Balázs Tóth – Máté Csiki – Gábor Dávid Kiss

Study on the Capital of Domestic Health Funds in an Environment of Interest Rates Close to Zero

Summary: Along with demographic, social and technological changes, the burden on the public health care system will grow with the increase in public health expenditure from the central budget; meanwhile, private expenditures continue to snatch a larger piece. The system of health funds is of paramount importance for health care financing and long-term financial planning. However, in 2010, the reserves behind the membership and increasing contributions and thus the accumulated capital were exhausted. In our study, we will examine the factors influencing the capital reserves of health insurance funds with the help of a vector autoregression (VAR) model, focusing on three specifications: the internal processes, the capital market and the health care system. The sample covers the period between 1998 and 2018, with annual data related to all health funds. According to specific models, used memberships, bond markets' yields, and life-span expectancy have a positive impact on the accumulation of funds by health insurance funds; nevertheless, the information available on the Internet may depreciate enthusiasm towards investment.[1]

*T*he role of conscious long-term financial planning and self-support is becoming more and more important nowadays. The health care system faces many social, demographic, financial and social challenges. This includes, in parallel with life expectancy increase and population decline, the apparition of an aging society and the dynamic development of health related technologies, thus increasing the need for more resources for the health care system. The role of health and healthy lifestyles, as well as of life spent in health and prevention are on the rise. Along with the challenges of self-support and the health care system, health insurance funds also play a prominent role in health care and long-term financial planning. It is important to notice how the social security managed by the state and health insurance funds share burden between them: savings in health funds are

E-mail address: tothbalazs@eco.u-szeged.hu
csiki.mate@eco.u-szeged.hu
kiss.gabor.david@eco.u-szeged.hu

basically used to cover relatively small-value, routine interventions (e.g. visits to private specialists, MRI scans, dental services, etc.), while social security is aimed at establishing and maintaining a complete health care infrastructure. Consequently the two systems are complementary in maintaining human capital.

In our work, we are examining whether the stagnation of capital invested in Hungarian health funds in 2010 can be traced back to the near-zero interest rate environment of the period, or the stagnation of capital invested by members is due to other structural reasons. For the purpose of the study, we analyse the change in the amount of capital in the hedging reserves along three dimensions: internal, capital market, and health care.

In the context of aging societies, the stability of pension systems tends to be examined; however, the aging of the population also has a major impact on the other social security segment. The population has become a riskier community due to changes in the composition of ages, since the older, inactive population, which has the higher share, does not enjoy the resources needed to finance health care interventions (Busa et al., 2009). The predominance of researches on the pension system issues may also be justified by the fact that pension savings play a bigger role in the Hungarian self-support system than private financing of health care expenditures (Ágoston, Kovács, 2007). However, of the three types of capital elements (money, humans and nature), investing in and maintaining human capital shall prevail in any society targeting economic growth and progress (Botos, 2015). The evolution of wealth deposited in health funds depends on the age structure of society and its expected outcome. The government currently encourages childbirth through tax allowances and direct subsidies (Sági et al., 2017; Sági, Lentner, 2018); however, it is questionable

to what extent the under-financing of social welfare systems limits the effectiveness of family policy measures. We believe that the prestige of private pension funds will continue to rise in the future.

The Hungarian health care system does not provide security for the population, although the level of public funding is average on an international level, and the private expenditures (voluntary health insurance system and direct contributions from households) are high alongside the public health expenditures by the central budget. The burden on the health care system and public services is quite important and still growing, and the state cannot keep up with these dynamic trends. As a direct result, private funding is playing an increasing role. According to *Péteri* (2011), there are several types of institutions dealing with private financing:

- households (purchase various health care products or services with or without invoice);
- health funds (they provide various services and reimburse their members against invoice for individual account costs only);
- employers (as funding contributors they mainly finance their employees' health fund membership, group insurances, as well as occupational health care);
- non-profit institutions (non-profit organisations, providing in-kind services or financial support, against invoices or documented settlements);
- and insurers through their various health insurance schemes (creating a risk pool, arranging services, rendering services to a beneficiary with or without invoice, usually but not necessarily to the insured).

As far as private funding is concerned, the volume of services purchased through voluntary institutionalised channels (health funds) is below the international average, four-fifths of private expenditures is paid directly to

service providers, while the remaining is paid through health insurance funds, or a smaller proportion through private insurers (Asztalos, 2017). According to *Asztalos* researches, in the light of the 2014 data, the combined level of household direct health care contributions and voluntary health funds was 2.4 percent of the Hungarian GDP, slightly above the EU average of 2.2 percent, and well above the Visegrád Three (V3) states' (Czech Republic, Poland, Hungary) 1.5 percent average. In terms of total health care expenditure, the proportion of voluntary health funds in Hungary (4.6%) is between the EU27 (5.4%) and the V3 countries (3.7%). In Hungary, the direct contribution of the population to the health care system was 2 percent of GDP in 2014, with Hungarian households spending more than the EU average on direct health contributions. In any case, it should be emphasised that, despite its many benefits, an increase in the level of private financing does not necessarily contribute to the performance of a given health care system. On the one hand, no optimal financing structure can be determined (Nemec et al., 2013), and on the other hand, public funding and performance of the health care sector tag along slowly but positively in post-socialist countries (Lyszczarz, 2016). This correlation is not considered to be of general application; in different countries it is influenced not only by economic and social issues but also by the efficiency of the health care system (Nemec et al., 2013; Lyszczarz, 2016).

Asztalos (2017) explains the high level of direct health care contributions due to low levels of public funding, inefficient resource allocation, limited access, asymmetry of the information, parasolvency, and the limited use of voluntary health insurance. According to him, health insurance funds have a relatively stable client base, revenues and a drug-focused spending structure in Hungary, and about two-thirds of the deposited funds come from employer contributions and one-third from fees paid by the members. Health insurance funds are also considered less popular saving destination with the general public because they provide a more complex and less transparent service for members than private pension funds. Confusing communication is considered to be one of the major concerns of health insurance funds (Busa et al., 2009), and may also impair their ability to raise more capital.

In our introduction, we explained the basics and financial characteristics of how the state owned social security and health insurance funds may share tasks. In the next chapters of our work, we will examine the background of the stagnation of capitals invested in health insurance funds during the decade starting in 2010, and see the ramifications of this process from the low yield and zero interest rate environment. For this purpose we will analyse changes in the amount of capital held by hedging reserves *(dFT)* along three dimensions: internal, capital market, and health care system. In order to introduce the internal dimension, we shall discuss the main regulations concerning the structure of health insurance funds, the accumulation of capital, and investment. On the other hand, the investment of accumulated capital is also affected by changes in the government bonds market, which also implies a remark on monetary policy. Logarithmic changes in the variables included in the study reflecting the period from 1998 to 2018 were introduced in the VAR models.

The study first analyses the theoretical and historical background as well as the role of health insurance funds, to discuss their relation to the state budget, portfolio management, and monetary policy. The specific models, the variables and the vector autoregression (VAR) model used are then exposed. We present

the results obtained by the models in the penultimate chapter.

THEORETICAL BACKGROUND

In this chapter, we first introduce the determinants of the infrastructure where health insurance funds are operating and then move on to the variables of capital raising and investing with special reference to the ramifications of monetary policy. And after this, the theoretical models used in our study will be presented.

