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The forint interest rate swap market and the main drivers of swap spreads

(A forint kamatswappiac jellemzői és a swapszpredek mozgatórugói)

Written by: Csaba Csávás–Lóránt Varga–Csaba Balogh*

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Contents

Abstract

In our paper we present the most important characteristics of the forint interest rate swap market, as well as examine the determinants and the information content of the forint interest rate swap spreads. The turnover of the forint interest rate swap market has grown dynamically in recent years, and now it may reach, or even exceed, the turnover of the government bond market. Due to the hedging activity of interest rate swap market makers, there is a close linkage between the forint interest rate swap market and the government bond market. In terms of investors, the interest rate swap and government bond markets are strongly segmented. Consequently, the spillover from one market segment to the other is not perfect.

Our analyses suggest that long-term forint interest rate swap spreads are exposed to the common impact of several factors. The strongest effects are attributed to government bond purchases by residents, the Maggie A spread, the slope of the yield curve and the forint/euro forward yield spread. In the developments of swap spreads, the impact of those trading strategies employing interest rate swaps can be detected. These are widespread in the domestic market, as is confirmed by anecdotal information. The results indicate that in certain cases the swap yields, while at other times the government bond yields carry additional information about long-term yield expectations. The values of the 5-year HUF/EUR forward spread 5 years ahead calculated from the swap yields and from the treasury yields differ markedly, and this difference is driven practically by the same factors that influence the interest rate swap spreads.

JEL: G12, G14, G15.
Keywords: forint interest rate swap market, government securities market, interest rate swap spread, swap spread model.

Összefoglaló

Tanulmányunkban bemutatjuk a forint kamatswappiac legfontosabb jellemzőit és megvizsgáljuk a forint kamatswapszpredeket befolyásoló tényezőket, valamint a swapszpredek alakulásából kinyerhető legfontosabb információkat. A forint kamatswapok piacának forgalma dinamikusan nőtt az utóbbi években, és ma már valószínűleg eléri, illetve meg is haladhatja az államkötvénypiac forgalmát. A forint kamatswappiac és az államkötvénypiac között szoros kapcsolat áll fenn, amit a kamatswappiaci árjegyzők fedezési tevékenysége biztosít. A végbefektetők körét tekintve a kamatswap- és az államkötvénypiac erősen szegmentált, amelyből eredően az átjárás a két piaci szegmens között nem tökéletes.

Vizsgálataink alapján a hosszú lejáratú forint kamatswapszpredeket számos tényező együttesen befolyásolja, melyek közül a legnagyobb hatást a belföldiek államkötvény-vásárlása, a Maggie A kockázati felár, a hozamgörbe meredeksége és a határidős forint/euro hozamfelár gyakorolja. A swapszpredek alakulásában tetten érhető azoknak a kamatswapokat alkalmazó kereskedési stratégiáknak a hatása, amelyek anekdotikus információk szerint is elterjedtek a hazai piacon. Eredményeink arra utalnak, hogy bizonyos esetékben a swaphozamok, máskor az államkötvényhozamok elmozdulásainak van egy olyan része, ami többletinformációt hordoz a hosszú hozamvárakozásokról. A swaphozamokból és az állampapírhozamokból számolt 5 év múlvai 5 éves forint/euro felárak mértéke szignifikánsan különbözik, mely eltérést lényegében ugyanazok a tényezők mozgatják, mint a kamatswapszpredeket.

JEL: G12, G14, G15.
Kulcsszavak: forint kamatswappiac, állampapírpiac, kamatswapszpred, swapszpred modell.

1 Introduction

In our study we present the most important characteristics of the market of forint interest rate swaps, the factors that affect the differential between the yields of interest rate swaps and government securities (i.e. the so-called interest rate swap spread) and the most important information which can be extracted from the developments in this differential.

At the global level, the market of interest rate swaps has developed significantly in recent years. For example, the euro interest rate swap market has become more liquid than the market of euro government securities. Underlying the timeliness of our analysis is that, based both on our estimates and anecdotal information, the turnover of the forint interest rate swap market has also increased considerably in recent years, and today it may reach, or even exceed, the turnover of the government bond market. An advanced state of the interest rate swap market and the information content of swap yields are of special importance from a central bank aspect, because long-term yields and the indicators derived from them play a significant role in monetary policy decisions.

Our study focuses on identifying the factors affecting the forint interest rate swap spread. Through an analysis of the swap spread we address why the indicators (e.g. long-term yield expectations) derived from interest rate swap and treasury yields are different. The results of the estimation also contribute to a deeper analysis of the functioning of the Hungarian interest rate swap market, and in an indirect manner may even help understanding events in the government bond market. The novelty of our analysis is that no econometric analysis quantifying the factors which influence the forint interest rate swap spreads has been prepared before, and hardly any assessments of swap spreads of emerging market currencies with a state of development similar to that of the forint market can be found in the empirical literature. A further novelty involves the extension of the analysis by the joint examination of interest rate swap spreads with different maturities, which allows even better-founded conclusions to be drawn with regard to the information content of interest rate swap spreads.

Our results suggest that the effects of several factors on the developments in forint interest rate swap spreads are different from those found in empirical literature, which can be explained by the peculiarities of the domestic market compared to international markets. Overall, we came to the conclusion that in certain cases long-term yield expectations are better reflected in swap yields, while at other times they are better reflected in government bond yields. Therefore, shifts in these expectations are easier to identify by the joint use of the yield curves estimated from forint government securities and from interest rate swaps (and/or other interest rate derivatives). A further result of the study is that in the developments in swap spreads one can detect the use of all trading strategies built on interest rate swaps, which are widespread according to anecdotal information.

The structure of the study is as follows. First, the most important features of interest rate swap transactions are described, followed by an overview of the main characteristics of the functioning of the forint interest rate swap market. Then the link between the government securities and interest rate swap markets is also presented. Later, hypotheses are set up with regard to the kinds of mechanisms through which various factors may influence the forint interest rate swap spread. In this process, the experiences recorded in the international empirical literature and the peculiarities of the domestic market are used. Following that, the results of the model exploring the explanatory factors of the forint interest rate swap spread are reviewed. Finally, the possibilities of using the interest rate swap yields in practice are examined, in terms of both spot and forward yields.

2 Interest rate swap transactions in general

CHARACTERISTICS AND FEATURES OF INTEREST RATE SWAPS

Participants in an **interest rate swap** transaction exchange the interest rates of funds denominated in the same currency. In the most common and most widespread type of interest rate swap one of the parties receives floating interest rates during the swap period, in exchange for which he pays a pre-determined fixed interest rate to the other party, with the maturity of the transaction typically being longer than one year *(fixed-for-floating, plain vanilla swap)*. Interest rate swaps differ from currency swaps not only in the fact that interest rates denominated in the same currency change hands (see Box 1). While in currency swaps usually both the principal serving as a basis for the transaction and the interest paid are actually swapped in their total amount, this is not typical for interest rate swaps. Given that in an interest rate swap the principals swapped notionally by the parties are equal, there is no need to actually swap them. Therefore, determining the nominal amount *(notional principal)* serving as a basis for the transaction is only necessary for calculating the interest to be paid over the life of the swap. The fixed and floating interest rates to be paid during the swap period at pre-determined dates are also denominated in the same currency. Accordingly, it is also not necessary to swap the total amounts of interest to be paid. It is sufficient if at each interest date the party which has the higher notional payment obligation pays the difference between the current values of the fixed and floating interest to the party with the lower nominal payment obligation (net interest payment). The notionality of the swapped principal and the net interest payment emphasise that the interest rate swap is a **derivative**, with no related lending position and, consequently, no significant counterparty risk either.[1]

The party which pays the fixed interest rate *(fix payer)* is called the buyer of the swap, whereas the one that receives the fixed interest *(fix receiver)* is the seller. Market makers of the interest rate swap market quote the interest rates for the fixed leg of swaps, indicating against which floating interest rates related to the reference interest rate they are valid. For example, the **swap curve** belonging to the 6-month euro LIBOR includes those fixed euro interest rates which the participants of euro interest rate swap deals with different maturities have to pay, if, in exchange, they would like to receive a floating interest rate corresponding to the 6-month euro LIBOR during the swap period.[2] The amount of the fixed interest to be paid in exchange for the given floating rate is determined in such a way that based on the yield curve valid when making the deal – i.e. taking account of current market expectations regarding future changes in yields – the net present values of the two cash flows should be nearly equal (not completely equal, because market makers include their own commission in the swap curve).

Box 1: Classification of swap transactions

When making swap transactions, participants always agree on the exchange of future cash flows. Swap transactions can be classified on the basis of whether the swapped cash flows are denominated in the same currency (interest rate swaps, asset swap) or different currencies (currency swaps); alternatively, the classification can be based on whether the instruments are traded in high volumes under standardised conditions or the instruments are custom-made, according to individual customers' demands.

Most of the global swap turnover is constituted by standardised instruments, typically traded at the interbank market. Of the interest rate swaps, the *fixed-for-floating* interest rate swap, which is the subject of our study, belongs to this group. Somewhat different from this are the swaps indexed to the overnight yields *(overnight indexed swap)*; in their case the floating leg of the swap changes every day in accordance with developments in the overnight yield which serves as a basis, the maturity of the transaction is shorter than that of the traditional interest rate swaps (typically less than three months), and neither when the deal is made nor over the life of the contract is there any cash flow. Settlement takes place at the maturity of the transaction. Of the currency swaps, the *cross currency basis swap*[3] and the *FX-swap* belong to the standardised instruments. Within the framework of cross currency basis swaps, the parties exchange amounts denominated in different currencies for a protracted period of time

[1] No significant counterparty risk compared with a bond of the same notional amount.

[2] In the case of some currencies, there are several interbank reference yields, and separate interest rate swap quotations belong to each. In the case of the euro, for example, in the euro LIBOR listing only London-based banks active in the money market participate, while in the listing of Euribor interest rates, besides the largest international banks, all countries of the euro area are represented at least by one bank, so this panel covers a much wider scope. As for euro interest rate swaps, this does not cause any practical problem, as the values of the two interbank yields are very close to one another. However, in terms of certain currencies (e.g. the yen) the various interbank reference yields can be quite different from one another, and the difference is also reflected in the interest rate swap quotations related to them.

[3] In general, swapping of two floating interest rates is called basis swap, irrespective of whether it is an exchange of cash flows denominated in the same currency (basis interest rate swap) or different currencies (cross currency basis swap).

(typically for several years), and during the life of the swap transaction they pay floating interest rates to one another, in the currency of the amount received by them. At the maturity of the swap the parties swap back the amounts which were exchanged at the beginning of the transaction. For example, a cross currency basis swap transaction is concluded by a bank if it exchanges a definite euro amount for dollar at the current exchange rate with another bank, pays an interest on the received dollar amount corresponding to the prevailing 6-month dollar LIBOR semi-annually over the life of the transaction, while receiving on the same dates interest corresponding to the 6-month euro LIBOR on the exchanged euro amount. *FX-swaps* are those currency swaps within the framework of which the parties swap an amount denominated in two different currencies at the spot exchange rate, and agree on a swap back at a future date (typically within one year) at the future exchange rate valid when concluding the transaction. Consequently, over the life of *FX-swaps*, cash flows are always exchanged twice, when concluding the transaction and at maturity.

Much lower turnover is involved with those swap transactions which are offered by various financial intermediaries (that are not necessarily market makers in the interbank swap markets) to their clients, tailoring the conditions of agreements to the latters' individual demands. The common feature of these swap transactions is that the relevant cash flow can be replicated by the financial intermediaries with a combination of standardised swap transactions traded at the interbank market. As a result of financial intermediaries' innovations, swap transactions which satisfy almost any customer demand can be created, for example various amortising interest rate swaps,[4] basis interest rate swaps,[5] asset swaps[6] and cross currency swaps which include fixed interest payment at least on one of the legs of the swap.

The frequency of floating interest dates is freely determined by the parties, although the most typical is the semi-annual or, less frequently, the quarterly interest rate period. Net interest is always paid at the end of the given **interest rate period**, but the value of the floating interest is fixed at the beginning of the interest rate period. This means that in the case of a semi-annual interest payment swap the magnitude of the floating interest rate due at the first interest payment (after 6 months) will be equal to the reference interest rate valid when concluding the transaction, while the floating interest rate due at the second interest payment (after 12 months) will be equal to the reference interest rate valid after 6 months, etc. Consequently, the value of the first floating interest to be paid is always known when an interest rate swap transaction is concluded. The fixed interest rate determined against the floating interest rate is an annual interest rate, and it is always paid only once a year, irrespective of the interest rate period related to the payment of the floating interest.[7] Accordingly, if the floating interest is paid semi-annually, only every second interest payment can be considered as real net interest payment. The participants in a transaction can also agree that the party paying the floating interest does not pay an interest which exactly corresponds to the reference interest rate, but one which is lower or higher to a pre-determined extent (for example 6-month euro LIBOR + 25 basis points). Of course, in this case the fixed interest rate to be paid will also be lower or higher. When determining the sum of the net interest payment obligations, certain interest rate swap markets calculate with 360 days, while others calculate with 365 days in a year.

Interest rate swaps are typically OTC *(over-the-counter)* transactions (which are not concluded at regulated markets). Central players of the market are the **market maker banks**, which regularly conclude interest rate swap transactions with various maturities with their clients on a business basis in order to earn commission income. Despite the fact that this is an OTC market, the market makers in the interbank trading usually settle their positions every day *(mark-to-market)*. In accordance with their clients' demands, market makers undertake the role of both the fix payer and fix receiver in the interest rate swap transactions. Market makers include their commission, which provides their earnings in the fixed interest rates (bid-ask spread). Market makers usually do not undertake a significant own open position, i.e. they hedge their net open interest rate position deriving from the interest rate swap transactions concluded by them with the help of government bonds or, in the most developed financial markets, interest rate futures. Market makers' clients, which can be other financial institutions or even other companies, conclude interest rate swap transactions in order to attain some kind of economic or financial target (e.g. interest earnings, hedging of outstanding open interest rate positions, risk management, etc.). A brief review of these targets is given below.

[4] In the case of amortising interest rate swaps, the notionally swapped principal used for determining the amount of the (net) interest payments gradually declines over the life of the swap.

[5] In basis interest rate swap transactions both parties pay floating interest denominated in the same currency, but fixed to different reference interest rates.

[6] Within the framework of asset swap transactions not simply a floating interest rate determined by a reference yield and a pre-determined fixed interest rate belonging to the given reference yield change hands during the term, but typically the fixed cash flow of a concrete financial asset is exchanged for floating cash flow. This means that the use of asset swaps allows a synthetic modification of the features of cash flows stemming from financial assets.

[7] Annual payment of the fixed interest is generally true for the European markets, but at dollar interest rate swap markets semi-annual payment of the fixed interest is also common.

GENERAL APPLICATIONS OF INTEREST RATE SWAPS

Interest rate swaps are derivatives, and can be used for managing interest rate exposures and interest rate risks. When interest rate swaps first appeared, their primary function was to enable economic agents having fixed-interest assets or liabilities transform the character of their assets or liabilities into floating payment and, vice-versa, to enable economic agents having floating interest assets and liabilities transform the character of their assets or liabilities into fixed-interest ones. Later, however, the role of interest rate swaps in risk management, as well as in taking and modifying interest rate positions, gradually came to the fore.

