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Analysing currency risk premia in the Czech Republic, Hungary, Poland and Slovakia

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(Árfolyam-kockázati prémiumok Csehországban, Magyarországon, Lengyelországban és Szlovákiában)

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Contents

Abstract

The paper estimates currency risk premia for the Czech Republic, Hungary, Poland and Slovakia. Three different approaches are applied: a constant premium approach based on rational expectations, while time-varying premia are estimated with a method using financial market analysts' surveys and also with a Kalman filter technique. A novelty in this paper is a crosscheck based on the three different approaches applied and also making use of implied and historical volatilities. The results highlight the importance of such a crosscheck: in the case of the Czech and the Slovak koruna and the Polish zloty this exercise reveals severe problems with the results, which otherwise would not have been discovered. On the other hand, the estimation methods produce convincing results for the Hungarian forint. The estimated Hungarian premium series reflect the major events that intuitively may have shaped currency risk in the country. A possible reason for these findings is a high signal-to-noise ratio in the case of Hungary where the risk premium has been large and exhibited substantial shifts through time. Finally, the strong comovement of the premium series obtained with the Kalman-filter and the survey data for the Hungarian forint also indicates that the survey expectations are largely in line with both the risk-premium-extended UIP and the rational expectations hypothesis, which is theoretically important as the UIP relates exchange rate expectations to the interest rate differential.

JEL: C30, C42, F31, G15.
Keywords: risk premium, exchange rate, Kalman filter, survey data.

Összefoglalás

A tanulmány az árfolyam-kockázati prémiumok alakulását vizsgálja Csehországban, Magyarországon, Lengyelországban és Szlovákiában három különböző módszertan segítségével: egy időben állandó prémiumot feltételezve a racionális várakozások hipotézise alapján, míg az időben változó prémium becslése egyrészt pénzpiaci elemzői várakozások alapján, másrészt az ún. Kalman-szűrő módszerét alkalmazva történik. A korábbi kutatásokhoz képest újdonság, hogy a tanulmány összeveti a különböző módszerek által adott eredményeket egymással, valamint implikált és historikus volatilitásokkal. Az eredmények alátámasztják ennek fontosságát: a cseh és a szlovák korona, valamint a lengyel zloty esetében az összehasonlítás komoly problémákat mutat az eredményeket illetően, amelyek egyébként nem kerültek volna napvilágra. Ugyanakkor a különböző becslési módszerek meggyőző eredményeket mutatnak a magyar forint esetében. A becsült magyar prémium idősor visszatükrözi a főbb eseményeket, amelyek intuitív módon alakíthatták a kockázati prémium alakulását. Ezen eredmények egy lehetséges magyarázata a magas jel/zaj arány a magyar esetben, mivel itt a kockázati prémium időben nagy mozgásokat mutatott. Végül, a Kalman-szűrővel kapott prémium idősor szoros együttmozgása az elemzői várakozásokkal azt is jelzi, hogy az elemzői várakozások nagyrészt összhangban vannak mind a kockázati prémiummal kiegészített fedezetlen kamatparitás (UIP), mind pedig a racionális várakozások hipotézisével. Ez elméleti szempontból fontos, mivel a UIP az árfolyam-várakozásokat a tényleges kamatkülönbözetekhez rendeli hozzá.

1 Introduction

The paper estimates currency risk premia in four emerging European economies: the Czech Republic, Hungary, Poland and Slovakia. Risk premia in the foreign exchange markets have received a lot of attention in the economic and financial literature. Besides the theoretical implications of the existence of risk premia regarding the failure of the hypothesis of the forward rate being an unbiased predictor of the future spot rate, it also has important practical repercussions for financial market analysis especially in emerging market economies.