A framework for the health insurance funds

In this section, we first define health insurance funds and then look at the characteristics of capital and membership. The health insurance fund is an organisation that provides and organises social or health care services to its members or to their close relatives on the basis of the operating principles defined in the Act on investment funds, or complementing, supplementing or replacing social security or other social services (Lukács, 2011). Health insurance funds supplement or replace services provided by social security.

The main feature of a health insurance fund is self-support with the purpose of providing a higher quality health care management for a large group of people in an organised form, offering them the opportunity to take advantage of related state subsidies in the form of tax allowances. In addition, the focus is on maintaining health and reducing the financial burden of handling with diseases (Lukács, 2011).

Voluntary health insurance funds can help support the financing of several types of services not covered by social health insurance. These may be supplementary services that provide coverage for services not covered by the basic insurance package and replace the on-demand contribution required by the public health package. The voluntary health insurance scheme is a specific scheme that is able to collect significant savings for the general public and contribute to the financing of health care service providers, complementing public health insurance. This system is of great importance not only because of the services provided, but also as a system creating a pool for savings (Busa et al., 2009).

A health insurance fund membership is basically a dedicated savings account where the deposited amount (amount paid and its yield) can only be used for individual purchases of health care products and services. The population can partially or fully replace its existing health care costs using services of a health insurance fund, while the emerging risks can be covered with public health insurance; therefore, according to Asztalos (2017), having a preference for membership in a health insurance fund is a reasonable choice.

At the time of the creation of the 1993 'treasury' act, the purpose of launching health fund institutions was to promote and encourage public savings (Vallyon, 2011). Health funds played a dynamic role on the three-player voluntary fund market in terms of wealth, income and membership since the funds were introduced.

There are three distinctive groups of funds in terms of institutional background within the health insurance sector (Vallyon, 2011). Funds created by employers serving typically state-owned companies and government agencies with a large number of employees have been on the market since 1996. These funds were the major players in the early years of 2000. It was the time when funds created by banks and / or insurances emerged, with the most dynamic growth in membership and

wealth from 2000. There is a special group of health funds organised by health care service providers, with the benefit of being open, accessible to all. In the years of 2000 there was a high degree of concentration in this sector: with 16 funds in 1995, 45 funds in 2006, only 37 funds left in 2008 and its further declining (Vallyon, 2011). According to *Vallyon* (2011), the dynamic growth in members of health funds from 2003 is due to the successful launch of financial institution-based funds, the rise of self-support in parallel with the health care system, the introduction of health fund contributions as a fringe benefit offered by employers, and the consolidation of enforceable tax allowances *(Figure 1)*. The role of tax allowances and awareness in Central and Eastern European countries was also

highlighted by *Borda* (2008). At the turn of the millennium, the countries of the region were still lagging behind. After the crisis and the restructuring of tax allowances, the growth of funds' assets and membership slowed down.

Income growth *(Figure 2)* shows similar dynamics to increase in memberships and assets. In the 2000s, with the rise in popularity of health funds, the value of contributions also inflated. There has been a shift in the proportion of contributions, after 2012 the employer contribution has shown a decreasing trend along with changes in tax regulations and benefits, while individual member contributions have increased. The health funds are sensitive to regulations concerning member contributions, taxes and discounts (Vallyon, 2011). In his study *Kovács* (2018) proposes
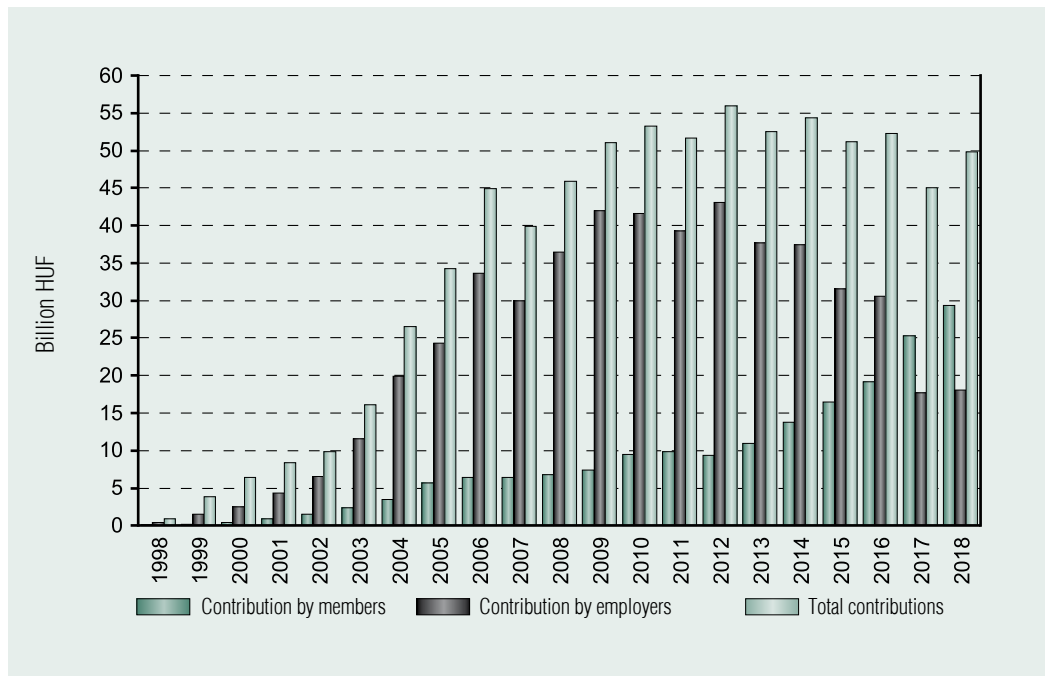
Figure 1

CHANGES IN THE MEMBERSHIP AND WEALTH OF HEALTH FUNDS

Source: Magyar Nemzeti Bank (MNB)

EVOLUTION OF PAYMENTS AND METHODS OF PAYMENT

Source: Magyar Nemzeti Bank (MNB)

another reason for the rise of funds after 2002. According to him, the role of private financing of health care services may also be influenced by gaps in the central budget and processes. If the regulation and financing of health care is unpredictable, the population is more likely to seek alternative financing, which in this case means voluntary health funds. This finding is also consistent with the rise between 2002 and 2010 and the stagnation after 2010 (Kovács, 2018).

Fund assets of health insurance funds

This section gives a summary on contributions to the health funds, their tax incentives and national economic benefits, and then explains the characteristics of the structure of this

particular market and applicable investment policies.

The very favourable tax environment facilitates the augmentation of the health fund membership base on the employers' and employees' side alike. To sum it up, within certain limits, corporate payments are tax payment obligations subject to tax deduction (19.04 percent), and individual payments are subject to PIT deductibles. On the employer's side, the savings consist of the full cost of the employee's contribution to the health fund paid by the employer, which is taxed at a preferential rate of 19.04 percent per employee up to HUF 23,400 per month. The employer's contribution to the health fund is not considered as income of the employee (nor is it subject to tax allowance). The tax environment has taken a turn for the

least advantageous in 2019: while individual payments continue to benefit from a 20 percent tax allowance on taxable income (up to an annual payment of up to HUF 150 thousand), employer payments (within the fringe benefits system) are already burdened by 33.5 percent public dues – however, the 20 percent tax allowance is still available (up to an annual limit of HUF 150 thousand), and the proceeds remain tax-free.