The dynamic growth in the turnover of interest rate swaps in recent years is mainly related to the **taking of interest rate positions** and their alterations, the primary target of which is to attain a gain on interest, i.e. speculation. Given their above described characteristics, interest rate swaps, compared to the sale and purchase of interest-bearing instruments (e.g. bonds), can be employed much more flexibly for taking and managing interest rate positions. The size and liquidity of interest rate swap markets have grown considerably in recent years. The net interest payment and the nominal character of the swapped principal allow the taking of much larger interest rate positions than the purchase of bonds. The flexibility of interest rate exposures created with the help of interest rate swaps is crucial in the case of short positions. In certain bond markets, investors expecting a rise in yields may encounter difficulties in connection with the short selling of securities, because, due to liquidity or regulatory reasons, securities lending cannot be performed or cannot be performed to an adequate extent in the given market. Instead of selling short, investors can conclude interest rate swap transactions, with which they receive a floating interest rate in exchange for a fixed interest payment, thus making a profit if the yield rise is higher than what is expected by the market.

For similar reasons institutional investors (various fund and assets managers, insurance companies, etc.) use interest rate swaps for managing the interest rate position of their portfolios consisting of interest-bearing instruments. These institutional investors can modify the duration of their portfolio much more flexibly with the help of interest rate swaps than with the sale and purchase of underlying assets. Investors expecting a rise in the level of the interest rate can reduce the duration of their portfolio by interest rate swap purchases (payment of a fixed interest rate in exchange for a floating one). With this they can reduce the loss resulting from an increase in the interest rate without having to sell significant quantities of securities, which they might not be able to do (for example, due to liquidity reasons) or could do only under less favourable conditions. The other main advantage of interest rate swap transactions is related to the notionally swapped principal, i.e. using them **allows the separation of interest rate risk and credit risk**, which are both present with bonds. Accordingly, interest rate swap markets allow the taking of interest rate positions even by those investors who would not like to bear the default risk related to government securities or other bonds denominated in the given currency, or whose risk management regulations limit this.

In addition to the above simple examples, interest rate swaps allow the creation of innumerable combined trading strategies based on the taking of positions even at several different markets simultaneously, which allow the realisation of a gain on interest. For example, by the simultaneous taking in different directions of interest rate swap positions bound to the same reference yield, but with different maturities, it is possible to speculate on a more significant than priced increase or decline in the slope of the yield curve, depending on whether the market player implementing the strategy pays the floating interest in the interest rate swap transaction with the shorter or longer maturity. Similarly, it is possible to make a profit with interest rate swap transactions of opposite directions concluded in different currencies, if the magnitude of the change in the given currencies' interest rate spread is different from the expectations of the market.

Originally, interest rate swaps served the purpose **of synthetic production** of floating or fixed interest rate payments. If, for example, an economic agent would like to finance its activity by issuing a floating-rate bond, but at the given market it can issue a fixed-interest bond under more favourable conditions (for example, for regulatory reasons or because there is higher demand for fixed-interest bonds in the given market), by concluding an interest rate swap transaction (in which it pays a floating interest rate in exchange for fixed interest rates) it can transform the character of its interest payment obligations into a synthetically floating interest-bearing one. However, for the synthetic modification of the interest payment of a given financial asset or liability, market participants mainly use asset swaps and other interest rate swaps tailored to individual company needs (e.g. amortising interest rate swaps), instead of standard fixed-for-floating interest rate swaps. After all, the synthetic modification of the character of assets or liabilities related to interest payment always serves the management of some kind of interest rate risk (for example, the motive behind changing the liabilities of the bond issuer into floating rate ones may be that its assets are also with floating rates, and it does not intend to undertake an open interest rate position).

With the help of interest rate swaps, **interest rate risks** related to the whole portfolio of assets and liabilities, moreover, to the differences between the structures of the assets and liabilities sides **can also be reduced**. Using a much simplified example, if a financial institution typically funds itself with floating rate liabilities, while its assets are mostly with fixed interest rates, this bank will suffer losses when interest rates increase (it will have to pay higher interest on its liabilities, while its interest income will remain unchanged). The financial institution can reduce this risk with the help of an interest rate swap transaction by paying the fixed leg of the swap, while receiving floating interest rates in exchange. With the proper choice of the interest rate period of the swap and the reference interest rate, which serves the purpose of determining the value of the floating interest rate, the bank can hedge a part of its interest rate risk stemming from the structure of its balance sheet, since it makes a profit when interest rates increase more significantly than expected at the date of concluding the transaction, i.e. it becomes the beneficiary of the net interest payment, which reduces its interest loss on its other assets and liabilities. Consequently, this is not a case when the bank clearly expects a rise in interest rates and strive for gain on interest based on this expectation, rather it simply aims to minimise the loss which it would suffer if the interest rate level increased. On the other hand, if interest rates decline the bank will become the net interest payer in the swap transaction and will lose part of the gain on interest on its other assets and liabilities. Therefore, in this case the bank uses the interest rate swap as a means of risk management.

3 The forint interest rate swap market

MARKET TURNOVER AND LIQUIDITY

The majority of *(fixed-for-floating)* forint interest rate swap transactions are concluded by foreign banks (typically headquartered in London) with one another and with their similarly non-resident clients, e.g. various fund managers. According to market participants' estimates, **the turnover of the forint interest rate swap market in London is approximately 2-4 times higher than that of the domestic market.** Anecdotal information suggests that all significant investment banks in London participate in the London-based forint interest rate swap market, although only some of them can be considered as real market makers. Market makers in the domestic market include some of the major commercial banks. They mainly trade with non-resident clients, mostly banks, and only a relatively small portion of their turnover is with domestic partners. Moreover, in most cases the domestic partners are also banks. Apart from them only a certain number of fund managers and insurance corporations are present in the market, while other companies practically do not conclude interest rate swaps in Hungary.

In most interest rate swap transactions, the size of the floating interest to be paid is determined on the basis of the 6-month BUBOR,[8] and market maker banks use annual and semi-annual interest rate periods for fixed and floating interest rates, respectively. However, in the shortest transactions (usually with a maturity of 1 year), a shorter, quarterly interest rate period is typical, while the reference yield is the 3-month BUBOR. Domestic banks use several kinds of infrastructure for concluding interest rate swap transactions. The most widespread involves concluding transactions through so-called inter-dealer brokers[9] and the Reuters Dealing system, but trading on the phone is not rare either. Without exception, domestic market makers trade with their partners on the basis of framework contracts concluded in advance, which, in most cases, are based on the international master agreement elaborated by ISDA.[10]

No regular data concerning the turnover of interest rate swaps concluded by domestic banks are available. Nevertheless, when examining the interest rate swap market activity, in addition to anecdotal information, we can rely on the results of the data collected by the MNB (within the framework of the triennial BIS survey) and useful conclusions can also be drawn from the developments in outstanding interest rate derivatives reported by domestic banks.

Outstanding interest rate swaps at banking sector level compiled from domestic banks' off-balance-sheet items have followed a dynamically growing trend in recent years (Chart 1). Outstanding interest rate swaps alone carry relatively little information, since the nominal value of interest rate swaps is summed up irrespective of the direction of the interest rate swap (i.e. there is no netting), thus data on outstanding stocks do not reflect the actual interest rate position. On the other hand, as the data on outstanding stocks include all previously concluded interest rate swaps which have not expired yet, and the maturities of interest rate swaps are relatively long, an increase in outstanding stocks can be considered as a natural phenomenon. However, from the data on outstanding stocks estimates concerning the volume of domestic turnover of interest rate swaps in a given month can be prepared. The size of the change in outstanding stocks in a month is equal to the swap turnover in the given month, less the nominal value of the swaps expiring in the same month. Therefore, the growth in outstanding stocks yields the lower estimate of the turnover of interest rate swaps.

Outstanding swaps started to increase in a perceptible manner from mid-2002, so this can be considered as the starting date of the Hungarian interest rate swap market. The turnover estimated on the basis of the change in stocks was gradually growing from this time on, before stepping on a much more dynamic than earlier growth path from the second part of 2005. The magnitude of the downward bias regarding the estimate for the turnover changed in time. As the maturity of swaps is relatively long, approximately 3 years on average according to anecdotal information, in the last part of the period under

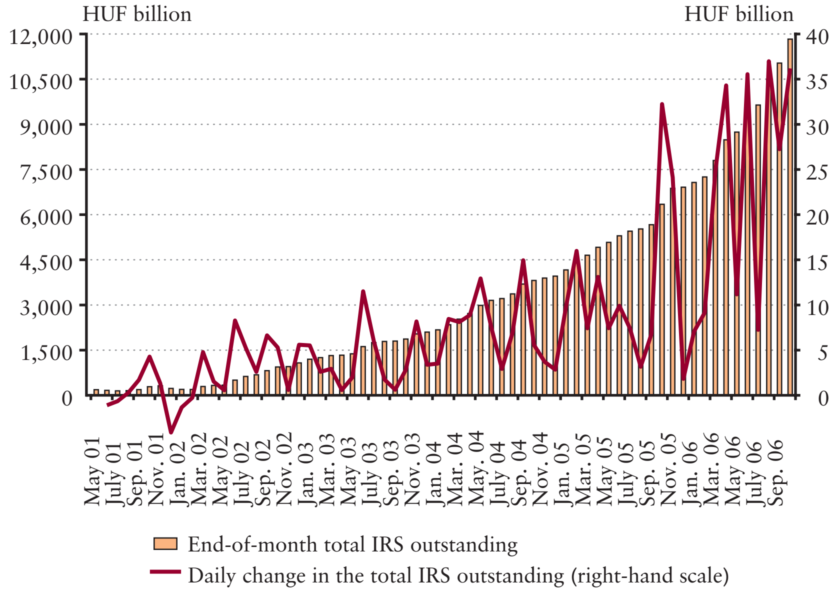
[8] BUBOR (Budapest Interbank Offered Rate) is the Budapest interbank (supply-side) borrowing rate on loans extended in forint; a reference interest rate calculated from the quotes of the most active banks in the Hungarian money market.

[9] Inter-dealer brokers mediate the demand and supply of the largest traders and market makers of individual financial markets. Through inter-dealer brokers market participants can trade with one another in large quantities and at low spreads, while also preserving their anonymity.

[10] International Swaps and Derivatives Association. The master agreement is mainly useful in transactions between partners belonging to different jurisdictions, as it provides for the legal security of transactions even in those issues where the legal systems concerned might involve different provisions.

Chart 1

Outstanding interest rate swaps concluded by domestic banks and the estimated daily swap market turnover



Source: Hungarian Financial Supervisory Authority, monthly report 3.DA.-3.DB.; outstanding stocks at nominal value, not consolidated.

review the underestimation was higher than earlier. Accordingly, the increase in the swap market turnover is even more dynamic than that suggested by the change in stocks.

One question concerns the magnitude of the underestimation. For its quantification we can rely on the BIS survey, according to which the swap turnover of domestic banks in April 2004 amounted to HUF 18 billion. In the same month, the change in total swaps outstanding expressed on a daily level was only half of that, i.e. HUF 9 billion. The daily change in outstanding stocks was between HUF 20 and 25 billion in 2006. Assuming that April 2004 was not a special month when much more or much fewer swap transactions expired than the average, **the daily average interest rate swap turnover in the domestic market could be around HUF 40-50 billion in 2006.** This estimated amount is in line with the results of our questionnaire survey conducted among the interest rate swap market maker domestic commercial banks, which also shows that the average daily turnover of interest rate swaps concluded by domestic banks was around HUF 45-50 billion in 2006. However, based on the results of the survey the domestic market is strongly concentrated; a few banks perform almost the entire turnover. Practically, they are the ones that conclude the average daily 20 interest rate swap transactions of the domestic credit institution sector, while the other credit institutions do not trade in interest rate swaps on a daily basis. Moreover, some of these banks conclude their transactions in the domestic market (Budapest) only in a geographical sense, as technically their position is recorded in the trading book of their respective foreign parent banks.

The swap turnover estimated as described above was compared with the monthly data of the domestic turnover of forint-denominated government bonds. During the comparison we tested the hypothesis that there is an interrelation between interest rate swaps and the activity of the government securities market, either because investors hedge their open interest rate swap positions with government bonds, or because they modify the interest rate exposure of their government securities portfolios with swaps. Given that both time series are characterised by a growth trend, we looked at the correlation between the changes in the time series. Between 2003 and 2006 the correlation coefficient between the monthly changes in these two time series was rather high, i.e. 0.38.[11] This means that the relationship between the activities in the two markets is relatively close, and this result also confirms that, despite the inaccuracy of the estimation, the change in and the dynamics of total swaps outstanding mirror the actual swap market turnover relatively well.

[11] The value of the correlation coefficient proved to be significant, which we tested with running a time series regression: we explained the change in the government securities market turnover with the differential of the estimated swap turnover.

In addition to turnover, another popular indicator of market liquidity is the bid-ask spread (Csávás–Erhart, 2005). Based on the indicative interest rate swap quotations originating from Reuters, the difference between ask and bid yields fluctuated around 10 basis points in the past two years, and according to market participants the actual bid/ask spread is also equal to that. The size of the spread is very similar to the bid-ask spread of the government securities market, which has also fluctuated around 10 basis points in recent years.[12] However, this does not justify a conclusion that the liquidities of the two markets are of similar magnitudes, as the bid-ask spread reflects various risks, which can be different for interest rate swaps and government securities. On the one hand, the spread reflects the risk that large deals may move the prices. However, as the nominal value is not exchanged in interest rate swaps, the same amount – theoretically – has a smaller impact than in the government securities market. On the other hand, the spread also covers market makers' risk stemming from the intraday open position, and this risk is proportionate to intraday volatility. Even if the volatilities of the yields of interest rate swap and government paper are equal, it causes a much greater change in the value of the interest rate swap, as the latter's duration is significantly higher in absolute terms.[13]

Based on our estimate of a HUF 40-50 billion average daily turnover of the domestic interest rate swap market and anecdotal information about the size of the London-based market, **the total daily average turnover of the forint interest rate swap market can be between HUF 120 and 250 billion**.[14] For comparison, the average daily turnover of the forint government bond market was around HUF 100-150 billion in 2006, and this also includes a significant part of non-residents' transactions between one another.[15] On this basis, it is probable that the magnitudes of the turnovers of the global forint government securities and interest rate swap markets are equal, or the turnover of the swap market may be somewhat higher. The higher liquidity of the interest rate swap market and the greater flexibility of transactions are also reflected by the fact that in 2006 the average size of a deal typically amounted to HUF 2-3 billion, while that in the government bond market was somewhat below HUF 1 billion.

