete recovery from the crisis is expected to take years for the euro-area countries, which suffered a serious downturn.

The crisis had a dramatic impact on the economic and social structure of Europe: the increase in unemployment and youth unemployment, the growing number of people living in poverty and the decline in families' income are only a few social and economic consequences of the crisis. In some countries, incomes fell to levels of 20 years ago as a result of the protracted crisis. In Bini Smaghi's opinion, the negative economic phenomena are only the symptoms of a much more serious problem. First of all, the crisis is of a political nature. It reflects that Western societies were unable to solve the problems which accumulated in the past 20 years, and thus drastic steps were necessary during the euro-area crisis to reform the economic and social structures. In view of their future re-election, during their time in office, democratically elected politicians are not willing to take measures that would endanger their re-election. Deeper structural changes and reforms have to be waited for until external economic conditions deteriorate to a level where

Norbert Szijártó is a junior research fellow at the Institute of World Economics of the Centre for Economic and Regional Studies of the Hungarian Academy of Sciences. E-mail: szijarto.norbert@krtk.mta.hu.

¹ At present, Lorenzo Bini Smaghi is a Visiting Scholar at Harvard's Weatherhead Center for International Affairs and Senior Research Fellow at Istituto Affari Internazionali in Rome. Between 2005 and 2011 he was a member of the Executive Board of the European Central Bank.

the financial markets are not willing to finance a country any longer. Then the emergency enforces unpopular economic decisions, which most often mean strict austerity measures. This, in turn, hinders economic activity, and threatens political and social cohesion.

In spite of the fact that the global financial crisis did not start from Europe, it still had the greatest impact on Europe due to the complexity of the decision-making mechanism of the European Union. The European Union cannot be considered a complete economic entity similar to the United States. On the whole, power (the co-ordination of individual policies) has not yet moved to the federal level from the local level; decentralisation will take long years, or even decades and will probably be coupled with a serious political crisis.

In the introductory chapter, the author raises six questions, which characterise the decision-making mechanisms of European states.² The first question examines the understanding of the global financial crisis and the euro crisis. The most frequently arising and most focussed-on problem during crisis management is the accumulation of debt (whether government or private). Why was the debt level as a proportion of GDP allowed to become so high? This is the result of the imprudent behaviour of banks, households, corporations and the public sector. However, blaming other actors or factors (financial sector, governments, the rich, China, the World Trade Organisation or the euro) may divert attention from the real problems and their efficient management. We also have to ask the questions why financial deregulation was able to create an environment that provided loans too easily, even for non-returning investment or consumption, why public expenditures financed from debt were able to grow faster than incomes, why interest rates were left at a low level for so long, or why the financial supervisory authorities of certain countries were so short-sighted and tolerated high risks. The answer may be that individuals, relying upon past trends, overestimate their future income. However, overestimation of economic growth is more deeply rooted, mostly in the trends in global economy in the past 20 years (i.e. the change in the structure of trade and technological progress), which questioned the growth models of developed industrialised countries and made their social structure unsustainable. Accordingly, the crisis may be understood as a structural crisis, to which there is one possible answer: deeper integration into the global economic system. Therefore, it is no wonder that the downturn suffered during the crisis was smaller for euro-area Member States which had become more deeply integrated into the international system as a result of structural reforms in the labour market and education, coupled with support for research and development as well as investment in infrastructure. By contrast, countries that kept postponing the implementation of structural

² The first five topics are typical of each developed industrialised state, but most seriously apply to EU countries.

reforms and whose respective economies were based mainly on the internal market suffered greater losses.

The second problem is the aforementioned continued postponement of politically costly reforms, which is typical of democratic systems. Reforms in certain countries are implemented only when they become necessary in order to avoid a much deeper financial and real economy crisis. A typical example for this is the transformation of pension systems: productivity in developed countries has declined in parallel with the increase in life expectancy. This does not cause a problem as long as the financial markets finance the given state, and the necessary pension reforms are not implemented until then. With a decline in propensity to invest, the risk premium on government securities starts to increase, and as insolvency approaches, the disbursement of pensions also encounters obstacles. And only then does it become clear for the government that the pension system is in need of reform. The third issue is partly the continuation of the previous one. In emergency cases, governments are ready to implement reforms, but due to the short time available they are unable to realise the whole complexity of a problem, and therefore often adopt solutions that are not comprehensive.