Incentivising household savings shall remain an important economic policy. Contractual savings are much more predictable and durable. By their very nature, their use can be predicted as it is considered to be limited. In addition, health insurance funds can also be considered as having a socially positive impact. The investment of savings accumulated by the health insurance funds can also be well regulated, and be channelled towards the financing of the Hungarian economy through appropriate regulation. Since members of the health insurance funds are also the owners of them shall also help to keep the profit in the country, spending or reinvesting it there. Voluntary health funds can help improve health conditions of the population, and such value would contribute to the reduction of health care expenditures of the State and lower costs for early detection of diseases. In addition, health fund payments are verified and supported by supporting documents helping to whiten incomes from black and grey economy sources. In the long run, another benefit is that tax avoidance and evasion can be improved rather than by increasing controls, and the value added tax and income tax may rise in the short term, which may soon outweigh the loss of revenue. This is also confirmed by previous experience as stated in *Busa et al.* (2009). Without altering habits related to tax payments, however, it is difficult to achieve such a change. The previous situation in Slovakia and Bulgaria gives a good

example of this, where the informal economy has hindered the unfold of formal private health contribution practice, as being not transparent and sometimes the preferred form of payment for both patients and health care workers (Nemec et al., 2013).

As *Table 1* shows, the stagnation of growth following the mid-2000s has led to market consolidation, with the three largest players now accounting for 74 percent of the total portfolio and 84 percent of membership, giving the market a highly oligopoly structure.

Health investment funds follow a three-fold structure in accordance with Act No. XCVI of 1993 on Voluntary Mutual Insurance Funds: the hedge fund is used to finance services, the operating fund to cover operating costs, while the liquidity fund serves to collect temporarily unused funds and, as a general reserve of the other two funds, to ensure the solvency of the fund. Contributions shall be placed in the hedging, operating and liquidity reserves in accordance with the operational requirements of the fund as specified in the statutes. The return on investments should be placed in the reserve the investments were taken from, but the board of directors of the fund may decide to credit the proceeds from other reserves for the benefit of the hedging reserve (individual accounts plus total of service reserves). Individual contributions made by incoming members, as well as the direct allowances must be placed in the hedging reserve. In order to reduce market and counterparty risks, funds are required to divide their investments by type of investment and by intermediaries. In accordance with the development and structural changes of the capital market, the Government regulates investment funds risk sharing and portfolio of assets by issuing safety rules and general instructions, as well as by restricting investments and shareholding in private limited incorporations to banks having their place of business in Hungary.

THE LARGEST HEALTH INVESTMENT FUNDS AND THEIR MARKET SHARE

Q3/2018	Market value of the portfolio (thousand HUF)	Participation in the portfolio (in %)	No. of members	Members participation (in %)
MKB	13,588,542	26.36	210,360	23.37
OTP	12,197,311	23.66	255,074	28.34
Prémium	8,525,492	16.54	227,327	25.26
Medicina*	4,072,112	7.9	61,675	6.85
Other		25.54		16.18

Note: Prémium and Medicina health investment funds merged in 2019.

Source: National Association of Voluntary Funds (ÖPOSZ) website

Table 2 shows the portfolio structure of some health investment funds. The table does not list the assets that the fund can invest in (which are allowed by the investment policy), but only those instruments that are actually considered for investments, i.e. the planned or actual weight of a particular asset in the portfolio is greater than 0 percent. Examination of the table clearly shows that public debt instruments have by far the largest weight in these portfolios.

The Impact of Monetary Policy

We described the health funds' involvement with government securities and money markets in the previous chapter. Changes in a benchmark interest rate also directly affect the interest rates on money market investments; moreover, a decline in yields may be accompanied by a temporary rise in exchange rates on the government securities market and fluctuating through certain maturities of the yield curve to varying degrees of intensity. Bond market programmes, which are becoming commonplace within the selection of unconventional European monetary policy

instruments, have a further impact on the willingness of foreign investors to buy (or to encourage investment by domestic players).

The Hungarian economy being in transition was characterised by high inflation and high interest rates until the mid-1990s, and until 2004 a significant period of interest rate cuts was observed. The consistent application of a monetary policy that complied with the rules became a priority for Hungary in the wake of the crises of the 1990s. Due to the effectiveness of further disinflation policies, Hungary switched to a system with strict inflation targets in 2001 (Novák, 2014). Following the dot-com crisis, the central banks of developed countries began a period of interest rate cuts, which also affected the 10-year yields. Hungarian monetary policy was facing the opposite direction to international trends and to the business cycle in the years before the crisis (Neményi, 2009). In response to the global financial and capital market imbalances and economic overheating that occurred before the crisis, central banks became tougher (Horváth, Szini, 2015). Central banks responded to the financial shock of 2008-2009 with significant interest rate cuts and eased monetary policy.

During the post-crisis recovery period, the

Table 2

PLANNED PORTFOLIO COMPOSITION OF HEALTH INVESTMENT FUNDS

Name of the health fund	Assets	min.(%)	target (%)	max.(%)
OTP (2018)*	Short-term funds		13.52*	
	Short-term government securities		37.03*	
	Long-term government securities		49.45*	
MKB (2018) (hedge fund)	Discounted treasury bill	40	70	100
	Hungarian government bond	0	30	60
Prémium (2019)	Total value of current accounts, deposits, and securities issued by entities belonging to the same credit institution or group, held by a credit institution or group of undertakings	0	15	20
	Hungarian Government securities and government guaranteed securities collectively	40	60	100
	Bonds issued by a Hungarian economic organisation	0	5	10
	Bonds issued by a Hungarian credit institution	0	5	10
	Domestic and foreign mortgage bonds	0	5	10
	Investment units issued by a real estate investment fund	0	10	10

Note: * For OTP, the structure of the actual portfolio is presented (31.12.2017).

*Source:* Our own edition based on investment policies and reports from health funds

global economy was characterised by a low global interest rate environment with key interest rates near to zero percent rendered by central banks of some advanced economies *(see Figure 3),* and as a general trend large quantitative and qualitative easing measures. Not only short-term yields, but also the communication improved through forward-looking guidance, the transformation of the monetary policy armoury, and the introduction of unconventional instruments, and the overall yield curve shifted downward significantly during the period of interest rate cut in Hungary (Felcser et al., 2015).

Monetary policy processes can have a significant impact on the effectiveness of health funds investment activities, as health funds typically have bond-over-investment guidelines. The MNB's self-financing programme contributed to the decline in yields through changes in the structure of public debt. By launching a self-financing programme aimed at reducing the country's external vulnerability, the central bank's manoeuvre has channelled the private sector towards internal public debt financing. The conversion of the benchmark instrument into a three-month deposit, the transformation of the interest rate corridor and credit facilities, and the change in the required reserve ratio encouraged banks to keep their funds in hedging securities (as much as in government bonds in increasing quantity)