THE FUNCTIONING OF THE FORINT INTEREST RATE SWAP MARKET AND ITS RELATIONSHIP WITH THE GOVERNMENT BOND MARKET

In this part, the functioning of the forint interest rate swap market and the motivations of market participants are examined primarily in terms of what relationship they create between the interest rate swap and government securities markets, and in this respect to what extent these markets are different from the developed financial markets. Mapping these features of the forint interest rate swap market contributes considerably to the identification of the factors which influence developments in interest rate swap yields, and to the adequate interpretation of information originating from the (relative) changes in these yields (compared mainly to forint government bond yields). Thus, in this part we present the market environment, the peculiarities of which basically influence the specification of the forint interest rate swap spread model described in the second part of this study and the interpretation of the results of the model. In the previous part we established that, based on the available data, there is a close relationship between the forint interest rate swap market and the forint government securities market (mainly the government bond market). This is indicated by the fact that the magnitudes of global turnovers of the two markets are equal, and there is a marked co-movement between the changes in turnovers. Theoretically, both interest rate swap market makers and investors of the interest rate swap market can establish a relationship between the government bond market and the interest rate swap market, provided that the interest rate swap market makers hedge their net open interest rate swap positions at the government bond market, and the majority of the investors of the interest rate swap market regularly trade at the government bond market as well. However, based on information received from market participants, we may say that the forint interest rate swap market and the forint government bond market are strongly segmented in terms

[12] Based on the indicative quotations (which do not mean an obligation to conclude a transaction at the given yield) from Reuters, the bid-ask spread calculated from the yields of forint government bonds is between 10 and 15 basis points, while based on the actual quotes in Bloomberg's electronic trading system it is somewhere below 10 basis points.

[13] Based on our estimates, the value of a 3-year interest rate swap position, calculating with a 10 basis point bid-ask spread, can even change to 20 times of its original value as a result of a 1 basis point yield curve shift, while in the case of a 3-year government bond the shift is only 2.5 per cent, in accordance with the duration.

[14] Non-resident market makers conclude interest rate swap transactions with one another and with foreign clients with an average daily value of approximately HUF 80-200 billion. The underlying reason for the high uncertainty is that for this data only market participants' estimates are available. According to anecdotal information, some years ago the forint interest rate swap turnover abroad was only a fraction of the above, which also means that, similarly to the domestic market, the turnover abroad started to increase dynamically only in recent years.

[15] KELER's (Central Clearing House and Depositary) secondary market turnover data include all transactions concluded between two participants that have different custodians keeping an account with KELER (Csávás–Kóczán–Varga, 2006).

of the circle of investors. Thus the relationship between the two markets is mainly attributable to the interest rate swap market makers.

In terms of the range of investors, the interest rate swap market and the government bond market are strongly segmented. Non-resident hedge funds, proprietary traders[16] and other non-resident investors striving for short-term gain on interest mainly take positions in the interest rate swap market when investing in forint interests, and do not buy forint government bonds. The main underlying reason is that the transaction cost of government securities transactions is higher (for example, custody services of the papers have to be managed), significant credit risk is related to them, their short selling is difficult, and their market is not liquid enough for high-volume daily trading. For these participants it is probably not worth installing the infrastructure for government securities trading, even if government bonds offer a slightly higher yield than interest rate swaps. Domestic institutional investors (investment funds, pension funds, insurance companies, etc.) and non-resident real money investors (for example, foreign pension funds), which typically do not conclude interest rate swap transactions but buy government bonds, belong to another group of market participants that invest into forint interests. These participants – unlike hedge funds and the other market players that belong to the previous group – are not motivated to install the infrastructure related to interest rate swap trading (concluding international ISDA agreements, development of back office systems, etc.) because direct investment in the government bond market better matches their investment targets and longer-term view, and the outstanding amount of forint government bonds always proved to be more than enough in the past to satisfy the demand created by them.

Despite the strong segmentation of investors, there is a very close relationship between the two markets, which is attributable to the interest rate swap market maker banks (which are typically in London). The forint interest rate desks of interest rate swap market maker investment banks provide quotes mainly to hedge funds, which perform a significant interest rate swap turnover, and to other clients that intend to take short-term forint interest rate positions. Market makers conclude the majority of their government bond transactions in order to hedge their (net) interest rate exposure stemming from interest rate swap transactions. Within the framework of their hedging activity, they manage on a daily level the government bond portfolio held by them in such a way that their total interest rate exposure, which includes their interest rate swap transactions as well, remains within the interest rate risk limit determined for them. Market makers often use the opportunity provided by the limits for position-taking. Consequently, their interest rate position is usually not zero. Compared with the developed markets, one of the most important features of the forint interest rate swap market is that only the forint government bond market allows the hedging of net open interest rate swap positions.[17] Consequently, **the 'real' liquidity providers of the forint interest rate swap market are the owners of government bonds**, i.e. the demand/supply pressure starting from the swap market is absorbed by them. In all probability the functioning of the interest rate swap market is also facilitated by the fact that the market maker investment banks hold a significant amount of forint government bonds.

When clients conclude interest rate swap transactions with a market maker as fix receivers, and consequently the market maker becomes a fix payer, it usually purchases government bonds with adequate maturity for its portfolio to keep its total forint interest rate risk exposure under a limit. However, otherwise (when it is a fix receiver) it does not always sell government bonds (e.g. because of the liquidity constraints of the market), but can try to hedge its position with interbank interest rate swap deals of the opposite direction (as a fix payer). Market makers prefer this solution especially when the swap spread is negative (the yield of government bonds is higher that that of interest rate swaps), as in this case they would be able to sell their government bonds even in small volumes only at a higher yield compared to hedging with an interest rate swap transaction. However, at the market as a whole, after reaching the risk limits, one of the market makers will finally be compelled to sell government bonds even in this case. It may happen that hedging the net fix receiver position requires the short selling of government bonds because, for example, the market maker does not have a sufficient quantity of government

[16] Hedge funds are private investment funds, the investors of which are typically wealthy private individuals and large institutional investors. As a consequence of the limited number of investors, they are exempt from numerous capital market regulations and reporting obligations, and they are generally characterised by a high leverage and the free use of financial derivatives. Proprietary traders are traders that conclude own-account transactions and manage the positions of large investment banks. Of course, investor protection regulations do not apply to them either, and their investments are also characterised by a significant leverage. For further details see Kóczán–Mihálovits (2004).

[17] In the previous chapter it was mentioned that in the developed financial markets the net open interest rate swap position can be hedged with long-term interest rate futures as well. Although futures BUBOR products and forint government bond futures contracts are also available at the Budapest Stock Exchange, there is practically no trading in these transactions, and they cannot be concluded for a maturity over two years. FRAs (forward rate agreements) are only liquid at maturities up to one year.

bonds for sale, or for other reasons short selling is more advantageous than direct selling. However, the large London-based investment banks, irrespective of the underdeveloped securities lending and repo market in Hungary, are probably able to hedge their net fix receiver open position even in this case. Securities lending is much more widespread in the London-based market, thus interest rate swap traders can borrow forint government bonds for short selling either from other investment banks or even from the clients of the investment bank (from the holdings in custody for clients).

Consequently, when the clients of market maker banks start significant one-way position-taking in the interest rate swap market, and, as a result, market makers' net open interest rate swap position increases dynamically, the hedging activity of market makers also requires a one-way, increasing government bond market position-taking. For example, market makers with increasing net fix receiver position have to sell an increasing amount of government bonds to hedge their respective positions, which triggers an increase in government bond market yields. In this case, supply pressure feeds through from the interest rate swap market to the government bond market, via the hedging activity of market maker banks. In contrast, market makers with increasing net fix payer position have to buy an increasing amount of government bonds to hedge their respective positions, which exerts a downward pressure on government bond market yields, i.e. demand pressure feeds through from the interest rate swap market to the government bond market. However, the causal relationship between the two markets is a two-way one, as interest rate swap market makers channel a part of the demand/supply pressure starting from the government bond market to the interest rate swap market. The underlying reason is that the government bond market demand/supply shocks move the yields of those government bonds with which the interest rate swap market makers hedge their net open interest rate swap positions. Consequently, beyond a certain extent market makers cannot disregard the yield change of government bonds in their own swap yield quotations, i.e. they have to modify the latter in an identical direction with the yield change in the government bond market.

Therefore, due to the segmentation of investors, either in the government bond market or in the interest rate swap market isolated price shocks can emerge, which, on the one hand, move the swap spread, and, on the other, also influence price developments in the other market as a result of the interest rate swap market makers' hedging activity. **The significance in certain market situations of the interest rate swap market and the government bond market compared to one another is greatly influenced by the prevailing ratio and activity of the players that invest in forint interests in the two markets, as well as by the magnitude of the deals concluded by them.** If domestic institutional and non-resident real money investors that buy government bonds start to take significant, one-way positions, government bond market prices will contain additional information compared to swap yields, and interest rate swap quotations will gradually converge to these prices. However, if non-resident investors, for example hedge funds, striving for short-term gain on interest start to take one-way interest rate swap positions, swap quotations will show additional information and price changes will feed through from this market to the government bond market.

The same extent of change in non-residents' holdings of government bonds may have a different meaning, depending on which market the price discovery is taking place at. If it is the real money investors that are active among the non-resident players, then the changes in non-residents' holdings of government bonds can mainly be attributed to them, but if it is the hedge funds, the changes are attributable to them to a lesser extent, as in this case it is rather the hedging activity of the London-based interest rate swap market makers that is reflected in the change in non-residents' holdings of government bonds. The interpretation also depends on what we think of the ratio of these two groups (real money investors and interest rate swap market maker investment banks) within non-residents' holding of government bonds, i.e. what size of the outstanding amount is held by the London-based investment banks to hedge their net open interest rate swap position. In recent years, within the group of non-residents investing in the forint market, the ratio of investors striving for short-term gain on interest to real money investors has increased.[18] Based on this and also taking into account the dynamic growth in turnover of the forint interest rate swap market, the changes in non-resident investors' holdings of government bonds can now better than earlier reflect the impact of interest rate swap market activity, i.e. the expectations of investors striving for short-term gain on interest regarding developments in the forint yield curve.

[18] For more details see Csávás–Kóczán–Varga (2006).

4 Factors affecting swap spreads: international experience and Hungarian peculiarities

One of the most important price-based indicators of the swap market is the spread of the fixed leg of interest rate swaps on treasury yields with the same maturity **(interest rate swap spread).** Analysing the swap spread, several authors found that the developments in the swap spread are not random, and the factors which explain the spread and its change can often be identified. A considerable part of the literature dealing with the swap spreads approaches the issue from empirical experience, identifying the individual factors on the basis of past observations, which we consider as starting points for the modelling of the forint interest rate swap spread as well.[19] At the same time, it should also to be taken into account that the forint interest rate swap market is different in many aspects from developed countries' markets, which are dealt with in the empirical literature. Accordingly, in addition to international experience, we also place great emphasis on the peculiarities of the Hungarian market when identifying the factors affecting the forint interest rate swap spread. The same factors may have a different impact on the forint swap spreads than in the case of the major currencies, and this cannot be neglected when establishing hypotheses regarding the expected sign of variables explaining the swap spread.

INTERNATIONAL EMPIRICAL EVIDENCE

Below we present the variables influencing the swap spread most often examined in the international empirical literature, highlighting mainly those we consider relevant in case of the forint interest rate swap. Moreover, also mentioned are other factors which cannot be quantified or which are hard to quantify, but can be useful in understanding the driving forces behind swap spreads. Our aim is not a comprehensive review of the literature, but the presentation of the causal effects in developed markets. Based on this, later we describe why we expect diverse effects with certain variables in the case of the forint interest rate swap spread stemming from domestic peculiarities, which are different from those of developed markets.

In developed markets, the **credit risk of interest rate swap market makers** is typically higher than that of sovereign issuers. Stemming from the direct default risk, at least theoretically, interest rate swap yields should be higher than treasury yields. However, interest rate swap transactions by themselves contain a minimal non-performance risk. On the one hand, because the amounts of principal do not change hands, only the size of the interest payment, more precisely, only its net value represents an exposure. On the other hand, participants in the transaction cover their exposure with collateral (daily mark-to-market). In addition, in the case of major currencies, the activity of clearing houses specialising in interest rate swaps also significantly reduces the default risk of interest rate swap transactions (SWAPCLEAR). Consequently, in the literature the impact of the counterparty risk on the swap spread is estimated to be a mere 1-2 basis points (Cooper–Scholtes, 2001).

However, the fact that the default risk of interbank players is higher than that of sovereign issuers may still have an impact in an indirect manner. We have mentioned earlier that the floating leg of interest rate swap transactions is bound to the yields of uncovered interbank transactions (LIBOR, EURIBOR, TIBOR, etc.). At the same time, short interbank yields are higher than treasury yields with the same maturities, partly due to the higher default risk, and, to a lesser extent, because they are quoted in the form of offer interest rate, which is higher than the bid/ask average. Therefore, the interbank/risk-free yield spread is reflected in the swap spread, and this is a usual explanation for the fact that in developed countries the swap yield is almost always higher than the treasury yield (Chart 2). Consequently, the change in **systemic risk**, which affects a considerable proportion of the participants in the banking sector, plays a role in the fluctuation of the swap spread.[20] At the same time, the change in **bank-specific risks** probably does not have an effect through this mechanism, as in the case of financial difficulties of individual banks in the panel of LIBOR-type indices the given bank would simply be excluded from the panel.

Based on empirical analyses, the coefficient of the spread between short interbank and risk-free yields on the swap spread is positive, although typically less than 1.[21] The underlying explanation is as follows. The interest rate swap spread can be

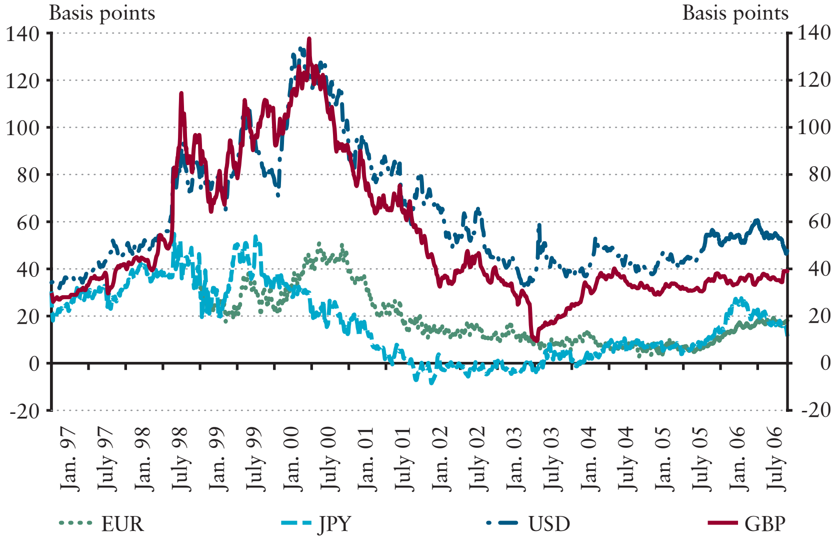
[19] In addition to this, the literature also includes a part which deduces the direction of the possible effect of factors influencing the spread from the theory of the pricing of interest rate swaps – see, for example, Alworth (1993).

[20] Heppke-Falk and Hüfner (2004) used the yield spread between the bonds of 'AA' and 'AAA' rated financial institutions to approximate the default risk.

[21] Cooper–Scholtes (2001), Rakkestad–Hein (2004), Subrahmanyam et al. (2001).

Chart 2

10-year interest rate swap spreads of major currencies (5-day moving averages)



Source: Thomson Datastream, ICAP. Spread between interest rate swap yield and benchmark government securities yields.

interpreted as the weighted average of the difference between interbank and risk-free yields expected for future interest payment periods. If all of these future spreads increase to the same extent, the swap spread also grows to the same extent, which would justify a coefficient equalling 1 for the interbank/risk free yield spread of the first interest payment period (which is known at the moment of concluding the swap transaction). However, it is likely that the interbank and risk-free yield spread expected for the future shows less fluctuation than the one related to the first period, since these two yields do not depart from one another over the long term, and this justifies a coefficient lower than 1.