The fourth problem lies in the nature of crisis management. Short-term solutions focus on fast recovery from the crisis, whereas long-term solutions aim at preventing the evolution of similar crises in the future. There are serious tensions between the two solutions. The dilemma mainly arises during the treatment of the financial system: to shift the responsibility upon the credit institutions, and the banks that apply a proper lending system will continue to work, while imprudent banks will go bankrupt, or to stabilise the whole financial system and keep lending alive during the period of the crisis as well through government support. In the United States, the bankruptcy of the Lehman Brothers in September 2008 (the lack of government support) triggered a process that resulted in the collapse of the market, and the Congress supported the financial rescue package only after that. The US Treasury recapitalised the major banks in order to avoid a deeper recession. No major bank collapsed in Europe during the global financial crisis; on the other hand, most of the European countries were averse to the recapitalisation of the European banking sector from state funds. This resulted in a gradual weakening of the European financial system and an increase in the risk premia of sovereign states in parallel with bank risks, which prolonged the crisis and terminated lending to the private sector.

The fifth subject matter is a scrutiny of the role of central banks. Central banks face a serious dilemma in the time of a crisis. On the one hand, if they intervene in order to prevent financial turmoil, they reduce market pressure and give time for politicians to implement unpopular reforms, but by that they generate inflation, i.e. they add to the burdens of taxpayers. On the other hand, if they do not intervene,

they jeopardise financial stability and price stability as well. This problem is even more complex in the case of the euro area as the debt crisis of certain Member States endangers the functioning of monetary policy and the transmission mechanism of monetary policy. Therefore, the ECB decided to purchase government securities of countries in distress, thus preventing sovereign default and giving time for governments to improve their respective financial positions.

The last topic deals with the problem of the incomplete nature of the euro area, foreshadowing the necessity of deeper integration. *'To overcome the crisis we need more Europe'*, as it has often been mentioned. However, more Europe or deeper European integration requires the delegation of all important components of economic policy to the community level. Of course, this is not supported in EU countries, which is clearly reflected in the strengthening of nationalist parties in European countries, which proclaim less Europe. The problem exists not only at the national, but at the EU level as well, because according to subsidiarity, one of the most important EU principles, a policy may be delegated to community level only if they are unable to exercise it better at national level. In Bini Smaghi's opinion, one or more further crises are needed to convince people that wielding power at the local level is unsatisfactory, and deeper integration is needed.³

The author divided the book into 20 smaller chapters, where the aforementioned six problems are discussed in more detail, embedded in the current economic developments in the euro area. The chapters do not present the history of the Economic and Monetary Union in chronological order from its outset to the crisis of the euro area, but describe certain problems that arise. In the individual chapters, the historical presentation is complemented by economic and political considerations.

Alternatives to the Economic and Monetary Union have not proven or could not prove successful. Bini Smaghi presents three possible options that could have been alternatives to the European monetary integration, but their application would also have caused serious economic problems. The first one could have been the further application of the European Monetary System, which followed the collapse of the Bretton Woods system, but the widening of the fluctuation bands with the crisis of the European Monetary System would have caused serious tensions in trade. Moreover, it would have jeopardised the functioning of the single internal market. The second option would have been the strengthening of monetary stability around the German mark, but the Bundesbank was responsible only for the stability of the German mark and not for other currencies. The third option could have been the establishment of an 'exclusive' monetary union, which would have torn the

³ This thought of Bini Smaghi coincides with the idea according to which European economic integration is reactive, and deepening only takes place if a response to some crisis is needed. The lack of proactive attitude is negligible in crisis-free periods, in the case of economic prosperity.

then European Union into two. Consequently, there remained no other solution but to establish the Economic and Monetary Union on the basis of the Delors Report, which is the clear consequence of creating the single internal market (with guaranteeing the condition of free movement of capital). Markets cannot become completely integrated until there are different currencies, but without the integration of the markets the monetary union cannot be considered an optimum currency area. The only remaining question is whether it would have been better to postpone the launching of the monetary union.