In the case of a constant risk premium, the traditional uncovered interest rate parity (UIP) condition fails i.e. positive interest rate differentials are not associated with identical currency depreciations. In addition, a time-varying risk premium in a risk-premium-extended UIP framework leads to variations in the interest rate and exchange rate. The presence of premia also distorts market-based information on expectations of future exchange rate movements as the forward rate will not be an unbiased predictor of the future exchange rate. As currency uncertainty in emerging economies can be substantial and rather volatile with sizeable repercussions on the prices of financial assets, financial markets and central banks have a great interest in analysing the evolution of the risk premium. Furthermore, currency risk, risk premium and the associated volatility are very important factors on the road towards adopting the euro which is to be completed by all of these countries (see e.g. Orlowski, 2004 and Csajbók and Rezessy, 2006).

The most common starting point to model currency risk premium is the afore-mentioned UIP condition. According to the UIP, financial market arbitrage should ensure that the yield offered by an asset denominated in one currency should differ from that of a similar asset denominated in another currency only by the expected change in the exchange rate assuming agents are risk neutral. If, on the other hand, agents do care about the riskiness of assets, they may demand additional compensation for holding riskier assets. Taking this into account, a risk-premium-enhanced version of the UIP can be written as follows:

$$(i_{t,k} - i^*_{t,k}) = (E(s_{t+k}) - s_t) + \rho_t \qquad (1)$$

where $i_{t,k}$ and $i^*_{t,k}$ are the home and foreign interest rate, $E(s_{t+k})$ is the log of the expected exchange rate k periods ahead expressed per one unit of foreign currency, s_t is the log of the spot exchange rate and ρ_t is the risk premium term.

Empirical tests of the UIP condition relying usually on the theory of rational expectations reject the validity of the hypothesis with an estimated negative relationship between the expected exchange rate changes and the interest rate differential. While most studies assume rational expectations and use realised spot data to proxy the expected exchange rate, some find a positive relationship using survey forecasts to replace the rational expectations hypothesis (see for instance Froot and Frankel, 1989 or Cavaglia, Verschoor and Wolff, 1994, Chinn and Frankel 1994 and 2002). In fact, Chinn (2006) finds that it is difficult to reject the UIP hypothesis using survey data. See Sarno and Taylor (2002) or Isard (2006) or Chinn (2006) for a recent review of the empirical literature. The most common explanations to the failure of UIP include time-varying risk premia, the issue of simultaneity which severely biases the regression results, the lack of rational expectations, transaction costs and peso problems. While it is probable that the concept of the risk premium is in itself insufficient to explain the magnitude of the failure of the unbiasedness hypothesis (Engel, 1996), there seems to be an agreement that it is an important phenomenon. As noted above, this is especially the case for emerging countries.

The estimation of the risk premium is surrounded by a great amount of uncertainty since it is an unobservable variable. For this reason, the paper applies three different approaches and does a crosscheck of the methods to analyse the robustness of the results. Previous work on the estimation of risk premia usually relied on one specific method, but the empirical results of this paper highlight the importance of applying several methods and comparing the results, as substantially different results cast doubt on their reliability.

The paper first uses a simple method to estimate a constant risk premium based on rational expectations. The second method is based on financial market analysts' surveys and follows earlier work of Froot and Frankel (1989) and Cavaglia, Verschoor and Wolff (1994). Finally, the paper also uses a Kalman filter approach that was first introduced by Wolff (1987) and applied later with several modifications – by some authors to estimate the term premia in interest rates – among others by Cheung (1993), Gordon (2003), Gonzalez and Launonen (2005), Gravelle and Morley (2005), Bidarkota (2005), Yu and Chen (2005).

2 Methods of estimating currency risk premia

2.1 CONSTANT RISK PREMIUM

The paper applies three different methods of estimating the risk premia. The first method can be used to estimate an average risk premium. Using covered interest parity, equation (1) can be transformed into:

$$f_{t,t+k} = E_t(s_{t+k}) + \rho \tag{2}$$

where $f_{t,t+k}$ denotes the forward exchange rate observed at period t maturing at period $t+k$. If we assume that expectations are rational, i.e.:

$$s_{t+k} = E_t(s_{t+k}) + \varepsilon_{t,t+k} \tag{3}$$

we obtain that the risk premium is:

$$\rho = f_{t,t+k} - s_{t+k} + \varepsilon_{t,t+k} \tag{4}$$

Based on equation (4), if a large sample of observations is available, we can assume that on average the forecast error $\varepsilon_{t,t+k}$ is close to zero, which implies that the average ex-post forward bias $(f_{t,t+k} - s_{t+k})$ will be close to the average risk premium. While this method is a simple way to gauge the average level of risk, it cannot capture time-varying premium and hinges upon the assumption of unbiased expectations.