The spread between uncovered interbank and risk-free yields can have an impact on the swap spread not only through pricing, but also through the synthetic reproduction of interest rate swaps. The swap can be replicated by the purchase of government securities financed through short-term and/or floating-rate borrowing (or with the opposite of this, i.e. the short selling of the paper and the short-term lending of the cash inflow). In developed markets, typically repo transactions provide for the funding or the lending. If a market maker bank hedges an interest rate swap through buying government bonds and funding it with repo, and before the maturity the spread between the uncovered yield constituting the floating leg of the interest rate swap and the (risk-free) repo yield[22] declines, the market maker will suffer a loss, to which it can react with a reduction of the fixed leg of the interest rate swap. The fact that market participants actually hedge interest rate swaps with repo transactions is reflected in the significant impact of changes in **repo yields** and **repo holdings** on the dollar interest rate swap spread (Kambhu, 2004).

Another important risk factor is the **difference in the liquidities of the markets**, which may affect the swap spread through the liquidity premium of instruments. Since high-frequency data related to the liquidity of interest rate swaps are typically not available, usually only the effect of the liquidity of government securities on the spread is analysed. Increasing liquidity of government securities reduces the treasury yield, and thus raises the swap spread. For its approximation, the so-called *on-the-run/off-the-run* spread, i.e. the yield spread between the just auctioned and the earlier issued government bonds, is used in developed government bond markets (Cortes, 2003).

In addition to the risk factors, the differences between the demand for and supply of individual instruments may also contribute to the fluctuations in the swap spread. An **increasing supply of government securities** reduces the swap spread if the higher supply results in an increase in treasury yields. This supply effect can be approximated with the net issue of government securities or the current fiscal deficit, but already the **expectations** regarding the future fiscal position may have an impact on treasury yields. However, empirical results are mixed; while some found a negative coefficient, others did not find these variables significant.[23]

[22] The name of this spread in the pound sterling market is LIBOR-General Collateral (GC) repo spread.

[23] Artus–Teiletche (2004), Cortes (2003), Cooper–Scholtes (2001).

The change in the **risk appetite** may also affect the demand for government securities. In developed countries, a decline in risk appetite *('flight to quality')* may restructure the demand from riskier instruments to less risky government securities, which may increase the swap spread through the decline in treasury yields. For example, for the approximation of investors' risk appetite the use of the volatility of share indices is typical when examining the swap spreads (Cortes, 2003).

In the empirical literature the most often used explanatory variable is the slope of the yield curve of the government securities market (the spread between long and short yields). Each of the studies examined by us found that an increase in the **slope of the yield curve** reduces the swap spread, irrespective of the currency of the interest rate swaps (euro, dollar, pound sterling, yen, German mark, French franc, Italian lira).[24] The change in the slope can affect the swap spread through several mechanisms. On the one hand, institutional issuers (e.g. corporations, government agencies) in the US market strive to **smooth their financing costs**, i.e. when the yield curve is upward sloping they try to reduce the costs of their long-term fixed rate liabilities in the given year by paying the lower floating leg in swap transactions. If the slope of the yield curve becomes steeper, the demand for the fixed leg of swaps increases, which reduces both the swap yields and the spread.

Expectations on economic growth may also be reflected in the slope of the yield curve. In the event of recession fears, both long-term treasury yields and the slope of the yield curve decline, while economic slowdown may increase the riskiness of the financial sector, which, as mentioned above, may increase swap yields. In addition, as a result of the decline in risk appetite, demand turns from risky instruments to government securities, which are considered to be safe, which also may lead to a fall in treasury yields.

In the dollar swap market, a further demand factor can be related to the market of mortgage bonds. Institutions holding **mortgage bonds** (Fannie Mae, Freddie Mac) – due to the prepayment option available to borrowers of mortgage loans – create demand for one or another leg of swaps depending on the changes in yield (Cortes, 2003). For example, in the case of declining yields the duration of their assets (mortgage bonds) declines due to the increase in prepayments. They can hedge this in the swap market by taking the position which pays a floating interest rate in exchange for the fixed interest rate *(convexity hedge)*. The demand for the fixed leg of swaps reduces both the swap yields and the spread.

Box 2: Structural factors affecting swap spreads

Structural factors influencing swap spreads comprise those which permanently affect the swap spreads of individual currencies. Of the factors listed above, several may have an impact not only depending on time – they may also explain the differences between the swap spreads of various currencies.

One of these factors is the aforementioned **difference between the liquidities of two market segments.** For instance, the US government securities market is considered to be much more liquid than the swap market, while the situation in the market of the euro is precisely the opposite. In the euro area, the turnover of interest rate swaps exceeds that of government bonds, while in the USA the turnover of the government bond market is higher (BIS, 2005; Balogh–Kóczán, 2007). One underlying reason is that the European government securities market is rather heterogeneous (differences in rating, taxation), which has contributed to the strengthening of the benchmark role of the swap market, while in the US market the liquidity of benchmark papers is more dominant compared to other government securities than in the euro area. The relatively higher liquidity of the swap market can exert a downward pressure on the swap spreads of the euro area (Chart 2).

As has already been mentioned, permanent demand and supply differences between the two instruments can also be classified under the structural factors. On the one hand, this may partly appear in the **level and dynamics of government debts,** which may also cause differences in the shifts of the swap spreads of individual currencies compared to one another. Examining the swap spreads, in the case of Japan it was found that with the increase in government debt after 2000 the difference declined close to zero (Clark, 2004). Through the demand for government securities, the role played by individual currencies in accumulating international reserves may also have a significant impact. Of the **reserve currencies,** the role of the dollar is declining, although it is still outstanding: according to IMF data, in 2005 the shares of the dollar and the euro in total reserves amounted to 67 per cent and 25 per cent, respectively. This may reduce the dollar treasury yields, and thus increase the spread. The distribution of **debt instruments** between sovereign and private issuers can also affect treasury yields. The ratio of private issuances is much higher in the US market.

[24] Apedjinou (2003), Artus–Teiletche (2004), Cortes (2003), Cooper–Scholtes (2001), Heppke–Falk–Hüfner (2004), Subrahmanyam et al. (2001).

The relative shortage of government securities may reduce treasury yields and increase the swap spread in relative terms. The fact that the dollar has the highest weight among international bond issues may also have the same impact.

The demand for government securities may also be affected by the extent to which individual central banks accept securities and other instruments as collateral for their credit operations. In this respect, the ECB's **list of eligible collaterals** is rather broad, thus government securities do not play a prominent role, as opposed to the practice of the Fed and the BoE. This means that in the euro area a smaller part of the outstanding amount is held by the banks for this purpose, i.e. there is a relatively smaller shortage of government securities in the market compared to the USA, which may indirectly result in higher treasury yields and thus in lower swap spreads (Clark, 2004). According to another explanation, in the USA, due to the prominent character of government securities among collaterals, they are relatively more valuable for the banks, and thus their respective yields are lower; this is also called *'convenience yield'* (Cooper-Scholtes, 2001).

FACTORS AFFECTING THE FORINT SWAP SPREAD: HYPOTHESES

In this subchapter we present the direction in which the variables theoretically affecting the forint interest rate swap spread can influence the spread and what the underlying causal relations may be. When establishing the hypotheses, on the one hand we rely on the findings of the international literature, though only on those we consider relevant for the forint interest rate swap market. On the other hand, the use of variables which are not typical in the international literature may also be relevant. Within the latter we have strived to select those indicators which are able to capture demand/supply shocks which affect the interest rate swap and government securities markets separately. There are several such indicators in relation to the government bond market (e.g. auction overbidding), while in the interest rate swap market, due to lack of volume-based information, we are looking for indicators that are assumed to move together with the demand for interest rate swaps. When establishing the hypotheses, wherever possible several alternatives are presented, since for the same variables both positive and negative signs are plausible, and it is during the empirical tests when we can decide which of them proves to be true. The expected signs are summarised at the end of the chapter (Table 1).

The floating yield of forint interest rate swaps is the BUBOR. Therefore, similarly to international experience, we expect that the spread between the yield of BUBOR and of the treasury bill with the same maturity (**BUBOR spread**) will increase the interest rate swap spread, with a sign less than 1. Although the value of the BUBOR spread is usually positive, we believe it is unlikely that this variable reflects a higher default risk of the domestic banking sector compared to that of the sovereign issuer. The underlying reason is that the rating of rated domestic banks – partly due to the significant ratio of foreign owners – is identical with that of the Hungarian government.[25] However, the BUBOR spread may be influenced by the fact that BUBOR is an offer interest rate, while the treasury yield is a bid/ask average. For example, in uncovered 6-month interbank transactions, based on Reuters quotations, the bid/ask spread is typically around 20-30 basis points, half of which may appear in the swap spread.

Another difference compared to the developed markets is that the major interest rate swap market makers are the London-based banks, while BUBOR is calculated from the quotes of domestic banks. Consequently, the difference between the default risks of market makers and the Hungarian government cannot be reflected in the BUBOR spread. (This is in contrast to major currencies, where the default risks of interest rate swap market makers and of the banks in the panel of interbank indices are the same, but higher than that of the sovereign authority.) However, the **systemic default risk** hidden in the interest rate swaps can have an indirect impact on the forint swap spread. The Hungarian government had an 'A' rating in most of the period to be examined later, while the rating of the London-based banks which quote the interest rate swaps is better, usually 'AA'. Accordingly, an obvious indicator can be a risk premium like the **Maggie A**, for example, which indicates the yield spread between 'A' and 'AAA' rated instruments. When the 'A-AAA' spread increases, typically the 'A-AA' and 'A-AAA' risk premiums also rise, i.e. theoretically the risk of government securities rises more than that of the interest rate swaps. Consequently, the increase in the Maggie A may be reflected in the decline of the swap spread, thus a negative coefficient is expected.

[25] Although only their respective foreign currency deposit ratings are comparable, in the rating of the government it is observable that there is no difference between the foreign currency and forint ratings.

However, in the case of forint interest rate swaps we still do not think that market maker banks' **idiosyncratic default risk** has any significant impact (similarly to international markets). This can be illustrated with the following example. In recent years, the 3-year credit default swap spread, which reflects the default risk of the Hungarian government, was around 20 basis points on average. In terms of interest rate swaps, the default risk applies only to the interest payment, which only constitutes 15-20 per cent of the nominal value of a 3-year bond issued at nominal value. The default risk is further reduced by the netting of interest payments, which is even further reduced by the application of daily margining, which has become widespread in the forint interest rate swap market. Consequently, the default risk of forint interest rate swaps cannot explain more than some basis points in the forint swap spread. Therefore, the swap spread can at most reflect whether the default risk of government securities changes, while that of the interest rate swaps remains practically unchanged.

At the same time, the **Maggie A bond index spread** also shows the changes in **global risk aversion**. When investors' risk appetite declines, they strive to reduce their exposures in risky instruments. This may also be true for those non-residents who, expecting a decline in yield, built up forint interest rate swap positions, and the simplest way for them to close their positions is to conclude interest rate swaps of the opposite direction. This, in turn, increases the supply of the fixed leg of interest rate swaps, which leads to an increase in interest rate swap yields, and with regard to the Maggie A it justifies a positive coefficient. At the same time, due to interest rate swap market makers' hedging activity, this effect can feed through to government bond yields as well. However, there are several factors due to which we do not expect market makers' demand for and supply of government bonds to completely offset the impact on the spread. On the one hand, it is typical of interest rate swap market makers that when they encounter the supply of fixed interest payment, for a while they react to it by increasing the interest rate swap yields, instead of selling government bonds. On the other hand, in our earlier analyses we found that in the government bond market, in addition to non-resident participants, domestic institutional investors also play a determining role (Csávás-Kóczán-Varga, 2006). Since domestic institutional investors do not use interest rate swaps, and their demand for government bonds is independent of the developments in global risk appetite, their activity can often offset the impact of interest rate swap market makers on government bond yields. Other indicators (e.g. the EMBI spread) may also be suitable for the approximation of the risk appetite. However, we rejected their use, as by using the Maggie A indicator in the model – if it proves to be significant – we can test which one of our two hypotheses is correct.[26]

Demand for government bonds can be another important factor which influences swap spreads. As the market roles of both non-resident players and domestic institutional investors are determining, in certain periods non-residents, while at other times residents can be the market participants who determine the market price, and their demand may move the government bond yields. However, the impact on the spreads also depends on the extent to which different types of participants use interest rate swaps. We have seen earlier that the group of investors of interest rate swaps is strongly segmented. On the one hand, domestic institutional investors and foreign real money investors prefer government bonds to interest rate swaps in taking an interest rate position. Therefore, their demand for government bonds has an effect on the treasury yields only, but not on the swap yields. On the other hand, however, that part of non-residents' demand for government bonds which is related to the hedging of forint interest rate swap market makers has a smaller impact on the spread than the demand of other participants. The underlying reason is that if the demand of clients of the market maker bank for the fixed leg of swaps increases, that reduces the swap yields and, due to the forint government bond purchases required for the hedging, the treasury yields as well (for a smaller effect it is also sufficient if market makers hedge their risk only partly, within their limits). Accordingly, the impact of non-residents' government bond purchases on the spread depends on the types of participants it is related to. In this respect, domestic participants, in turn, may be considered as a homogeneous group, thus we expect that **domestic participants' government bond purchases** increase the swap spread through the decline in treasury yields.[27] The more typical it is that interest rate swap market makers' activity underlies non-residents' government bond purchases and sales, the more likely it is that this variable is found to be significant.

[26] The yield volatility of forint government bonds can also be mentioned, an increase in which also may induce investors holding forint bonds to hedge the risk. However, as opposed to the Maggie A indicator, its disadvantage is that volatility jumps up not only when the yields increase significantly, but also when they fall.

[27] The underlying argumentation in more detail is as follows. Let's assume that domestic participants, when they are the price makers, with one unit of their government bond purchase reduce the yields by coefficient x, and increase the swap spread to the same extent. In addition, those non-residents who do not use interest rate swaps also have the same size of impact on the spread in those periods when they influence the yields. Due to the activity of the interest rate swap market maker banks, the non-resident sector's demand for government bonds would increase the spread with a coefficient smaller than x in those periods when it is the non-residents that move the yields. As in the secondary market, residents and non-residents can buy government papers only from one another, in this latter case the result for the residents' coefficient would be less than (-x) in absolute terms. As the price making role can change over time – even within a day – the two effects on the whole do not offset one another, but an impact of residents' government bond demand less than x is expected for the average of a long period, pointing to an increase in the spread.

A widespread strategy in both developed markets and the forint interest rate swap market involves the **combination of interest rate swaps and government bonds**, which may bring profit from the shifts in the swap spread. If a market participant expects an increase in the swap spread, it can bet on it by buying government bonds and concluding an interest rate swap in the opposite direction, i.e. by paying the fixed interest rate. If treasury yields fall, there is a gain on the price of the government paper, and if the swap yield increases, there can be a profit on the swap position. Accordingly, it reduces the treasury yield and raises the swap yield. Due to the relatively low liquidity of the forint government bond market, purchasing at auctions may be more convenient than at the secondary market, because the former can involve a lower price effect. This is well illustrated by the fact that in 2006 the average issued amount in the auctions of the 3-year government securities was approximately HUF 80 billion, while the daily average turnover of papers with a maturity between 2 and 4 years is around HUF 50 billion. If the application of this strategy at auctions is typical, it results in an increase in the swap spread on **auction days**.