The launch of EMU has made it clear that this is a one-way process; it is not possible to step back from a deeper stage of integration to a lower stage. Greece's exit from the euro area has been on the agenda in political and academic circles for years, but it does not even have any legal basis.⁴ As a result of an exit either a dual currency system should be applied or a new currency should be introduced (return to the earlier one), but both steps would have serious economic consequences: the exiting country would be unable to finance itself from the international markets, euro-denominated government debt would increase considerably, and the country – Greece in this case – would have to face a much more serious economic recession.

In the presentation of the crisis, Bini Smaghi mentions that (when the book was written) three countries in a crisis (Greece, Ireland and Portugal) became insolvent due to completely different circumstances. Spain and Italy also faced serious economic difficulties, which were alleviated only by the OMT announcement. However, during this time, 'Northern' or core states did not suffer any strong economic downturn. This was mainly attributable to the fact that for example Germany in the 2000s, although with difficulties, but implemented the structural reforms that significantly improved its international competitiveness. In the author's opinion it was of crucial importance. Competitiveness as a key factor is mentioned several times in both the Introduction and some chapters. Firstly, the countries that implemented the necessary reforms did not suffer any material downturn. Secondly, their labour cost based competitiveness improved considerably, contributing (through exports) to these countries' recovery from the crisis.

Bini Smaghi devotes several short chapters to the foundation of new institutions. The European Stability Mechanism, aka the European Monetary Fund, was an important factor to calm down financial markets. The establishing of the Banking Union is a necessary condition for a deeper European monetary integration, as excessive lending by banks and their insufficiently strict regulation constituted one of the underlying reasons of the crisis. With their community regulation the European banking sector may become more integrated, and it may also handle the

⁴ Based on the Treaty of Lisbon, it is possible to withdraw from the European Union, but not from the euro area.

relationship between bank risks and sovereign risks. In addition, he emphasises the crisis management by the European Central Bank as well as its unconventional instruments that have allowed and may allow time for individual governments to implement the necessary adjustments and reforms.

In the Summary, he presents his own comments on the future of European economic integration in four points. The first one outlines the incompatibility of European economic models. He states that the current economic models are inadequate in the new global context, and structural changes are necessary. The second one is about the independence and supervision of institutions, which may provide basic input on formulating individual national economic policies. The purpose of this is to avoid an overestimation of future economic growth to an extent typical before. The third one underlines the national fiscal framework, supports the idea of the fiscal pact, in which the planning of national fiscal policies is carried out for the medium term, and the reduction of government debts is an essential objective. Finally, demographic problems are focussed on. Economic decisions related to the issue of ageing should not be postponed, and temporary or incomplete short-term adjustments should not be made.

Lastly, the difficulties ahead of us might seem insoluble, but the past 60 years of European history have shown that any problem can be overcome. There is still a long way to go, but even the United States was not created in a day; not even in a century.

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 ± 50 per cent deviation is accepted. Manuscripts should be written in Hungarian and/or English.
- Papers always begin with an abstract which should not exceed 800–1000 characters. In the abstract a brief summary is to be given in which the main hypotheses and points are highlighted.
- At the bottom of the title page a footnote is to be given. The footnote contains every necessary information related to the paper (acknowledgement, relevant information etc.). This is followed by the name of the institution and position the author works at, e-mail address in Hungarian and English.
- Journal of Economic Literature (JEL) classification numbers 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 separated by comma. When citing, the exact page be indicated.
- Tables and figures are to be numbered continuously (chapters and subchapters should not contain restarted numbering). Every table and figure should have a title and the units of quantitative values are to be indicated. Tables and figures are to be made by MS Word and Excel in Hungarian and English. Notes and sources are to be put directly at the bottom of the tables, figures.
- Equations should be aligned to the right and should be numbered continuously in parenthesis. (Chapters and subchapters should not contain restarted numbering.)
- 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 and tables should be sent in MS Excel file both in Hungarian and English.
- In case of further questions related to the manuscript visit the following website: http://english.hitelintezetiszemle.hu/szerzoknek/Authors_Guide_EN.pdf

Thank you!

The Editorial Office of the Financial and Economic Review
H-1054 Budapest, Szabadság tér 9.
Phone: 06-1-428-2600
E-mail: szemle@hitelintezetiszemle.hu



www.hitelintezetiszemle.hu