2.2 TIME-VARYING RISK PREMIA BASED ON ANALYSTS' SURVEYS

An alternative approach, one that can be used to estimate time-varying premia, relies on financial market analysts' surveys. Using this information as market expectations of future exchange rate, we can express the premium as the difference of the forward rate and the forecast rate from equation (2).

$$\rho_t^{survey} = f_{t,t+k} - E^{survey}{}_t(s_{t+k}) \tag{5}$$

We also need to take into account that survey data are contaminated by measurement error (which we denote as $\varepsilon^{survey}{}_{t,t+k}$). Thus, we have:

$$E^{survey}{}_t(s_{t+k}) = E_t(s_{t+k}) + \varepsilon^{survey}{}_{t,t+k} \tag{6}$$

The main advantages of this approach are that we do not have to assume a constant premium and can thus obtain time-varying premium estimates and that we do not assume rational expectations. One problem associated with this method, however, is that surveys may not be representative of the whole market.

2.3 TIME-VARYING RISK PREMIA USING A KALMAN FILTER APPROACH

It is also possible to use signal extraction methods to estimate a time-varying risk premium. Using equation (2), the ex-post forward bias can be decomposed into a risk premium term and a forecast error. In addition, if we write the risk premium itself as an autoregressive process, we obtain the following state space representation of the ex-post forward bias and the risk premium:

$$f_{t,t+k} - s_{t+k} = \rho_t + v_{t+k} \;{}^{1} \tag{7}$$

[1] Note that v_{t+k} equals $\varepsilon_{t,t+k}$ of equation (4).

$$\rho_t = \alpha + \phi\rho_{t-1} + u_t \tag{8}$$

This system can be estimated with a Kalman filter provided that the disturbance terms v_{t+k} and u_t are normally distributed white noise processes. Equation (7) is referred to as the signal equation, while equation (8) describes the evolution of the unobserved state variable. With the help of the Kalman filter, one can estimate a latent state variable, ρ_t in our case, when only the signal variable, i. e. the ex-post forward bias here, is observed and an autoregressive process is assumed for the state variable. For our purpose, in the case of a forward exchange rate maturing $t+k$ periods ahead, the forecast error term v_{t+k} will follow an MA(k-1) process:

$$v_{t+k} = \upsilon_{t+k} + \upsilon_{t+k-1} + \ldots + \upsilon_{t+1} \tag{9}$$

The disturbance terms can either be correlated or not, this is taken into account in the estimations in the analysis.

The main advantage of this approach is that we can obtain time-varying premium series estimates without having to rely on potentially problematic survey data. On the other hand, this method also hinges upon the assumption that the market forecasts of the exchange rate are unbiased, i.e. the unobservable forecast errors should on average be close to zero in the time period under review. If this does not hold, our results will be biased and they will not only show the risk premium but will also be affected by deviations from rationality. Taking into account that both approaches to estimate a time-varying premium have their drawbacks, a crosscheck of the results is warranted. This is done in the section on the robustness of the results.

3 Empirical application

3.1 DATA

Data for the Czech, Polish and Slovakian currencies are taken from Eurostat. Forward exchange rates are calculated from spot exchange rates and interest rate differentials relative to the euro area. The sample for the forward rates for these currencies goes from January 1999 until February 2007. The sample for the Hungarian forint starts in April 2001, in order to exclude a major regime switch in exchange rate policy in spring 2001 when the country gave up a tight crawling peg regime and adopted a wide fluctuation band of ±15%. Regarding forward and spot exchange rates for the forint, the paper uses monthly data from Thomson Datastream where real forward rates are readily available for this period. The data used are first-working-day observations of each month for the forint and monthly averages the other three currencies. As a robustness check, several alternative series were created by taking other days of the month, and the series thus obtained were very similar to each other and also to that of the monthly averages. Consequently, the results are not sensitive as to which days of the month are chosen for analysis.