Another variable which may influence the swap spread is **overbidding at government bond auctions**. Extrapolating the above explanation, if the impact of auction days reflects the swap+government bond strategy, a higher auction demand may reflect a greater number of participants who miss the auction, although they intended to buy government securities at the auction and conclude a swap related to it. Consequently, on those auction days when overbidding is higher than usual, the swap spread increases to a lesser extent, i.e. the ceteris paribus effect of this variable is negative. An alternative hypothesis can also be set up to test whether these really are the processes underlying the effect of auctions. In recent years it could be observed that on auction days when the overbidding exceeded the average, secondary market government bond yields typically declined. Consequently, higher overbidding may raise the swap spread, if this is the only mechanism which prevails.

In addition to the demand factors, the **supply of government securities** can also affect the swap spread, through the treasury yields. As later we are going to work with daily-frequency data, **net or gross government securities issues** can be the adequate variables. However, in the use of the daily gross issue it may cause a problem that it closely correlates with the days of auctions, thus together they cannot be included in the regression. Therefore, with this variable we are only going to test what its sign will be if the dummy variable reflecting the auction days is replaced with it. If the supply effect is significant, it has a negative effect on the spread due to the increase in bond yields. On the other hand, the net government securities issue may also have an impact on the swap spread, although we consider it unlikely that we will get a significantly different result compared to the gross issue, in view of our observations that redemption of government securities does not affect the developments in yields.

The **difference between the liquidities** of the two markets may have an impact on the forint swap spread, similar to the case of other currencies. Increasing liquidity of government securities reduces the treasury yield, thus raising the swap spread. For its approximation we use the daily **government bond market turnover**, as other market liquidity indicators are either not available (e.g. on-the-run/off-the-run spread) or cannot be considered sufficiently reliable (bid/ask spread) (Csávás-Erhart, 2005).

In international markets, the **slope of the yield curve** affects the swap spread through mechanisms, the underlying motivations of which are not present in the domestic market (smoothing of corporations' financing costs with interest rate swaps, the effect of changes in economic activity on long yields). However, according to anecdotal information, one of the often applied strategies in the forint interest rate swap market is speculation on changes in the slope of the yield curve, which may even move the swap yields through the demand for and supply of interest rate swaps. For example, an increase in the slope of the yield curve can be exploited with the following combined strategy. For the investor it is worth concluding two swaps, where it pays the fixed leg of the longer-maturity interest rate swap, while receiving the fixed leg of the shorter swap (Chart 3). Consequently, with an increase in the longer interest rate swap yield and a decline in the shorter interest rate swap yield the investor can make a profit. Supply of the fixed leg of the longer-term swap increases, while demand for the fixed leg of the shorter interest rate swap reduces the swap yields belonging to the given maturity.[28] Accordingly, this strategy increases the longer-term swap spread, while reducing the shorter one, as it does not directly affect government bond yields.

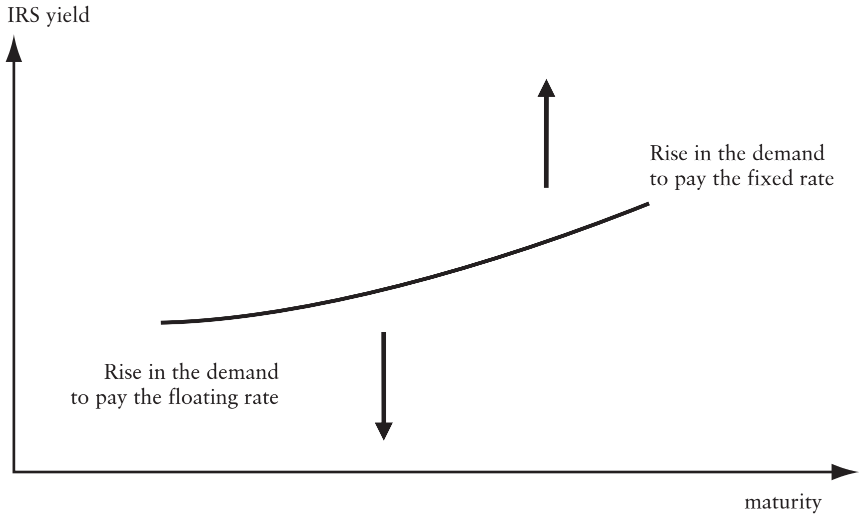
The question is in what periods the application of this strategy can be most typical, and with what variable its presence can be captured. The slope of the yield curve can be suitable for this purpose. If, in parallel with an increase in the slope of the

[28] Although a strategy like this is not delta-neutral, i.e. parallel shifts in the yield curve also influence the value of the position, but it can be managed by taking interest rate swap positions of different quantities with shorter and longer maturities and of different directions, which also moves the two swap yields in a different direction.

yield curve, investors expect it to become even steeper, the coefficient of the slope related to the swap spread is positive in the case of the longer swap and negative in the case of the short one (so it involves some kind of positive feedback trading). If, however, as opposed to the above, an increase in the slope of the yield curve makes market participants bet on a return of the slope to a lower level, opposite coefficients are received (negative feedback). And if the application of this strategy is independent of the actual developments in the slope of the yield curve, an insignificant coefficient can be expected. The impact of this mechanism on the swap spreads can be stronger than in the developed markets, as the volatility of forint long yields is higher than that of major currencies, and betting on the slope of the yield curve can mostly be performed by interest rate swaps, because the short selling of government securities is limited.

Chart 3

Interest rate swap strategy relying on an increase in the slope of the yield curve



In the countries which are to adopt the euro, a popular trading strategy entails speculation on the developments in the forward yield premium relative to the euro; the simplest method of this speculation involves the application of interest rate swaps. For example, an increase in the **5-year forward yield spread 5 years ahead** can be exploited using the following strategy. First, the payment of the floating leg of a 5-year interest rate swap and the payment of the fixed leg of twice as much 10-year interest rate swaps is required. The double multiplier is explained by the fact that the 5-year forward yield 5 years ahead can well be approximated with the difference between the double of the 10-year yield and the 5-year yield (see the Appendix for the deduction). In parallel with this, a position in the opposite direction is required to be taken from euro interest rate swaps.[29] Therefore, compared to the above outlined speculation on the slope of the yield curve, the only difference is that here the underlying asset is not a spread between a longer and a shorter yield, but the difference between the double of the 10-year yield and the 5-year yield. Accordingly, if an investor expects an increase in the 5-year forward spread 5 years ahead, the demand for and supply of swaps have an effect in the direction of an increase in the 10-year swap yield and a decline in the 5-year swap yield (Chart 3). Therefore, the conclusion regarding the positive and negative feedback trading is valid here as well. If investors expect an increase in the forward yield premium when it is on the rise, the coefficient of the 5-year yield spread 5 years ahead relative to the swap spread will be positive at the 10-year swap and negative at the 5-year swap. In the event of negative feedback trading the resulting signs are the opposite. Nevertheless, the application of similar trading strategies is not typical of the major markets, and probably this is the underlying reason why we have not found any example in the empirical literature for the examination of forward yields among the factors affecting the spread.

The aforementioned hypotheses regarding the forint swap spread are summarised in Table 1.

[29] In fact, for this strategy there is no need for interest rate swaps, as at certain market makers it is possible to directly bet on the forward premium. However, the simplest way for market makers to hedge this position is with the combination of interest rate swaps; thus its effect may be indirectly reflected in the shift of swap yields.

Table 1

The expected direction of the effect of variables influencing forint swap spreads

	Expected sign
BUBOR spread	+: affecting through the floating leg of IRS
Maggie A spread	- : if reflecting default risk embedded in IRS +: if reflecting hedge of interest rate risk by IRS
Residents' purchase of government bonds	+: reflecting segmentation between IRS and government bond investors
Auction days	+: affecting through the combination of IRS and government bonds
Auction overbidding	+: if affecting only through the demand for government bonds - : if affecting through the combination of IRS and government bonds
Government bond turnover	+: affecting through the liquidity of government bonds
Slope of the yield curve	- (shorter maturity); + (longer maturity): if reflecting positive feedback + (shorter maturity); – (longer maturity): if reflecting negative feedback
Forward yield spread	- (shorter maturity); + (longer maturity): if reflecting positive feedback + (shorter maturity); – (longer maturity): if reflecting negative feedback

5 Factors affecting the forint interest rate swap spread: empirical analyses

The hypotheses regarding the forint interest rate swap spread outlined in the previous chapter were tested with the help of time series regressions, the main aim of which was to identify the factors which move the spread. We also intend to use the results of the model to examine whether the most typical trading strategies related to interest rate swaps can be detected in developments in the interest rate swap spread. Relying on the major explanatory variables, we are also looking for an answer as to whether it is the swap yield or the treasury yield that better reflects long-term interest rate expectations.

DATA USED

The source of interest rate swap yields is ICAP (earlier Garban-Intercapital), a London-based interdealer broker, also active in the market of interest rate swaps. (The quotations are indirectly from the data base of Thomson Datastream.) For comparability with treasury yields, the 3-, 5- and 10-year maturities are analysed. We compared the swap yields to the par yields calculated from the Svensson yield curve fitted to treasury yields and not to the benchmark government securities yields, in order to avoid the bias stemming from the difference in the yield calculation of the two instruments (see the Annex).[30] Due to the availability of data the swap yields are closing prices, whereas the zero coupon yield curve is calculated from early afternoon data, thus the swap spread can be considered as an approximation.[31] We found the swap yield data reliable from the second part of 2002 on, which is the same time when the interest rate swap market turnover started to increase. From the sample we omitted the most turbulent days, when there were significant changes in yields, which could also bias the value of our swap spread estimations.

As in the case of forint interest rate swaps over one year the floating interest rate is equal to the 6-month BUBOR, the spread between the short interbank and risk-free yields is described by the difference between the 6-month BUBOR and the 6-month treasury yield (hereinafter: **BUBOR spread**). We did not compare BUBOR to the yield of the half-year benchmark government security, but to the 6-month zero coupon yield estimated by the MNB, as the maturity of the 6-month benchmark paper is between 4.5-6 months.

For the approximation of **residents'** government securities demand we used their secondary market government bond purchases, since they buy the majority of government bonds in auctions, and thus their total purchase – including that in the primary market – closely correlates with the auction days, which also constitutes one of the explanatory variables. We used **the cumulated government bond purchase**, assuming that when they do not buy in net terms, it does not have to have an impact on the swap spread. The time series contains both domestic banks' holdings on own accounts and their holdings in custody services for other non-resident participants. Therefore, this time series is as the negative of the cumulated secondary market purchases of non-residents.

The **dummy variable describing auction days** includes the auction days of all long-term government bonds, when its value is 1, and zero on other days. The definition of this variable was motivated by the fact that even though there are auctions when only one paper is issued, most often the Government Debt Management Agency Ltd. (ÁKK) auctions two series. On the other hand, the frequency can be increased by taking all bond auctions into account.

Auction overbidding was quantified in a way that when several papers were auctioned on the same day, total bids submitted were divided by the total amount offered. We include the **change in auction overbidding** in the final model, thus the strong correlation of this variable with auction days can be avoided.

[30] The par yield means the hypothetical yield of a bond, the price of which is 100, and which pays a fixed interest rate at the same intervals with the floating leg of the interest rate swap, with the repayment of the whole notional at the end. The yield to maturity represents the constant yield, discounting with which all the cash flows of the government bond we arrive at the market price of the bond.

[31] A significant change in the yield between the sampling of the two data causes bias in the spread, even if the afternoon change in the yield is the same for the swap and government securities market yields. However, this cannot be a problem in the modelling, as due to this, a noise with an expected value of 0 is added to the actual swap spread, which affects only the standard error of the model, and not the unbiasedness of the parameters.

The **government securities turnover** was calculated on the basis of KELER's (Central Clearing House and Depository Ltd.) data, for all government bonds. This indicator also contains a part of trading among non-residents, as opposed to the turnover performed by domestic primary dealers (see Csávás-Kóczán-Varga, 2006).

The source of the **Maggie A** spread is JP Morgan. This indicates the spread between euro-denominated bonds with average maturity and A rating and ones with AAA rating, expressed in yield (credit index).

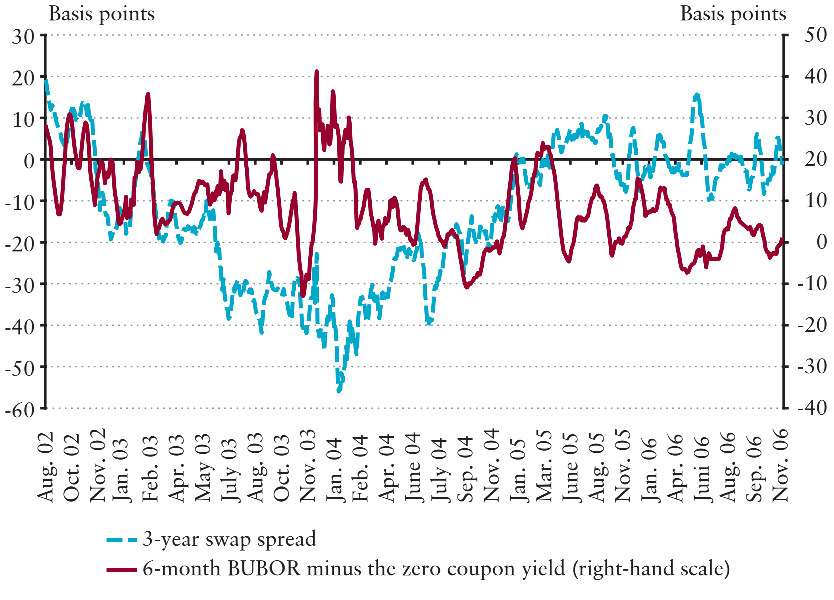
We defined the slope of the forint yield curve as the **yield differential between 10-year and 3-year spot yields**, calculated from the zero coupon yield curves estimated with the Svensson method. Although in the literature usually the differential between a long and a short yield is used (e.g. 10-year and 3-month), this does not cause any significant difference but facilitates interpretation, since we examine the 3-, 5- and 10-year swap spreads. The **5-year HUF/EUR forward spread 5 years ahead** was calculated from forint and euro government securities yields, also using the Svensson yield curve.

DEVELOPMENTS IN SWAP SPREADS

In the last 4-5 years, the 3-year forint swap spread fluctuated within a band 60 basis points wide. Although this fluctuation itself can be considered low in comparison with the level of spot yields, it is still higher than the band in which the euro interest rate swap spread fluctuated in the same period (approx. 20 basis points). This means that the swap spread has a relatively large variability, based on which it is worth examining the factors which influence the spread.