MNB, ECB, FED BASE RATES AND HU10Y, GER10Y, US10Y
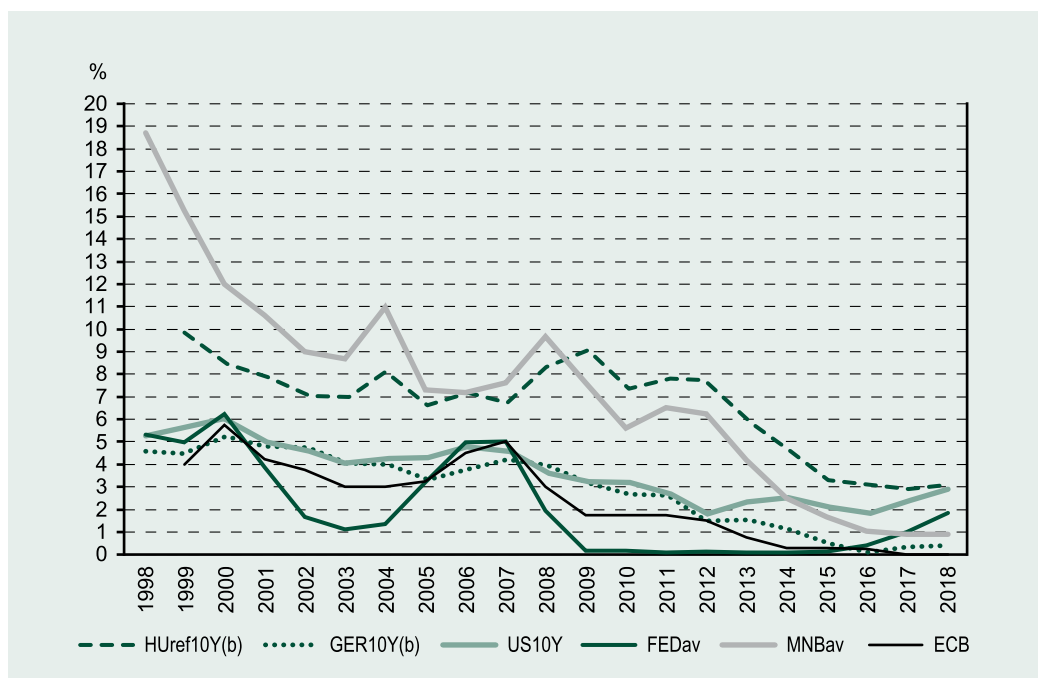
Source: MNB, FRED database

(MNB 2019). The self-financing programme provided a healthier debt structure on the supply side through lower government bond yields and lower yields on the demand side (Matolcsy, Palotai, 2018). The downward shift in the yield curve has had a significant impact on the expected return on investment of the health insurance funds.

Theoretical model

In our study we suggest to investigate the reasons behind the stagnation of capital invested in health funds in 2010. For this purpose we will analyse changes in the amount of capital held by hedging reserves *(dFT)* along three dimensions: internal, capital market, and health care system.

The internal variation in accumulated capital may depend on changes in membership *(dL)*, contributions *(dB)* and the ratio of employer's and private contributions *(dMM)* (1a). The introduction of the membership in the equation is justified by the entry and exit balance of members after 2011, where the overall contributions insured the inflow of fresh capital into the model. In addition, it can be assumed that employer's contributions are a greater attraction to entry than if employees had to allocate resources themselves for this purpose without benefiting from fringe benefits offered by employers. We shall presume that all coefficients will reflect a positive correlation $(\beta_1, \beta_2, \beta_3 > 0)$.

$$dlnFT_t = konst. + \beta_1 dlnL_t + \beta_2 dlnB_t + \beta_3 dMM_t + \varepsilon_t \tag{1a}$$

The transmission mechanism of monetary policy has an indirect impact on both long-term reference bond yields *(dR)* and foreign exchange rates *(dEUR/HUF),* particularly in the period characterised by sliding depreciation before 2001, (including the 2003 lane shift, see in 1b). This exchange rate policy system is controlled by one dummy variable *(dummy_csl),* while the 2008 global financial crisis is represented by another dummy variable *(dummy_rec).* Given the bond-over-investment policy of the funds concerned, the decline in bond yields – and thus the rise in exchange rates – is expected to lead to an increase in capital over the medium term, but stabilising at a low level would be dampening fund's yield. Having the forint exchange rate included into our equation we are able to show the direction of capital flow and contrasts in inflation. We shall take for granted that the interest rate environment has a positive $(\beta_4>0)$, foreign exchange rate neutral $(\beta_5\approx0)$ effect on capital changes, during wich the fund capital increased dramatically in a period of sliding depreciation $(\beta_6>0)$, but the global financial crisis may have destabilised investors $(\beta_7<0)$.

$$dlnFT_t= konst.+\beta_4 dlnR_t+\beta_5 dlnEURHUF_t+ \beta_6 dummy\_csl_t+\beta_7 dummy\_rec_t+\varepsilon_t \quad (1b)$$

The capital accumulated in health funds are basically used by members to finance small-scale routine interventions (e.g. dental treatment, private consultations, CT or MRI scans), while high-spending treatments remain the responsibility of state owned social security funds. However, it remains a question how long life expectancy increase *(dT)*, public health care spending, the available capacities in terms of hospital beds *(d)*, and customer awareness *(dGoogle)* will result in an upswing in capital accumulation (1c). The increase in life expectancy may be neutral $(\beta_8\approx0)$ since it affects already inactive citizens, while membership in

health insurance funds is typically offered for the working age population (and they are the ones who are benefiting from tax incentives). We suppose that the decline in the number of beds will divert citizens towards private health care, optimally due to, for example, the proliferation of one-day interventions and the evolution of the overall technological background $(\beta_9<0)$. We measured (potential) customer awareness through Google searches for the keyword 'health funds,' where higher search rates are likely to be associated with more serious investment intent – otherwise there is ground for scepticism $(\beta_{10}>0)$.

$$dlnFT_t= konst.+\beta_8 dlnT_t+\beta_9 dlnBed_t+ \beta_{10} dlnGoogle_t+\varepsilon_t \quad (1c)$$

Loosening global monetary policy may indirectly affect Model 1b, in particular through anomalies in the interest rate variable.

DATA AND METHODOLOGY

In our study we evaluate the models presented in the theoretical chapter above by vector autoregression (VAR). Thereby, we will first introduce the main variables, then the methodology used and the related diagnostic requirements in this chapter.

Data

Members of the ÖPOSZ have a total market coverage of 95 percent (based on membership data) and 88 percent in terms of managed assets. We relied on the data provided by ÖPOSZ in the collection of data for our time columns (i.e. data related to capital, number of employees, type of payment, funds) for the health funds. For availability reasons the period under review covers data from 1998 to

2017. *Figure 4* shows that the majority of the capital is contained by the hedge fund (which is why we examine it in Models 1a, 1b, 1c) and exponential growth climaxed at the end of the 2000s.

It can be noted that both membership and contributions followed a similar path to the variation of the capital *(Figure 5)*, whilst employers slowly abandoned the system.

The 10-year benchmark yield of government bonds declined on both global and domestic scale in the second half of 2010, whereas the depreciation of the Hungarian currency (Forint) began with the global financial crisis, followed by a system of correlations expected from unsecured interest rate parity *(Figure 6)*. Recession periods were determined by CEPR's warnings for the Eurozone.

Longer life expectancy despite the decline in the number of beds is considered a decisive factor influencing demand for health fund services, and technology used implies advanced developments. In the meantime, following a steady upward trend, the number of Google searches is down after 2010 – indicating a drop in interest or, on the contrary, well-informed customers *(Figure 7)*.

The logarithmic change in the variables included in the study was incorporated in the VAR models, since logarithms provided a raise to a similar scale, while differentiation provided stationary input.