It is important to stress that the conclusions of the paper are not a corollary of the different data sources. The analysis was implemented for the Czech, Polish and Slovakian currencies for real forward data from the same source and format as the Hungarian case and the conclusions are the same. The reason for reporting the results with the implied forward rates for the three currencies here is simply the availability of longer time series.

Market analysts' expectations of future exchange rates are taken from monthly Consensus Forecast polls for all four currencies, which are recorded in the middle of each month. The Consensus Forecast surveys are available from January 2001 till January 2007.

3.2 CONSTANT RISK PREMIA

Estimates of the constant risk premia based on ex-post forward bias series for the four countries are presented in Table 1 for three different maturities from 1 month to 1 year. Given that these countries are generally considered to be emerging markets, one would expect positive risk premia vis-à-vis the euro with the latter generally considered to be the anchor currency, and this is in fact what the results show.

Among the four countries, Hungary seems to have the highest premia for all maturities of around 5-7% in annualised terms, followed by Slovakia, the Czech Republic and Poland. The premia show strong significance, using Newey-West standard errors, except in the case of the zloty. The high level of premia in Hungary is in line with the weak fundamentals of the economy and the related twin deficit situation in the period under review. In contrast, the fundamentals might have suggested a lower premium level for the Czech Republic and a higher one for Poland. Here the potential biasedness of market forecasts may have some role.

Table 1

Estimates of average constant risk premia for the Czech Republic and Slovakia

	Czech Republic	Hungary	Poland	Slovakia
1 month	4.1 (2.2)	7.6* (3.3)	2.5 (4.3)	6.7* (2.6)
3 months	3.5 (1.9)	7.0* (2.7)	2.0 (3.7)	6.7* (2.1)
1 year	3.7* (1.5)	4.7* (1.5)	3.6 (3.0)	5.7* (0.6)

Notes: Annualised figures in percentages, Newey-West heteroskedasticity and autocorrelation consistent standard errors in parentheses.

** Significant at 5% level. For the sake of comparability with the other approaches, the sample for the averages is 2001-2007.*

3.3 TIME-VARYING RISK PREMIA BASED ON ANALYSTS' SURVEYS

Table 2 shows the average levels of risk premia, while Charts 1-2 show the evolution of risk premia for the four currencies using survey data[2]. The two currencies exhibiting the highest premia throughout the bulk of the past 5 years are the zloty and the forint. In the case of the forint, this can be explained with weak fundamentals, notably the severe and persistent twin deficit situation. For the zloty, this may be related to the relatively high volatility of the currency in comparison with the volatility of the other currencies. In addition, occasional political uncertainty may also have had some role in the case of the zloty.

On the other hand, for most of the time the measured risk premium has moved in a substantially lower range in the case of the Czech and the Slovak koruna. These currencies are relatively more stable than the other two, and the fundamentals are generally considered to be better than in the case of the forint. The premium of the Czech koruna has fluctuated around zero in the past few years disregarding a few very short-lived deviations. A potential reason for this may be the high degree of nominal convergence that the country has achieved and the favourable external position of the country.