Chart 4

Developments in the swap spread and the BUBOR spread (10-day moving averages)

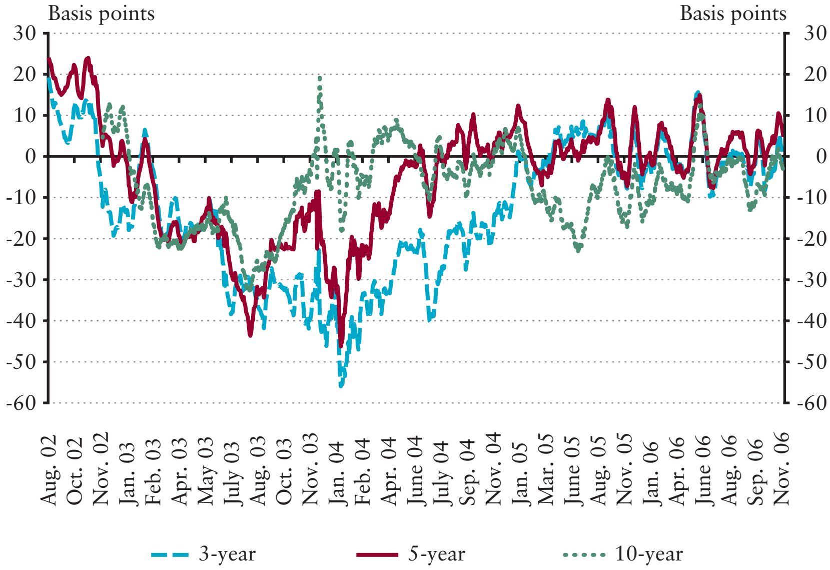


Sources: Thomson Datastream, ICAP, MNB; swap spread calculated from par yields.

We have already indicated that, according to the international literature, the BUBOR spread may be one of the major factors which move the swap spreads. The correlation is obvious: the 3-year swap spread and the 6-month BUBOR spread often move in the same direction, and the latter seems to explain the outliers of the swap spread as well (Chart 4). The BUBOR spread by itself, which is usually greater than zero, would justify a positive swap spread, but the average value of the swap spread is negative. This also indicates that several other factors may move the swap spread.

Chart 5

Swaps spreads with various maturities (10-day moving averages)



Sources: Thomson Datastream, ICAP, MNB; swap spreads calculated from par yields.

In the developed markets, it can be observed in the movements of interest rate swap spreads with various maturities that longer-term spreads are usually higher (Cortes, 2006). The explanation for this is similar to that of the term structure of major market yields: the term premium is higher at longer maturities. This order is often valid for forint interest rate swaps, although in certain cases an opposite order can also be observed (Chart 5). (The average of the 3-, 5- and 10-year swap spreads in the sample is -13, -5 and -8 basis points, respectively.)

Interest rate swap spreads with various maturities usually show a close co-movement, although sometimes movements in opposite directions are also observable. The value of the correlation coefficient between the levels of the 3- and 5-year swap spreads in the whole sample is nearly 0.8, while it is somewhat lower (0.65) between the 5- and 10-year swap spreads. However, the two most distant maturities hardly correlate with one another (0.3). These observations indicate that the information contents of individual swap spreads may be different, so we believe it is worth examining the explanatory factors of all three swap spreads with different maturities.

Later we shall see that major shifts in swap spreads cannot be connected to one factor; swaps spreads are moved by numerous variables together. Our analyses do not focus on the impact of certain events on swap spreads, as that would be made very difficult by the fact that daily changes are rather noisy due to the aforementioned characteristics of the time series. Instead, we strive for general conclusions, which hold true for the whole period under review.

RESULTS OF THE FORINT SWAP SPREAD MODEL

In the course of our empirical examinations, the 3-, 5- and 10-year interest rate swap spreads were analysed separately. The period under review is between August 2002 and November 2006; we used daily-frequency data. For the estimation we used the least squares method, running the regressions on the level of the spreads.[32] (OLS is also the most often used method in the literature, and where the time series properties of the examined variable allow, usually the level of spreads is examined.) For comparability, the same explanatory variables were included into all three models, independent of maturity; only the dependent variables are different. The results are summarised in Table 2.

[32] Based on the Dickey–Fuller and Phillips–Perron tests, it can be rejected that the time series of the spreads and the explanatory variables contain unit root. However, several of the explanatory variables contain trends, which were eliminated by including a trend variable in the model. Due to the autocorrelation of the residual, we used Newey-West standard errors.

Table 2
Results of the swap spread model

Dependent variables: SPREAD 3Y, SPREAD 5Y, SPREAD 10Y
Method: Least Squares
Sample: Aug. 2002 – Nov. 2006
Included observations: 842; 755; 777
Newey–West HAC Standard Errors & Covariance

Variable	SPREAD 3Y	SPREAD 5Y	SPREAD 10Y
BUBOR SPREAD	0.118** (0.017)	-0.079 (0.232)	0.028 (0.584)
MAGGIE A	0.133** (0.032)	-0.123 (0.2149)	0.194** (0.010)
RES. BOND PURCHASE	0.112*** (0.000)	0.076*** (0.000)	0.049*** (0.002)
AUCTION DUMMY	2.835*** (0.006)	1.990* (0.059)	2.550*** (0.006)
AUCTION OVERBIDDING	-0.967*** (0.003)	-1.160*** (0.000)	-0.948** (0.002)
BOND TURNOVER	0.006 (0.485)	0.006 (0.562)	0.017* (0.053)
Slope	0.140*** (0.000)	0.039*** (0.003)	-0.094*** (0.000)
5Y5Y FORWARD SPREAD	0.000 (0.997)	0.046 (0.142)	-0.098*** (0.000)
T	-0.241*** (0.000)	0.044*** (0.000)	-0.071* (0.063)
C	23.72*** (0.002)	21.572* (0.036)	-7.385 (0.448)
R-squared	0.627	0.408	0.263
Adjusted R-squared	0.663	0.401	0.255

*Parameters significant at 10 per cent, 5 per cent and 1 per cent were marked with *, ** and ***, respectively. The meaning of the variables:*

BUBOR SPREAD: the difference between the 6-month BUBOR and the 6-month zero coupon yield; MAGGIE A: the difference between the yields of euro-denominated 'A' and 'AAA' rated instruments; RES. BOND PURCHASE: residents' secondary market cumulated government bond purchase, on deal date; AUCTION DUMMY: the days of government bond auctions; AUCTION OVERBIDDING: the change in auction overbidding on auction days compared to the previous auction; BOND TURNOVER: the daily turnover of forint government bonds, on deal date; SLOPE: 10-year and 3-year forint zero coupon yield differential; 5Y5Y FORWARD SPREAD: the differential between the 5-year forint forward yield 5 years ahead and the euro forward yield; T: linear trend; C: constant. Variables are in basis points and HUF billions.

In the case of the 3-year spread the explanatory power of the model is more than 60 per cent. We could explain 40 and nearly 25 per cent of the fluctuations of the 5- and 10-year spreads, respectively. This is in line with the experience in the literature; on a similar-size daily-frequency sample, Apedjinou (2003) detected a 50 per cent R-squared with regard to the dollar swap spread. The fact that the regression of the 3-year spread has the highest explanatory power may indicate that the swaps around 3 years may be the most liquid. In a less liquid swap market, the fundamentals are less able to influence the swap spread, misalignments may be more frequent and developments in the spread may be noisier (Apedjinou, 2003).

In accordance with our expectations, the sign of the **BUBOR spread** became positive with the 3-year spread. The underlying explanation for the coefficient which is significantly smaller than 1 may be that at the time of concluding the interest rate swaps the floating interest rate payment of the first period, i.e. 6-month BUBOR, is already known. However, the BUBOR spread does not have a significant impact on the 5- and 10-year swap spreads. Our explanation for this is that the first 6 months constitute a relatively small part of swap maturities, thus they affect the interest rate swap yield to a lesser extent.

The coefficient of the **Maggie A** spread became significant and positive in the case of the 3- and 10-year swap spreads. In relation to our previously outlined hypotheses, this confirms that the risk premium has an impact through the developments in global risk appetite and not through the default risk of interest rate swaps. Based on the above, it is probable that, in the event of a decline in investors' risk appetite, non-resident investors that pay the floating leg of interest rate swaps reduce their exposure by using interest rate swaps, thus the increase in the supply of the fixed leg of interest rate swaps raises the swap yields, while it affects government bond yields to a lesser extent.

A positive coefficient was received for **residents'** cumulated **government bond purchases** at the secondary market for all spread maturities. Simultaneously with bond purchases of HUF 10-20 billion, swap spreads increase by 1 basis point. This positive coefficient confirms that feature of the functioning of the market whereby the range of interest rate swap and government bond investors is segmented. Consequently, domestic institutional investors' demand for government securities has a greater effect on swap spreads than that of non-residents, as the latter group is heterogeneous in terms of the application of interest rate swaps (market makers and those non-residents who strive for gain on interest and only trade in swaps). However, this does not mean that it is only residents who move the bond yields. It only means, when non-residents are the price makers, that this is not reflected in the spread or only to a smaller extent, due to the hedging activity of interest rate swap market maker banks.[33]

On average, the swap spread is 2 basis points higher on **auction days** than at other times, for all three maturities. In the previous chapter the relevant explanation for this was that the activity of participants betting on developments in the swap spread may be in the background and they, in addition to government bonds, also buy interest rate swaps, thus moving the two yields in opposite directions. This hypothesis is confirmed by the negative coefficient of auction overbidding received for all three maturities. When **auction bidding** is higher than usual, this strategy may be less typical, thus it is less able to increase swap yields. At the same time it is worth mentioning that these two variables together increase the explanatory power of the model only to a minimum extent, i.e. this trading strategy may not be the most widespread in the interest rate swap market.

The dummy variable reflecting auction days was replaced with the **gross government bond issue**. However, this variable became significant only for one of the maturities. Moreover, as opposed to our expectations, an increase in the supply of government bonds does not reduce, but increases the spread. This is consistent with the explanation we gave for the auction dummy variable. Using the **net issue** we saw that it did not become significant in any case. Consequently, this suggests that the government bond issue does not have a material effect on the swap spread.

The coefficient of the **government bond market turnover** became significant only for the 10-year swap spread. However, its magnitude is very low; a HUF 60 billion increase in turnover (nearly one half of the average turnover) reduces the treasury yield only by 1 basis point relative to the swap yield. The underlying reason may be that, as we have already seen, the swap market and government bond market turnovers move in the same direction.

The **slope of the yield curve** has a negative effect on the 10-year swap spread, but the direction of the impact on the 3-year spread is positive. Of our two earlier alternative hypotheses this corresponds to the one according to which market participants typically bet on a decline of the slope of the yield curve when it rises (negative feedback), and this affects the spreads through the demand for swaps. The sign of the slope of the yield curve became positive for the 5-year interest rate swap as well, but its size in absolute terms is much smaller than for other maturities. Presumably, the underlying reason is that – taking account of investment banks' recommendations – the speculation expecting a shift in the yield curve is typical at both the shorter and longer ends of the 1- and 10-year segments. A maturity around 5 years may be the one which sometimes belongs to the longer and sometimes to the shorter interest rate swaps in the trading strategies expecting a shift in the yield curve, thus their effects on the swap yield may partly offset one another.

In the case of the **5-year forward spread 5 years ahead** compared to the euro we found that the coefficient for the 10-year swap spread is negative, but it did not become significant for the other maturities. However, this is true only for the final model specification. Omitting the non-significant variables from the 5-year spread model, we found that the parameter of the forward spread is positive (0.058) and already significant at 5 per cent.[34] The different direction of the effect related to the 5- and 10-year spreads can be explained with strategies which are similar to those in the case of the slope of the yield curve, and this also suggests some kind of negative feedback trading. However, due to the sensitivity to the omitted variables, this can

[33] This effect could also be detected between daily changes in yields and residents' daily bond purchases at the secondary market for the period when, according to anecdotal information as well, it was the domestic institutional investors who moved the yields (second part of 2004). An effect like this could not be detected for the whole period, probably because at other times the price making role alternates between residents and non-residents.

[34] In the case of the 3-year swap spread the coefficient did not become significant even when the insignificant explanatory variables were omitted.

be considered as weaker empirical evidence than with the explanation for the variables presented earlier. Even if less convincingly, this result confirms the anecdotal information that speculating on the forward yield premium is popular, and may be able to move the swap and treasury yields relative to one another.

Summarising the main results of the model, we can conclude that the forint interest rate swap spreads are influenced by several factors together. Some of them contradict those found in international literature, but can be explained by the peculiarities of domestic markets (e.g. the positive coefficient of the slope of the yield curve for several maturities). On the other hand, our analyses confirm what is written in the part which describes the market, i.e. in terms of the range of investors, the interest rate swap and government bond markets are strongly segmented. Our results also confirm that the trading strategies which profit by the shifts in the slope of the yield curve and in the forward yield premium and use interest rate swaps are not only present, but their magnitude may be able to shift the swap yields. A further motivation for using interest rate swaps is that non-market maker participants with forint exposures hedge their risks with swaps in certain periods.

ROBUSTNESS ANALYSIS

Instead of including the trend variable in the model, we also ran the regressions for the detrended variables; the sign of the estimated parameters did not change, only the significance level of one or two variables declined. Moreover, the explanatory power of the detrended models did not become significantly smaller than the ones examined earlier, i.e. the relatively high R-squared values are not caused by the use of the trend variable.

We also examined whether the decomposition of the whole sample into sub-samples results in any change. The sample of nearly 800 elements was divided into 2, then 3 equal parts. The sign of the parameters usually did not change, although several variables lost their significance. This may have been caused by the smaller size of sample, so this does not really affect what is described above either. (Only the sign of the Maggie A changed to negative, but even that in only one of the sub-samples, and only in the regression of the 3-year swap spread.) Moreover, certain variables, such as the government securities market turnover, became even more significant.

We indicated earlier that the difference between the par yield and the yield to maturity shows the spread in a biased way, if the benchmark yield is deducted from the swap yield. The result of replacing the dependent variables with the spreads calculated as described above was that several explanatory variables lost their significance, although the main conclusions remained unchanged.

Structural breakpoint tests revealed that there could be breaks in the sample, and the values of parameters might have varied over the time, but because the measure of the coefficients of variables was not used when interpreting the parameters, this does not affect our earlier conclusions.

Another methodological problem may be that several – 11 in total – explanatory variables were used, which may involve the danger of multicollinearity, impeding the ceteris paribus interpretation of coefficients. However, examining the correlations by pairs between independent variables, we found that it is below 0.2 in the case of most variable pairs, and there are only 3 variables between which it reaches the 0.4 correlation coefficient. On the other hand, we did not see any sign of the typical symptoms of strong multicollinearity, and omitting the most important variables did not change the signs of the remaining variables.

As significant autocorrelation remained in the residuum, instead of HAC standard errors we also examined the model with the inclusion of autoregressive terms. This did not affect the robustness of the results either; the sign of significant variables remained unchanged. Another way of eliminating autocorrelation involves the differentiation of variables. As the one-day change in variables resulted in a very noisy time series, we ran the model for one-week frequency as well, though we did not experience a turn of signs in this case either.

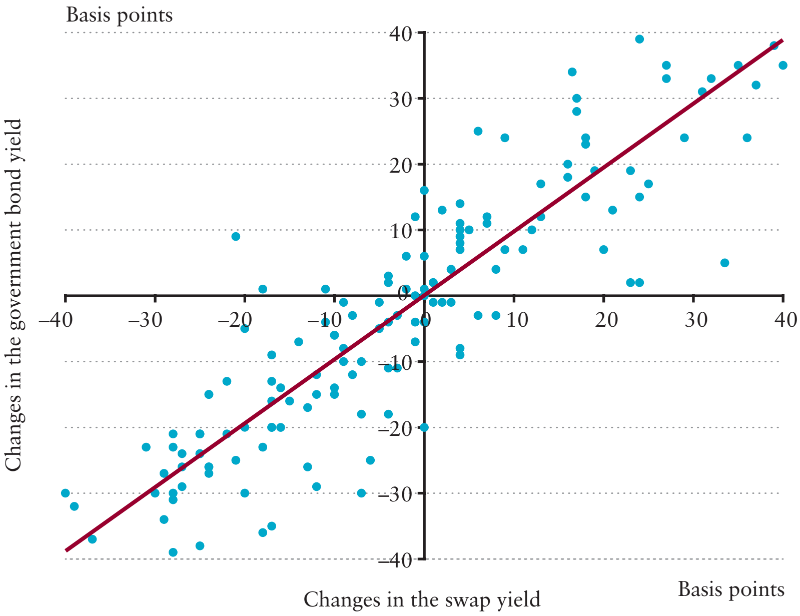
6 Application of the interest rate swap yields

INTEREST RATE SWAP AND GOVERNMENT BOND YIELDS: WHICH ONE IS WORTH LOOKING AT?