Methodology

The vector autoregression (VAR) model (2) is based on the temporal feedback of the values of an *n* quantity of *y* variable delayed by *p* according to Kiss (2017):
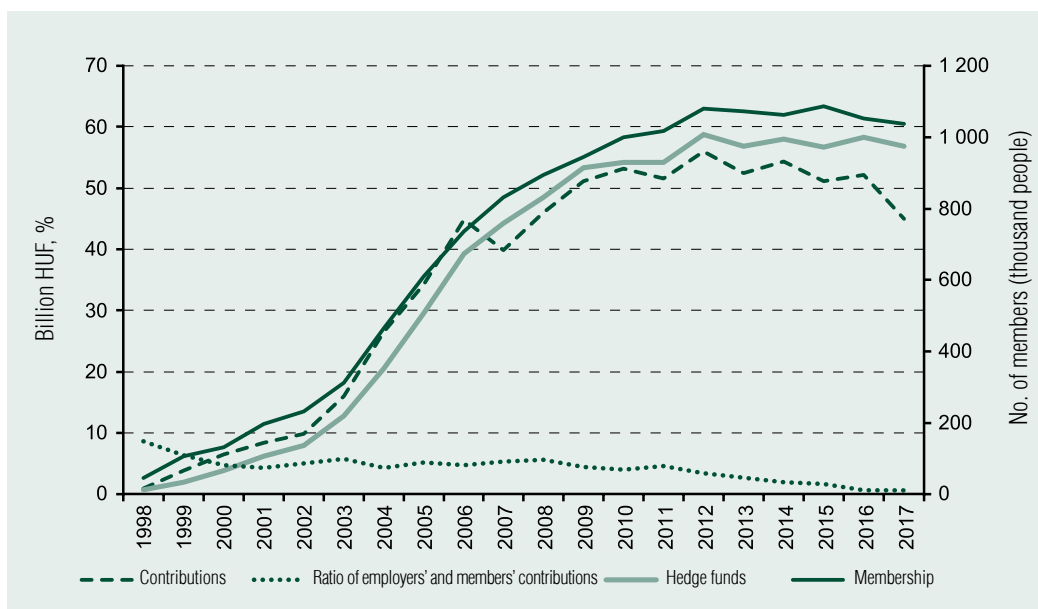
Figure 4

CHANGES IN THE WEALTH OF HEALTH FUNDS
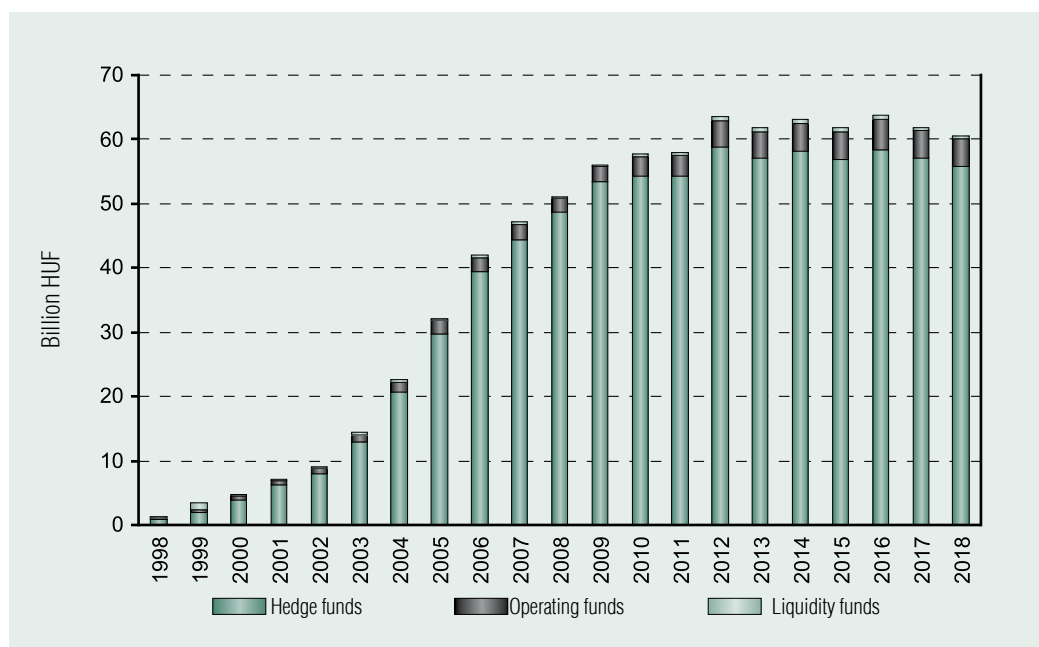
Source: MNB

Figure 5

CHARACTERISTICS OF THE HEALTH FUND MARKET
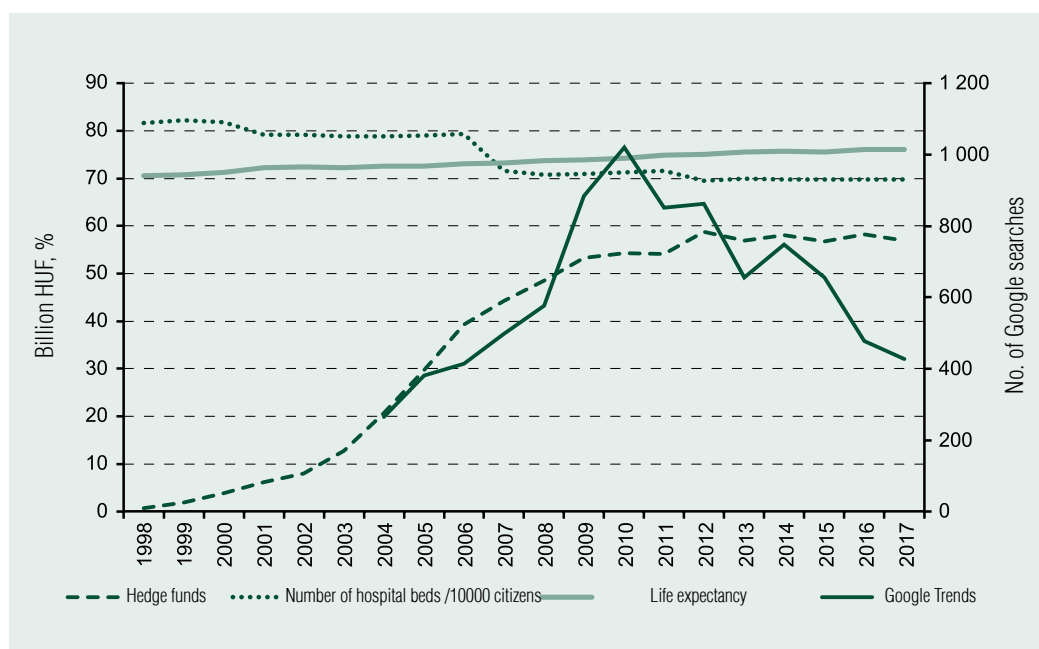

Source: MNB

Figure 6

EVOLUTION OF THE CAPITAL MARKET ENVIRONMENT

Source: Stooq.com, MNB, CEPR

Figure 7

EVOLUTION OF HEALTH MARKET VARIABLES

Source: MNB, Hungarian Central Statistical Office (HCSO), Google Trends

$$
\begin{matrix}
y_{1t} \\
y_{2t} \\
y_{nt}
\end{matrix}
= A_1
\begin{matrix}
y_{1t-1} \\
y_{2t-1} \\
y_{nt-1}
\end{matrix}
+ ... + A_p
\begin{matrix}
y_{1t-p} \\
y_{2t-p} \\
y_{nt-p}
\end{matrix}
+
\begin{matrix}
\varepsilon_{1t} \\
\varepsilon_{2t} \\
\varepsilon_{nt}
\end{matrix}
\tag{2}
$$

The application of the model requires the use of stationary inputs, checked by the ADF test. Meanwhile, through hypothesis testing, the autocorrelation of error terms should be avoided by setting a delay number resulting in Durbin–Watson test statistics close to 2. Moreover, the predictions must maintain the normal distribution of error terms, which is checked by the Doornik–Hansen test, which hypothetical zero digit matches the normal distribution of error terms ($p > 0.05$ indicates already an acceptable output). We also rely on recommendations based on the AIC and BIC information criteria to determine the optimal delay time.