Table 2

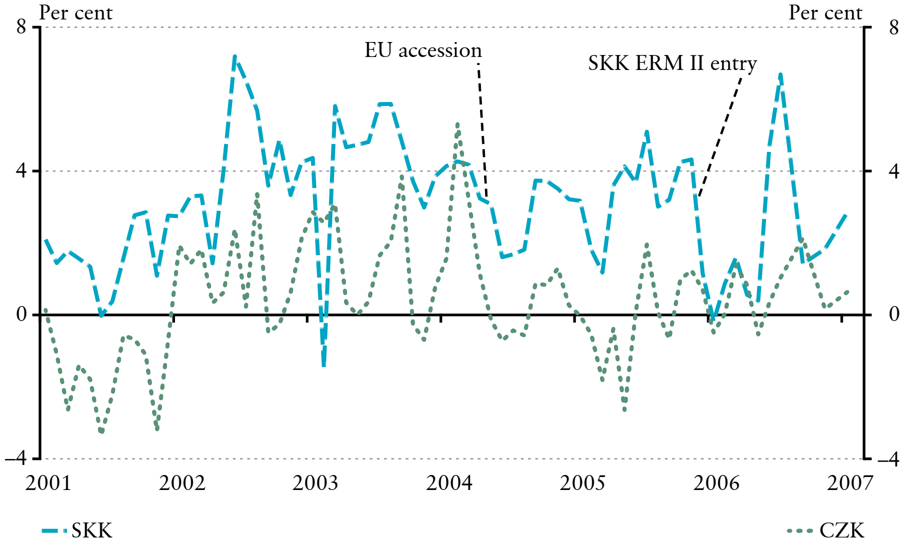
Average levels of risk premia using analysts' surveys

	Czech Republic	Hungary	Poland	Slovakia
3 months	–1.1 (0.7)	3.3* (1.2)	7.2* (1.5)	3.6* (0.7)
1 year	0.4 (0.3)	3.9* (0.6)	5.8* (0.5)	3.1* (0.3)

Notes: Annualised figures in percentages, Newey-West standard errors in parentheses.
** Significant at 5% level.*

Chart 1

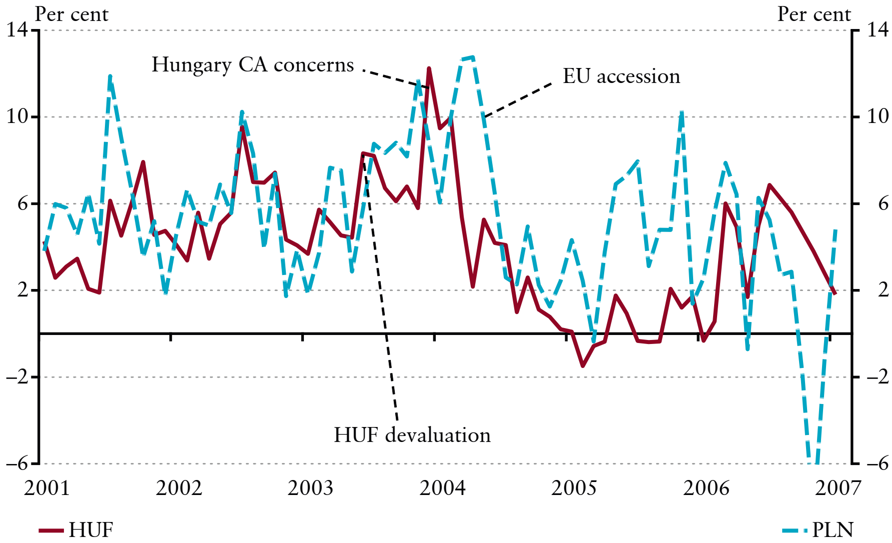
Evolution of 1-year risk premia in the Czech Republic and Slovakia using analysts' surveys



[2] For the zloty, the Consensus Forecast data are available only against the US dollar for most of the sample, while the other currencies are measured against the euro. Though this raises problems regarding the cross-country comparison, the problem is not likely to be substantial, because the premium of the dollar versus the euro is probably very low. As a result, the premium of the zloty versus the two main currencies is unlikely to be significantly different.

Chart 2

Evolution of 1-year risk premia in Hungary and Poland using analysts' surveys



It is also worth investigating whether there is any visible sign of a convergence process in the evolution of the premia of the other currencies. All of these countries are expected to adopt the euro in the future, which will imply the elimination of currency risk. While the premium in a given period prior to euro adoption may be positive – with its level depending among others on how far the country is from adopting the euro – a credible convergence process would probably be associated with a declining path in the premium over a longer horizon as the expected entry to the euro area draws closer.