So far we have only examined the difference between interest rate swap and government bond yields, but it is worth studying the developments in these two yields separately. The correlation coefficient between both the levels of yields and the changes in yields in 1 week is high, above 0.9. However, comparing the changes in the two types of yields during one week we observed that their values are often much different, and sometimes shifts in opposite directions can also be observed (Chart 6).[35] Therefore, we consider it important to examine which yield can be considered more reliable and which one may reflect yield expectations better when yield changes in the two markets have different magnitudes and/or different directions.

Chart 6

Weekly changes in 3-year swap and government bond yields (Aug. 2002-Nov. 2006)*



** Par swap yields and benchmark government securities yields. Shifts exceeding 40 basis points are omitted from the sample to eliminate turbulent periods of time.*

In general, the question can also be raised whether the interest rate swap market or the government bond market can be considered more important in terms of the developments in prices. We have already indicated earlier that not only the changes in the demand and supply factors of the interest rate swap market may pass through to the government bond market, but many times an impact of the opposite direction may also be typical. However, for a direct testing of this, government bond market and interest rate swap market order flow data (by types of participants) would be needed, which are not available to us. Nevertheless, to answer the question, we can use the results of the regressions presented in the previous chapter.[36]

On the one hand, interest rate swap and government bond yields are connected by yield expectations, through the pricing of the two instruments. If long-term treasury yields increase, while the expected BUBOR spread remains unchanged, the interest rate swap yield of the same maturity may also increase, even without significant trading in the two markets. However, we saw from the above that the demand for and supply of government bonds and interest rate swaps may be able to divert the two

[35] This partly may be caused by the different intraday sampling, although based on the information available to us it cannot be decided how much it explains. However, by choosing the 1-week frequency the above problem can somewhat be reduced.

[36] Another possible way to test it indirectly is to examine whether it is typical of the time-series developments in forint interest rate swap yields and treasury yields if one of them precedes the other. We examined this on the basis of available daily data using a simple method, the so-called Granger causality test, for the entire sample period. The Granger causality tests detected a two-way relationship, which does not contradict the above.

yields from one another. We examined which factors are responsible for the majority of the explanatory power of regressions. These are government securities purchases by residents, the Maggie A spread, the slope of the yield curve and the 5y/5y forward spread, which together account for more than 95 per cent of the total R-squared. Consequently, the question is which of the demand-supply factors behind these variables may be related to government securities market expectations and which ones to swap market yields expectations.

The significance of the forward premium and the slope of the yield curve suggests the presence of strategies betting on future shifts of certain structure in yields with the help of interest rate swaps. As the impact of these strategies appears directly only in the interest rate swap yields and not in the treasury yields, this allows a conclusion that when these factors have an effect there is a part of the change in swap yields which carries additional information compared to government bond yields. This conclusion is confirmed by our interpretation of the Maggie A variable, according to which it may reflect the hedging of interest rate risk with interest rate swaps, which is reflected only in the swap yields and not (or only partly) in treasury yields, although there may be expectations of a yield increase in the background. However, what follows from the explanation of residents' government securities purchases is that in this case only the demand/supply factors affecting the government bond market are reflected in the spread, i.e. in this case it is the government bond yields that carry additional information. Consequently, we may say that **in certain periods it is the swap yields**, **while at other times it is the government bond yields that may reflect long-term yield expectations better**. Therefore, it is worth following the developments in yields in both markets, and only based on a detailed analysis of the reasons underlying the changes in yields is it possible to decide which type of yields can be considered more reliable under the given market conditions.

YIELD CURVE ESTIMATION

The most important objective of the use of yield curves by central banks is the estimation of market expectations with regard to short and long yields. Of the central banks having more developed markets than the forint market, the Bank of England uses two yield curves to estimate interest rate expectations (Brooke et al., 2000). On the one hand, fitting the treasury yields and the repo market yields they produce a risk-free yield curve, which accurately approximates short-term yields as well, and on the other hand, using the interbank yields (interbank uncovered, futures and FRA yields, the yields of both overnight and 6-month indexed transactions in the case of interest rate swaps) a **Bank Liability Curve** is generated. However, the forward yields derived from the two yield curves may provide a biased estimate of the central bank interest rate expected by the market from a number of aspects. First, forward yields contain term premium. Second, there are differences between the credit risk premiums of different assets. Third, premiums may also be different depending on the liquidity of the given market. In addition, there may be differences between the characteristics of the policy instrument and market instruments (e.g. in eligible securities, or replaceability in the event of the use of repo). If estimates can be given for these biasing factors, it is also possible to directly compare the two types of yield curves.

At present, the MNB estimates one type of yield curve on the basis of government securities market quotations by fitting the Svensson zero coupon yield curve. Interbank yields are used separately, producing separate estimates from the instruments with different maturities, taking into account that earlier the liquidity of these instruments lagged behind that of the government securities market. Therefore, at present the MNB uses the swap yields as well only indirectly: from the 5-year HUF/EUR forward spread 5 years ahead conclusions can be drawn regarding market expectations concerning the expected date of joining the euro area (see the next subchapter). In the market of forint interest rates, of the above mentioned instruments, the Bank Liability Curve, the use of which may be advantageous for several reasons, can be produced with the help of the BUBOR and the FRA quotations in the case of short maturities, and by using the interest rate swap yields in the case of longer maturities.

In the case of short yields (FRA), on the one hand, much more data points are available than in the case of treasury yields. The underlying reason is that in the domestic market repo yields are not yet available, due to the low turnover and relative under-development of the repo market. Therefore, the short end of the government securities market yield curve – which is mainly fitted on treasury bill yields – relies on relatively few data points. On the other hand, the liquidity of treasury bills is relatively low, while the FRA market can be considered more liquid, and in the case of publicly available quotations the FRA bid-ask spreads are significantly lower. With swaps this is also an advantage: in the swap market, the typical bid-ask spread is 10 basis points, while in the government securities market, in the case of stock exchange quotations it is 40 basis points on average. Combining the swap, FRA and BUBOR data, the number of maturities reaches the treasury yields, thus the Bank

Liability Curve can cover a wide range of maturities, probably with less uncertainty than the treasury yield curve, due to the low bid-ask spreads. Accordingly, it is easier to identify a shift in expectations if the two types of yield curve are used together.

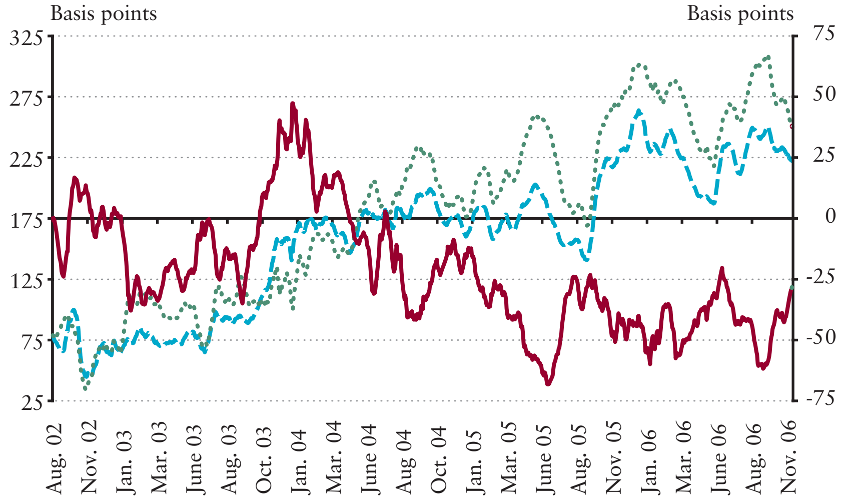
LONG-TERM FORWARD YIELD SPREADS

One of the possibilities of using the information content of the yield curve involves the calculation of long-term forward yield spreads. An indicator like this, also popular among market participants, is the 5-year HUF/EUR forward spread 5 years ahead **(5y/5y forward spread).** This indicator reflects, inter alia, the credibility of economic policy and the probability of adopting the euro.

Similarly to yield curves, there are several ways to derive the 5y/5y forward spread. Besides treasury yields, it can be calculated from Bank Liability Curves as well, published for example by Reuters, which, in accordance with what was mentioned in the previous chapter, uses the yields of short-term interest rate derivatives and interest rate swaps for the estimation. We compared the value of the 5y/5y spread published by Reuters with the 5y/5y spread calculated from the zero coupon yields fitted by the MNB (hereinafter **swap market** and **government securities market 5y/5y forward spreads.**) It is common in the two types of yield curve that both are zero coupon yield curves, thus their values are comparable with one another. However, there is a difference: Reuters estimates the yield curve with a spline method, while the MNB uses the Svensson yield curve. Nevertheless, based on our analyses, this cannot cause a systematic difference between the two 5y/5y forward spreads.[37]

Chart 7

5y/5y forint-euro spread calculated in two ways (10-day moving averages)



The swap market and government securities market 5y/5y forward spreads move closely together; between both their levels and the changes in yields during 1 week the correlation coefficient was 0.95 (Chart 7). Nevertheless, a more detailed analysis of the difference between the spreads calculated in two ways is important for two reasons. On the one hand, the difference between the spreads fluctuated within a very wide band of more than 100 basis points in the period under review. The magnitude of the difference is well perceptible if, instead of comparing the nominal values of the spreads, with the help of the forward yield curves we prepare an estimate regarding the date of the adoption of the euro expected by the market (more precisely, priced in the yield curve). We found that in the period under review **a 1-year shift in the expected date of**

[37] We examined this hypothesis indirectly, without comparing the two types of yield curve fittings. We examined the relationship between the par swap yields available to us and the points of the interbank yield curve fitted by Reuters. Although we found differences, they do not move together with the difference between the 5y/5y forward spreads calculated in two ways, thus the error stemming from the difference in fitting may be negligible.

adopting the euro is consistent with a 40-50 basis point increase in the 5y/5y forward spread. This can be considered very high, as a shift of this size in the expected date of joining the euro area usually takes place in such a short time only as a result of some kind of fundamental shock.

On the other hand, although in the past there was no major difference between the dynamics of the spreads calculated in the two ways, this may change in the future. Soon we shall see that the difference between the swap market and government securities market spreads is related to the interest rate swap spread. If the 5y/5y forward spread declines as the date of adopting the euro approaches, while, due to the activity of the swap market, the difference between the spreads calculated in two ways is expected to fluctuate within a similarly wide band as in the past, there is greater chance that the two indicators will move in opposite directions. Then the question already mentioned in connection with the swap spreads arises: Which forward yield may reflect expectations more accurately?

Of the two indicators, market participants typically use the interest rate swap market 5y/5y forward spread. In addition to easier availability, they may be motivated by the fact that it is possible to trade in this instrument directly. At the same time, there is trading in the 5- and 10-year government bonds as well, although to a lesser extent than in the segment around 3 years, and due to this bond market participants' forward yield expectation appears in the relationship of the yields of the two maturities as well. However, we have no information about the magnitude of the trade in the 5y/5y swap market forward spread. Consequently, the fact by itself that this is a tradable instrument does not justify the conclusion that the interest rate swap market yield spread is the more informative indicator under any circumstances.

WHY IS THE FORWARD YIELD SPREAD OF GOVERNMENT SECURITIES MARKET DIFFERENT FROM THAT OF THE INTEREST RATE SWAP MARKET?

In order to obtain an answer to the above question, we examined which factors influence the difference between the swap and government securities 5y/5y spreads. This difference can be decomposed as follows (for the deduction, see the Appendix):

The 5x5 symbol indicates the 5-year forward yield 5 years ahead, r is the spot yield, the upper indices represent the currency

$$\left(5x5_{SWAP}^{HUF}-5x5_{SWAP}^{EUR}\right)-\left(5x5_{GB}^{HUF}-5x5_{GB}^{EUR}\right)\approx\left(2\cdot r_{10,SPREAD}^{HUF}-r_{5,SPREAD}^{HUF}\right)-\left(2\cdot r_{10,SPREAD}^{EUR}-r_{5,SPREAD}^{EUR}\right)$$

(HUF, EUR), while the lower index indicates the maturity in years (5, 10) and the relevant instrument (swap, government security, swap spread). Accordingly, the difference between the 5y/5y forward spreads calculated in two ways depends on 4 factors: the 5- and 10-year forint and euro interest rate swap spreads. It can be proved that this expression in fact is nothing else but the approximate value of the difference between the forint and euro 5-year **forward interest rate swap spreads** 5 years ahead (see the Appendix).

Therefore, the difference between the 5y/5y forward spreads calculated in two ways depends both on forint- and euro-specific factors. With regard to the period under review, we carried out a decomposition, during which we found that the difference was most often influenced by the forint swap spreads, while the euro swap spreads had a much lesser impact (Chart 8). Therefore, in the following we are looking for an answer to the question of what it is that influences the forward forint swap spread (i.e. the difference between the double of the 10-year interest rate swap spread and the 5-year interest rate swap spread).

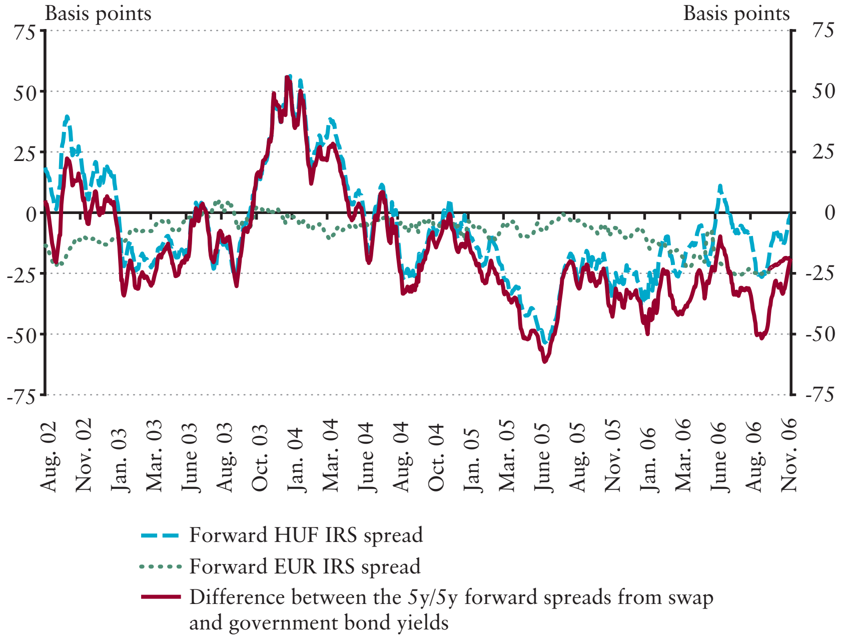
Based on the analyses by Cortes (2006), the difference between interest rate swap spreads of different maturities is influenced by the same factors as the swap spreads themselves. Starting from this, as the forward interest rate swap spread can also be looked at as a difference between spreads with different maturities, we assumed that the forint forward swap spread can be explained with the same variables which we presented earlier.[38] Accordingly, the dependent variable is the difference between the double of the 10-year interest rate swap spread and the 5-year interest rate swap spread, whereas the explanatory variables are the same as in the previous chapter, and the period under review is also the same.