The number of variables included in the

models to be tested in our calculation is largely limited by the number of years involved in the study. A regression's fluency (3) must be a positive number, that is:

$$
t \times v - v^2 \times l > 0 \tag{3}
$$

where v is the number of variables, t is the number of years included in the measurement, l is the number of delays. Since annual data on the capital of health funds is only available since 1998, only a limited number of variables could be included in our model.

RESULTS

In our work, we were keen to discover what factors led to the variation in capital accumulated in health funds and to what

extent these factors can be attributed to the close-to-zero interest rate policy of 2010. Therefore, we proposed three models: a model internal to health funds (1a), a capital market-specific collection of data (1b), as well as a health-market-specific model (1c).

The logarithmic differentiation of variables proved to be stationary according to the ADF test – but we had to work with double differentiation for the number of members (*Table 3*).

For vector autoregressions (Table 3), the information criteria in all cases supported the use of a two-year delay, and we found normally distributed, non-auto-correlated error terms (the latter was disfigured only in Model 1c, but in the other models, normality required for prediction was not met).

In the 1a model internal to health funds an augmentation in membership increases the volume of the capital, but the negative effect of the contributions challenges our intuition: we have found a negative coefficient when

running the model in various environments such as without MM (employer/employee contribution ratio), adding a recession dummy or introducing some delay. Similar results were obtained for the impact of individual variable shocks on capital change for the impulse response functions in *Annex 1*: whenever an augmentation in membership resulted in an increase in capital, contributions had a negative effect on the levels of the capital over a 2-year period. An explanation to this may be that members make larger direct contributions before some major expenditures, so they can benefit from the tax deductibles later. Another specific result is that contributions to health funds have been channelled towards private contributions, and this positive effect on the level of capital has not been altered by employers abandoning the system. Based on the assessment of variables in *Annex 2*, membership is the pivotal element of the equation, explaining nearly 40 percent of the standard deviation after 3 years.

Table 3

RESULTS OF THE ADF TEST

Name of the variable	Value of p in the	
	d ln	*d dln*
Capital of the hedge fund	0.0207	
No. of members	0.5851	0.0002
Contributions	0.0004	
EUR/HUF	0.0004	
10-year benchmark yield	0.0137	
Life expectancy at birth	0.0017	
No. of hospital beds / 10,000 habitants	0.0035	
Google Trends	0.0577	
Employer / employee contribution ratio	0.0345	

Note: 'd ln': single logarithmic differential, 'd dln': double logarithmic differential

Source: own calculation

With respect to the capital market-specific model 1b, it can be seen that increasing government securities yields have a beneficial effect on capital growth, whereas the weakening forint tends to withhold capital accumulation. In this context, it is not surprising to discover that the strict exchange rate target policy had a positive impact for the first few years, when the global financial crisis stands for the negative coefficient. The impulse responses functions (Annex 1) give similar results, in the sense that yield escalation has negative effects in the first two years, but one can note the positive ones as well after short-term assets expire the years after. The variance decomposition testifies to a 20% weighting of yields, emphasising the importance of the capital flow environment symbolised by the exchange rate (Annex 2). It should be noted that this model had the highest determining coefficient (*R*-squared and adjusted *R*-squared) of the three, which emphasises the dominance of the capital market in terms of variation of the capital.

In Model 1c describing the health market environment, life expectancy and an increase in targeted Google searches have the exact opposite effect on capital accumulation; nevertheless, the decline in the number of hospital beds tends to hike it. All this is somewhat contrary to intuition, but impulse response functions are a sign of frustration only with Google searches: more targeted searches result in a decrease in capital, meaning that potential clients do not view health investment funds as a means of capital accumulation (Annex 1). The variance decomposition testifies to a 20% weighting of targeted searches on Google (Annex 2).

We can clearly state that the membership in model 1a, the bond market yields in model 1b, and the expected life expectancy in model 1c have a positive effect on the capital accumulation of health insurance funds *(Table 4)*. Meanwhile, contributions and access to information suggest an asset management strategy that is likely to limit further capital accumulation: it seems not rational to raise this form of savings above a certain level in a client's portfolio. It is questionable whether raising the annual tax deductibles ceiling or expanding membership would be a more efficient means of stimulating growth. This is all the more important because predictions falling outside of the 9-year dynamic sample model based on model error terms also foresee stagnation of the capital reserves *(Annex 3)*.

SUMMARY AND OUTLOOK

Our study summarised the characteristics of the Hungarian health funds system and its significant role in the national economy, while examining changes in the capital accumulated in health insurance funds using different specific models. In the model internal to health funds an augmentation in membership increases the volume of the capital, but the negative effect of the contributions challenges our intuition. Similarly, when looking at the impulse response functions, it can be seen that the augmentation of the membership resulted in an increase in capital, whilst contributions had a negative effect on the level of capital over a 2-year period. The possible explanation to this is assuming larger contributions by members ahead of higher expenditures. Moreover, contributions to health insurance funds have been channelled towards private contributions, and this positive effect on the level of the capital has not been altered by employers abandoning the system. The variance decomposition attests that membership remains the pivotal element of the equation.

According to the capital-specific model, changes in government securities yields are not, whereas the weakening of the Hungarian

Table 4

RESULTS OBTAINED AFTER USING THE VAR-MODEL FOR ALL THREE MODELS

	Variable		Co-efficients	*p-value*	Co-efficients	*p-value*	Co-efficients	*p-value*
	constant		0.1448	0.2432	0.1087	0.0139**	−0.0199	0.6575
	dln capital	*t*–1	1.5667	0.0245**	0.9542	0.0002***	0.9542	0.0049***
	dln capital	*t*–2	0.3914	0.2576	−0.6072	0.0084***	−0.0464	0.8163
model 1a (+)	dln members	*t*–1	0.0321	0.9166				
	dln members	*t*–2	0.4528	0.0186**				
	dln contributions	*t*–1	−0.4125	0.1018				
	dln contributions	*t*–2	−0.7058	0.0778*				
	d MM ratio	*t*–1	−0.1703	0.1653				
	d MM ratio	*t*–2	−0.0040	0.9702				
model 1b (+)	dln state bond yield	*t*–1			−0.1441	0.2384		
	dln state bond yield	*t*–2			0.2696	0.0608*		
	dln EUR/HUF	*t*–1			0.5472	0.0397**		
	dln EUR/HUF	*t*–2			−0.9419	0.0226**		
	dummy exchange rate	*t*–1			−0.0379	0.4319		
	dummy exchange rate	*t*–2			0.2907	0.0037***		
	dummy recession	*t*–1			0.0123	0.6143		
	dummy recession	*t*–2			−0.1316	0.0066***		
modell 1c	dln life-span	*t*–1					−15.2753	0.0193**
	dln life-span	*t*–2					14.1802	0.0419**
	dln No. of hospital beds	*t*–1					0.5764	0.4517
	dln No. of hospital beds	*t*–2					−1.6371	0.0516*
	dln Google searches	*t*–1					−0.3402	0.0200**
	dln Google searches	*t*–2					0.1733	0.2188
diagnostics	Durbin-Watson		1.9978		2.0836		2.7264	
	Doornik-Hansen		3.3103	0.9134	8.3955	0.5903	10.9630	0.2038
	R-square		0.8572		0.9544		0.9284	
	Adjusted R-square		0.6940		0.8784		0.8568	

Note: *if p<0,1, ** if p<0,05, *** if p<0,01, +: HAC standard errors (Bartlett kernel)

Source: own calculation

currency, the Forint, is generating the opposite effect on the capital, and the global financial crisis played the role of a negative multiplier. The impulse responses functions proved us that yield escalation has negative effects in the first two years, but positive effects follow for the years ahead. The variance decomposition testifies to a 20% weighting of yields, emphasising the importance of the capital flow ecosystem symbolised by the exchange rate.