In the case of the Polish zloty, there seems to be some downward trend in the premium in the second half of the sample from the rather high levels observed around 2004, which can be consistent with an improvement in the assessment of the convergence process of the country in that period.

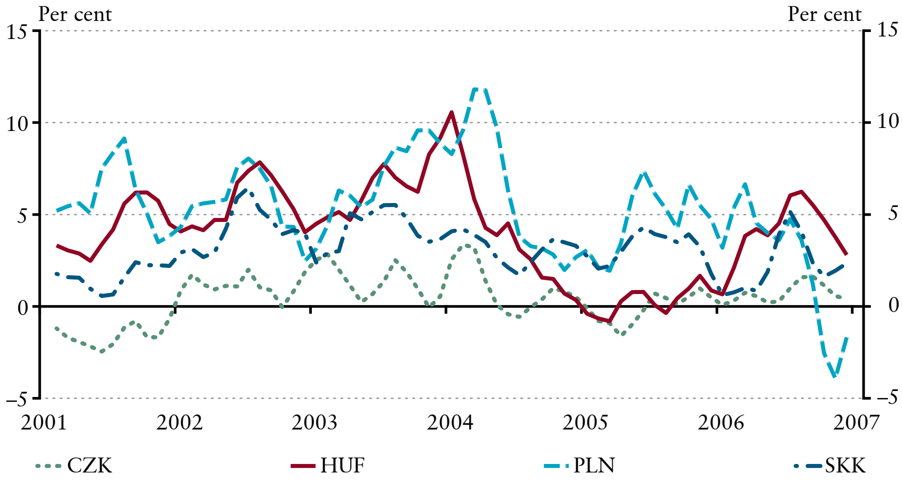
Following a shorter period of rise, the premium on the Slovak koruna seems to have been broadly on a declining path since mid-2002 in line with the progress in nominal convergence and a credible plan to adopt the euro. In this context it is interesting to see that the estimated premium fell to zero shortly after the koruna joined the ERM II mechanism, but the role of global risk appetite in this cannot be excluded either (as indicated also by Chart 3 on the comovement of the premia). Subsequently the premium on the koruna rose again temporarily, partly because the results of the parliamentary elections cast doubt on future economic policy and thus on Slovakia's euro adoption plans, and partly due to an adverse shift in global risk appetite.

Somewhat surprisingly, some downward trend is discernible for the forint in the second half of the sample period, however the Hungarian series is likely dominated by other factors than convergence. The major rise in the premium in 2003 was not only the result of worsening fundamentals and thus a delay in convergence, but also reflected a fall in the credibility of macroeconomic policy, in particular exchange rate policy, following the devaluation of the fluctuation band in June, 2003. Subsequently, the sudden fall in the premium in 2004 somewhat contradicts the intuition, as it was not underpinned by an improvement in fundamentals, and the fall is probably too sharp to be explained with an improvement in exchange rate policy credibility. Technically, the premium fell to 0 because strong expectations of future depreciation appeared, which approximately equalled the interest rate differential implying a 0 premium in a UIP framework.[3] Later on, a sharp upward correction took place in the premium in 2006 following a marked deterioration in the market assessment of the fiscal situation.

[3] As the other time-varying risk premium measure and the volatility indicators also exhibit a similar fall for the Hungarian forint, this issue is further discussed in the relevant part of Section 3.5 on the crosscheck of the results.

Chart 3

The comovement of 1-year risk premia in the region



It is also worth noting, that in spring 2004, when the four countries entered the European Union a noticeable downward shift occurred in all the four premium series. This can be partly because EU-membership itself has a stabilising effect on economic policies in general and partly because it represents a major step on the road towards adopting the euro.