[38] For the analysis we did not use the zero coupon yields, in contrast with the above charts, but the par interest rate swap spreads. Although the zero coupon and the par yields are not identical, this does not affect the dynamics of the time series, and its advantage is that in this way we can compare our results with the regressions described earlier.

Chart 8

Decomposition of the difference between the 5y/5y forint-euro spreads calculated in two ways

(10-day moving averages)



The chart shows the forward euro interest rate swap spread multiplied by minus 1, thus the sum of the two time series constitutes the difference between the spreads calculated in two ways.

Table 3

Results of the forward interest rate swap spread model

Dependent Variable: 2x10Y SZPRED - 5Y SZPRED
Method: Least Squares
Sample: Aug. 2002–Nov. 2006
Included observations: 743
Newey-West HAC Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BUBOR SPREAD	0.122*	0.066	1.853	0.064
MAGGIE A	0.421***	0.098	4.282	0.000
RES. BOND PURCHASE	0.003	0.020	0.145	0.885
AUCTION DUMMY	2.957***	1.051	2.813	0.005
AUCTION OVERBIDDING	-0.712*	0.367	-1.942	0.053
BOND TURNOVER	0.022*	0.010	2.221	0.027
SLOPE	-0.219***	0.017	-12.696	0.000
5Y5Y FORWARD SPREAD	-0.024***	3.300	-7.136	0.000
T	0.073	0.049	1.484	0.138
C	-40.572***	12.845	-3.159	0.002
R-squared	0.550	F-statistic		104.440
Adjusted R-squared	0.545	Prob. (F-statistic)		0.000

*Parameters significant at 10 per cent, 5 per cent and 1 per cent were marked with *, ** and ***, respectively. The meaning of the variables is the same as in Table 2.*

The results are very similar to those seen with the 10-year swap spread, but the explanatory power became much higher (Table 3). Three of the 4 significant variables which provided most of the explanatory power in the regressions of the swap spreads are the same again, and their signs are the same, too (Maggie A spread, slope of the yield curve, 5y/5y forward spread).

However, a major difference is that the domestic government bond purchase lost its significance. This was the only variable which indicated that the demand/supply shocks to the government bond market may also divert the swap and treasury yields form one another. The other 3 variables, in turn, reflect factors behind which there are trading strategies that may be related to the use of interest rate swaps, and which influence the difference between the 5y/5y forward spreads calculated in two ways. Consequently, **the 5y/5y forward spread calculated from the swap yields may better reflect future yield expectations than the one calculated from treasury yields.** Thus, in the periods when the model is able to explain most of the difference, the dynamics of the spread calculated from the swap yields may include additional information on long-term yield expectations compared to that of the government securities market. Accordingly, this conclusion is different from what was said of the spot swap yields, where we saw that in certain periods it is the swap yields, while at other times it is the government bond yields that may better reflect long-term yield expectations.

The interpretation of explanatory variables is also similar to the earlier regression; of them only the forward yield spread is discussed in more detail now. In line with the above, the negative coefficient received for the 5y/5y forward spread may reflect the fact that market participants typically bet on a decline in the 5-year forward spread 5 years ahead when it is on the rise (negative feedback; the correlation can also be observed in Chart 7). Presumably, the underlying explanation is that the forward spread followed a rising trend during the period under review as a whole, but there may have been participants who expected a decline in the spread sooner or later, and thus, stemming from the demand for and supply of swaps, the 5y/5y forward spread calculated from the swaps usually increased to a lesser extent than that of the government securities market.

A further difference between the spreads calculated in two ways is caused by the fact that with the adoption of the euro the value of the earlier transacted forint interest rate swaps will be equal to that of euro interest rate swaps of the same parameters. The underlying reason is that, in accordance with the practice of the countries which joined the euro area earlier, BUBOR will most probably be replaced by EURIBOR. However, due to the higher default and liquidity risks, treasury yields are expected to exceed euro yields. This factor by itself justifies a negative forward interest rate swap spread. However, this is able to explain only a very small part of the difference, as in euro area countries which currently have the worst ratings (Greece, Italy) treasury yields are only 10 basis points above the euro yield curve. In any case, this is another argument for using swap yields: when estimating the expected date of the adoption of the euro there is no need for assumptions regarding the size of the premium of Hungarian government securities compared to euro yields after the adoption of the euro.

7 Conclusions

Approximately 70-80 per cent of the estimated daily average turnover of HUF 120-250 billion of the forint interest rate swap market is between non-resident market participants, and the centre of the market is in London. Almost all major London-based investment banks are present in the market, although only some of them can be considered real market makers. The domestic market is highly concentrated and most of the turnover of commercial banks is with their non-resident partners, mainly foreign banks.

Similarly to global trends, the bigger part of the forint interest rate swap market turnover is related to taking and managing speculative interest rate positions. On the one hand, the main underlying reason is that with the help of interest rate swaps it is possible to take an interest rate position without involving any significant credit risk. On the other hand, compared to government bonds, interest rate swaps are much more flexible instruments with lower transaction costs, and with them it is much easier to open a short interest rate position utilising the increase in the interest rate level and to close long interest rate positions taken earlier. Due to these favourable characteristics, in the forint interest rate swap market mainly hedge funds and other non-resident investors are active, striving for short-term gain on interest rates. Typically, they do not buy forint government bonds, while domestic institutional investors and non-resident real money investors that traditionally invest in the government securities market practically do not conclude interest rate swap transactions. Nevertheless, there is a close relationship between the forint interest rate swap market and the forint government bond market, which is attributable to the interest rate swap market makers that hedge their net open interest rate swap positions with government bond transactions.

The 3-, 5- and 10-year forint interest rate swap spreads are under the common influence of several factors. Some of these are different from those found in international literature, but they can be explained by the peculiarities of the domestic markets. Nevertheless, our analyses confirm that the interest rate swap and government securities markets are strongly segmented in terms of the range of investors. However, we succeeded in rejecting the hypothesis that interest rate swap market makers' credit risk significantly affects swap spreads. Trading strategies, which are widespread according to anecdotal information and are built on interest rate swaps undertaken with the expectation of changes in the slope of the yield curve and in forward yields, can be detected in the developments in interest rate swap spreads. Although in terms of their levels treasury yields and swap yields move very closely together, in terms of changes shifts of different sizes can also be observed. From the interpretation of the explanatory variables we came to the conclusion that in certain periods it is the swap yields, while at other times it is the government bond yields that may better reflect long-term yield expectations. Accordingly, it is easier to identify the shift in expectations using the yields (or yield curves fitted on them) from the two markets together.

The dynamics of the 5-year HUF/EUR forward spreads 5 years ahead calculated from the swap yields and the treasury yields are practically the same, although often there is a considerable difference between their levels. The variables of our swap spread model are able to explain most of this difference as well, and they confirmed that the 5y/5y forward spread calculated from the swap yields may generally reflect future yield expectations better than the government securities market spread.

8 Annex

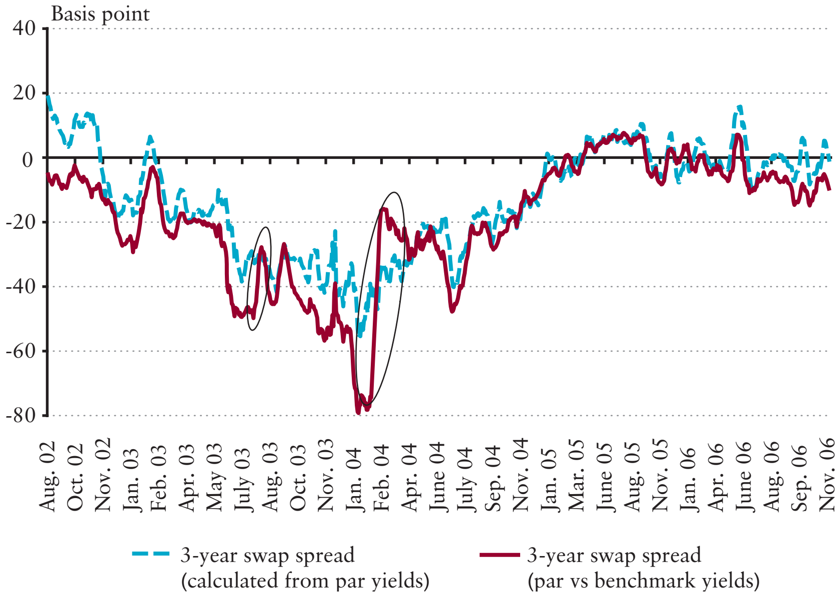
CALCULATION OF THE FORINT INTEREST RATE SWAP SPREAD

The easiest way to derive the forint interest rate swap spread is to deduct from the fixed yield of interest rate swaps the yield of the benchmark government security of the same maturity. However, interest rate swaps are quoted in the form of par yields, whereas the yield of benchmark government securities is calculated as a yield to maturity. In order to make the yields of interest rate swaps and bonds comparable, the same calculation methodology has to be applied, for which either an interest rate swap or a treasury yield curve is needed. In this study, the treasury yield curve estimated by the MNB with the Svensson method was used and converted into par yields. Deducting it from the swap yield resulted in the interest rate swap spread.

Chart 9

3-year interest rate swap spread calculated in two ways

(10-day moving averages)



Sources: Thomson Datastream, ICAP, MNB. When calculating the par government bond yield it was taken into account that in the case of forint interest rate swaps the fixed leg is paid annually, while the floating one is paid semi-annually.

The difference between the forint swap spreads calculated in two ways can be presented through the example of the 3-year maturity. In one of them we deducted the par yield and in the other we deducted the benchmark government bond yield from the interest rate swap yield (Chart 9). The most significant differences stem from the fact that the residual maturity of benchmark bonds changes, while that of swap yields is unchanged. Due to the significant inversion of the yield curve in July 2003 and February 2004, when the benchmark change took place, the extension by nearly half a year of the maturity resulted in a significant fall in the benchmark yield, and this is why the swap spread relative to the benchmark yield jumped up, which would be a biasing factor from an analysis point of view. Compared to that, smaller changes in the dynamics of the two time series were caused by the fluctuations of the residual maturity of the 3-year benchmark bonds between 2.5 and 3.25 years during the period under review. Minor differences in level are explained by the fact that the magnitude of the yield to maturity also depends on the nominal interest rate of the bond, whereas the par yield is not affected by that.

9 Appendix

The difference between the 5-year HUF/EUR forward spreads 5 years ahead calculated from the swap yields and from the treasury yields can be expressed as follows (see Chapter 6 for a key to the signs used):

$$\left(5x5_{SWAP}^{HUF} - 5x5_{SWAP}^{EUR}\right) - \left(5x5_{GB}^{HUF} - 5x5_{GB}^{EUR}\right) = \left\{\left[\sqrt[5]{\frac{\left(1+r_{10,SWAP}^{HUF}\right)^{10}}{\left(1+r_{5,SWAP}^{HUF}\right)^{5}}} - 1\right] - \left[\sqrt[5]{\frac{\left(1+r_{10,SWAP}^{EUR}\right)^{10}}{\left(1+r_{5,SWAP}^{EUR}\right)^{5}}} - 1\right]\right\} -$$

$$\left\{\left[\sqrt[5]{\frac{\left(1+r_{10,GB}^{HUF}\right)^{10}}{\left(1+r_{5,GB}^{HUF}\right)^{5}}} - 1\right] - \left[\sqrt[5]{\frac{\left(1+r_{10,GB}^{EUR}\right)^{10}}{\left(1+r_{5,GB}^{EUR}\right)^{5}}} - 1\right]\right\} = \left\{\left[\frac{\left(1+r_{10,SWAP}^{HUF}\right)^{2}}{1+r_{5,SWAP}^{HUF}} - 1\right] - \left[\frac{\left(1+r_{10,SWAP}^{EUR}\right)^{2}}{1+r_{5,SWAP}^{EUR}} - 1\right]\right\} -$$

$$\left\{\left[\frac{\left(1+r_{10,GB}^{HUF}\right)^{2}}{1+r_{5,GB}^{HUF}} - 1\right] - \left[\frac{\left(1+r_{10,GB}^{EUR}\right)^{2}}{1+r_{5,GB}^{EUR}} - 1\right]\right\} \approx$$

$$\left[\left(2\cdot r_{10,SWAP}^{HUF} - r_{5,SWAP}^{HUF}\right) - \left(2\cdot r_{10,GB}^{HUF} - r_{5,GB}^{HUF}\right)\right] - \left[\left(2\cdot r_{10,SWAP}^{EUR} - r_{5,SWAP}^{EUR}\right) - \left(2\cdot r_{10,GB}^{EUR} - r_{5,GB}^{EUR}\right)\right] =$$

$$\left[\left(2\cdot r_{10,SWAP}^{HUF} - 2\cdot r_{10,GB}^{HUF}\right) - \left(r_{5,SWAP}^{HUF} - r_{5,GB}^{HUF}\right)\right] - \left[\left(2\cdot r_{10,SWAP}^{EUR} - 2\cdot r_{10,GB}^{EUR}\right) - \left(r_{5,SWAP}^{EUR} - r_{5,GB}^{EUR}\right)\right] =$$

$$\left(2\cdot r_{10,SPREAD}^{HUF} - r_{5,SPREAD}^{HUF}\right) - \left(2\cdot r_{10,SPREAD}^{EUR} - r_{5,SPREAD}^{EUR}\right)$$

The 5-year forward forint swap spread 5 years ahead can be approximated as follows:

$$\left(5x5_{SWAP}^{HUF} - 5x5_{GB}^{HUF}\right) = \left[\sqrt[5]{\frac{\left(1+r_{10,SWAP}^{HUF}\right)^{10}}{\left(1+r_{5,SWAP}^{HUF}\right)^{5}}} - 1\right] - \left[\sqrt[5]{\frac{\left(1+r_{10,GB}^{HUF}\right)^{10}}{\left(1+r_{5,GB}^{HUF}\right)^{5}}} - 1\right] =$$

$$\left[\frac{\left(1+r_{10,SWAP}^{HUF}\right)^{2}}{1+r_{5,SWAP}^{HUF}} - 1\right] - \left[\frac{\left(1+r_{10,GB}^{HUF}\right)^{2}}{1+r_{5,GB}^{HUF}} - 1\right] \approx$$

$$\left(2\cdot r_{10,SWAP}^{HUF} - r_{5,SWAP}^{HUF}\right) - \left(2\cdot r_{10,GB}^{HUF} - r_{5,GB}^{HUF}\right) =$$

$$\left(2\cdot r_{10,SWAP}^{HUF} - 2\cdot r_{10,GB}^{HUF}\right) - \left(r_{5,SWAP}^{HUF} - r_{5,GB}^{HUF}\right) =$$

$$2\cdot r_{10,SPREAD}^{HUF} - r_{5,SPREAD}^{HUF}$$

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