In the model describing the health market environment, life expectancy and an increase in targeted Google searches have an opposite effect, while the decline in the number of hospital beds has a similar effect on capital accumulation. According to the impulse response functions showing Google searches, a higher search volume results in a decrease in capital, consequently the model shows that potential clients do not view health investment funds as a means of capital accumulation. Moreover, according to the variance decomposition Google searches represent 20% weighting in the model.

To sum it up, memberships, bond markets' yields, and life-span expectancy have a positive impact on the accumulation of funds by health insurance funds. Following the trends in contributions and access to information, it seems not rational to raise this form of savings above a certain level in a client's portfolio.

From the point of view of the relationship between health insurance funds and economic policy, the question of whether changing public benefits for the funds, thus encouraging an existing or new member base or expanding membership would be a more efficient means of stimulating growth. Due to the investment policy of the funds favouring government bonds, the development of government bond yields significantly influences the change in the capital accumulation of the funds; therefore, it is safe to state that the monetary policy can materially influence the operation of the funds influencing them in line with national economic considerations. In addition, health funds can play an important role in whitening the health care ecosystem.
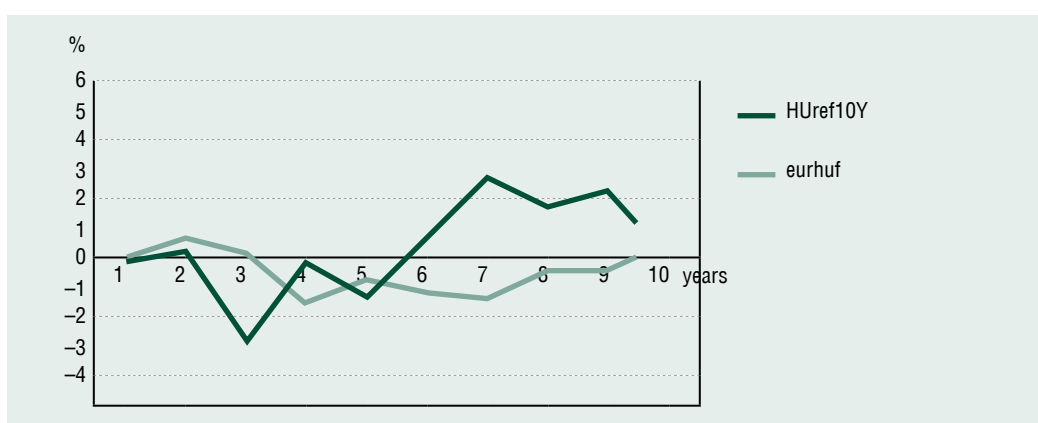
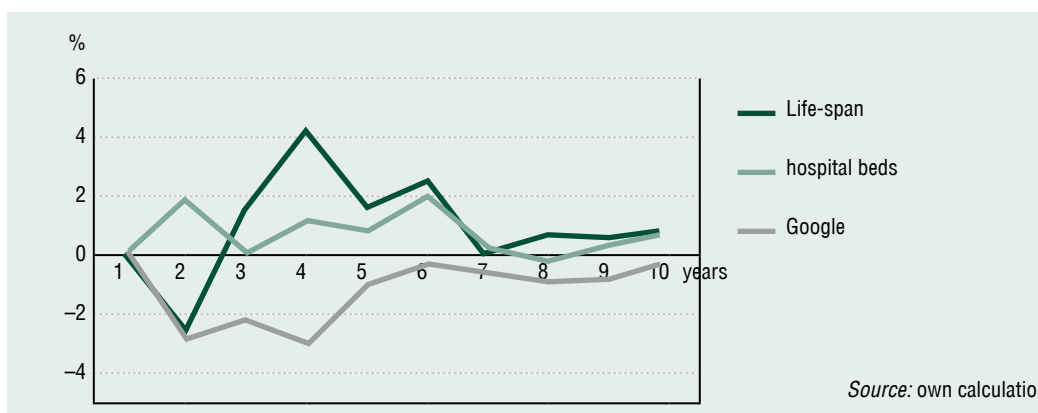## IMPULSE RESPONSE FUNCTION (IRF)   *Annex 1*

MODEL 1A: impact of members, deposits, MM ratio on capital
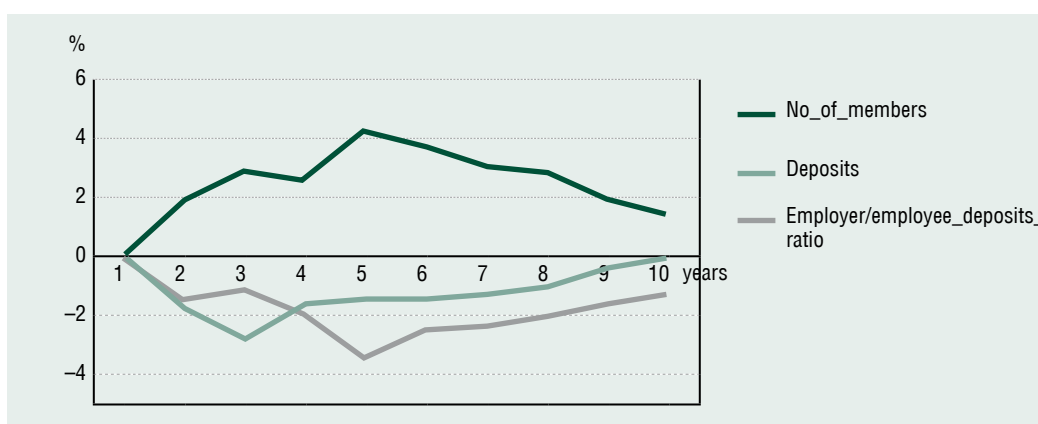
MODEL 1B: model 1b: impact of yield of bonds and EUR/HUF exchange rates on capital

MODEL 1C: model 1c: impact of life-span, hospital beds and searches on Google on capital
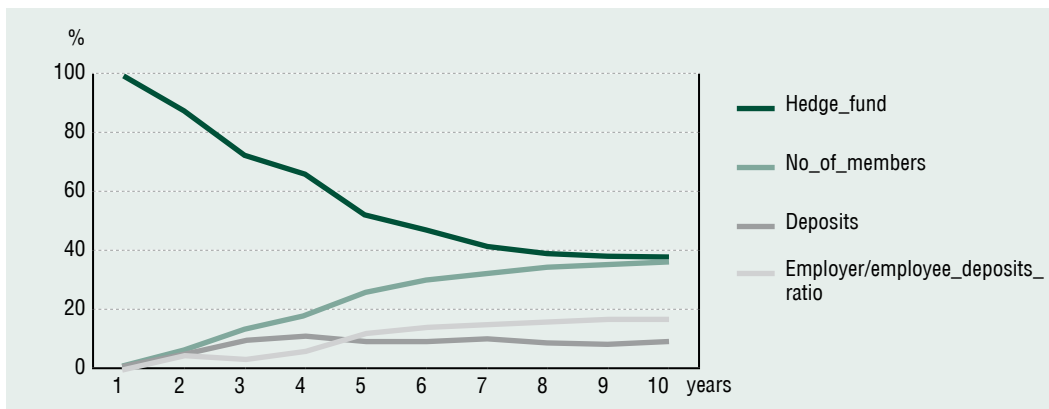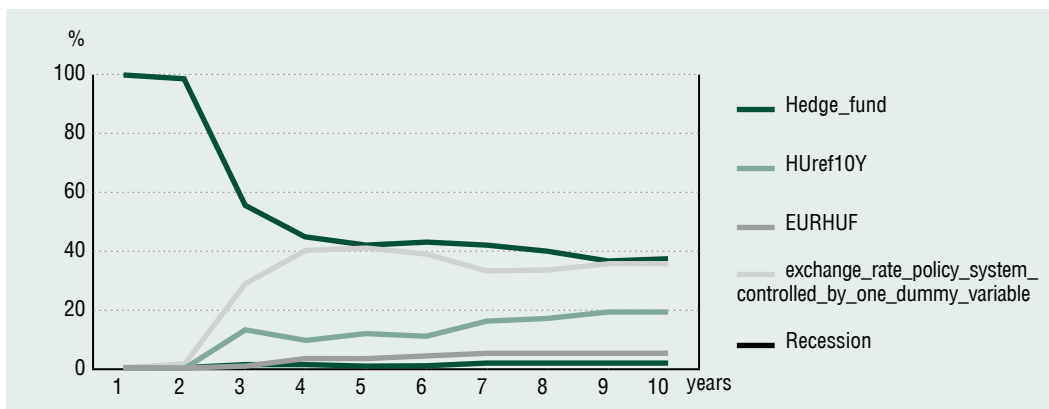

Source: own calculation

**VARIANCE DECOMPOSITION (CHOLESKY DECOMPOSITION)**   *Annex 2*

1A: to what extent variation in deposited funds is due to variables such as members, deposits, and MM ratio, %

1B: to what extent variation in deposited funds is due to variables such as bond yields, and EUR/HUF exchange rates

1C: to what extent variation in deposited funds is due to variables such as lifetime, number of hospital beds, and Google searches
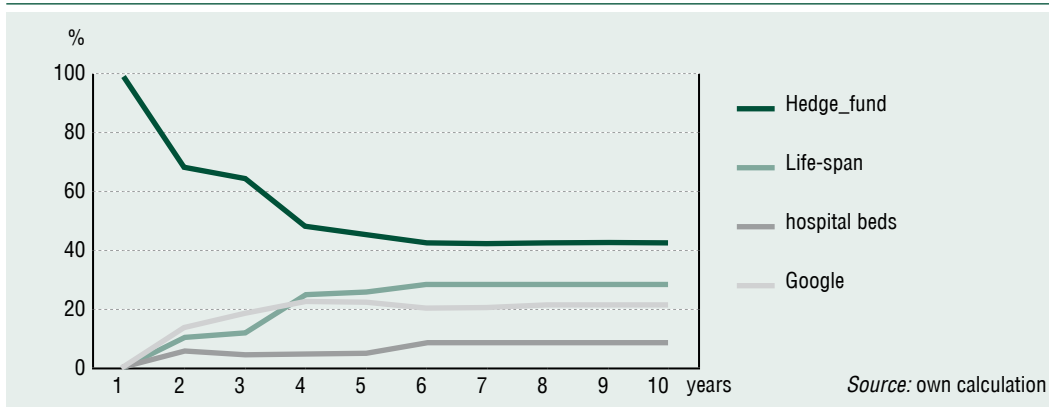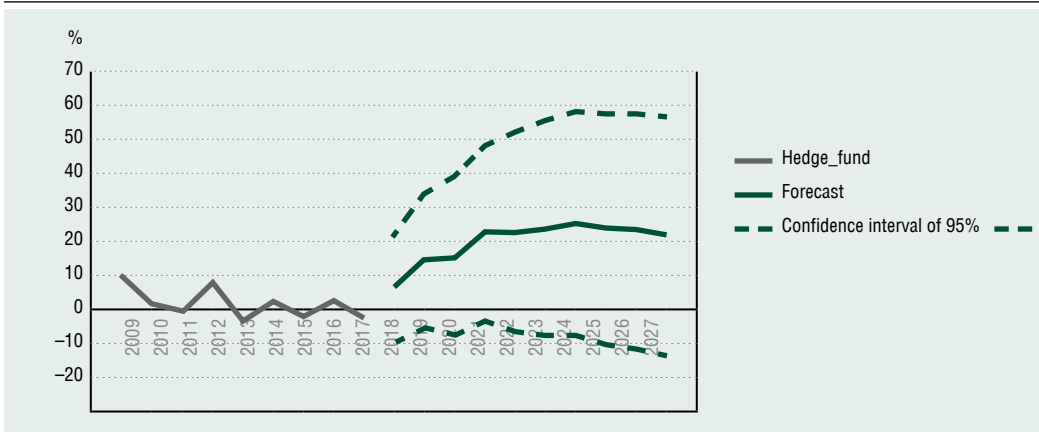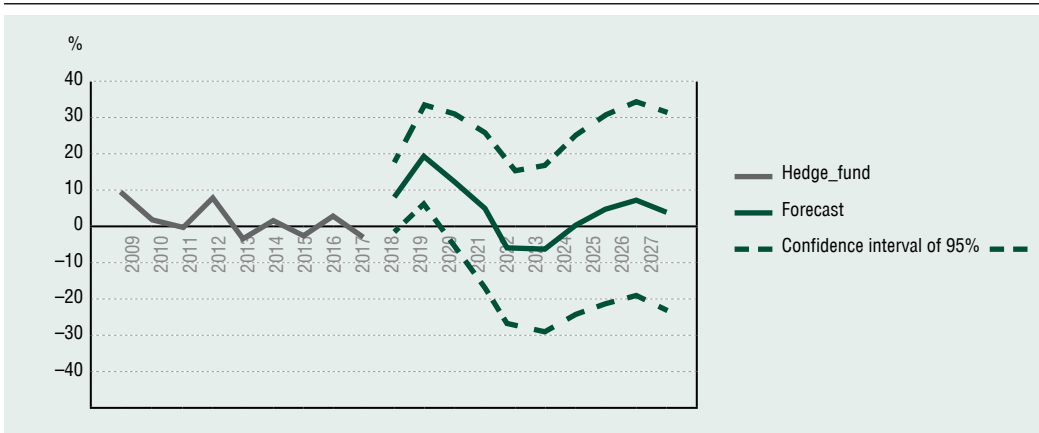

Source: own calculation

OUT OF DYNAMIC SAMPLE FORECASTING   *Annex 3*

Forecast for model 1A

Forecast for model 1B

Forecast for model 1C

Source: own calculation

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