Chart 3 plots the three-month moving averages of the premia for all the four currencies to illustrate their tendency to move together. The zloty and the forint exhibit surprisingly strong comovement and the Slovak koruna also tends to move with the other two albeit to a lesser extent. This comovement is likely the result of shifts in global investment risk assessment which influences all emerging market financial assets. The Czech koruna seems most insulated from common risk premia shocks. Though in several occasions it moves in the same direction as the others, the size of the changes are small in most cases for the Czech koruna.

3.4 TIME-VARYING RISK PREMIA USING A KALMAN FILTER APPROACH

As noted above, the Kalman filter provides an effective way to estimate time-varying premia without having to use survey data. The method produces plausible estimates only in the case of the 3-month maturity, and therefore only these results are reported in the paper.

As a first step, it is usual in the literature to check the normality of the ex-post forward bias series, as the Kalman filter assumes normality. Table 3 presents the Jarque-Bera test statistics for the four currencies, based on which we cannot reject normality at any commonly applied significance levels[4].

Table 3

Jarque-Bera test statistics for the 3-month ex-post forward bias series

Czech Republic	Hungary	Poland	Slovakia
0.95 (0.62)	0.15 (0.92)	1.66 (0.44)	2.88 (0.24)

Notes: p-values in parentheses.

[4] It must be noted though that this does not necessarily imply that the two disturbance terms are normally distributed, but this is the most that the data allows us to check.

It is also necessary to specify the time series properties of the model. As we have 3-month forward data, the forecast error term v_{t+k} will follow an MA(2) process. Regarding the autoregressive properties of the risk premium term, it is straightforward – and this is what is usually done in the literature – to check the autoregressive properties of the forward bias series. In our sample, an ARMA(1,2) specification is appropriate for all the four currencies, thus the risk premium is modeled as an AR(1) process.

In the implementation of the estimations, it is useful to specify the initial conditions for the state variable and its initial variance in order to find plausible premium estimates. In the case of the forint, the initial state value is specified to be equal to the level of the risk premium for the same time period obtained with the Consensus Forecast surveys. As the sample of the forward bias goes back to 1999 for the other three currencies while the Consensus Forecast only to 2001, the average premium level is chosen. The initial state variance is set equal to the sample variance of the survey risk premium series in all the four cases.

The choice of the autoregressive parameter ϕ of the risk premium term in equation (8) is a theoretically important issue, as it determines whether ρ_t will be stationary or not. Therefore two estimations are carried out for all currencies: one with no restrictions on ϕ and a random walk case with ϕ restricted to 1. As it turns out, the unrestricted estimations result in a random walk specification in all cases (see Table 5) and thus only the latter ones are reported.[5]

Table 4 summarizes the main results of the Kalman filter method. The Czech koruna and the Polish zloty show a sample mean of around 4 per cent. In the case of the other two currencies, the sample means are higher, around 5 per cent on annualised terms.

The potential correlation of the two disturbance terms is also an important issue. In his paper, Wolff (1987) assumes that they are uncorrelated but Cheung (1993) points out that they must be correlated if $k = 1$, as both the risk premium and the forecast error at time t depend on the information which comes out from time $t - 1$ to t. In his estimations he finds a negative correlation of around –20 to –40 per cent for the major currencies. This means that smaller risk premia tend to be associated with a larger unexpected depreciation and Cheung mentions that this is complementary to the finding of Fama (1984) that risk premia are negatively correlated with expected depreciation rates.

In our case we have $k = 3$, in which case the correlation of v_{t+k} and u_t is not straightforward. In the state space framework applied in this paper this kind of correlation is allowed for. As to the empirical results, this correlation is slightly negative for all the four currencies, though it is significant only in one case. There can be several factors behind this finding. Adaptive expectations may result in serially correlated forecast errors, which together with the results of Cheung mentioned above, can explain the finding of this paper. One can also imagine a situation where monetary policy reacts to past risk premium shocks or reacts in a persistent manner; this can also explain the correlation found here.

Table 4

Results of the Kalman filter approach

	Czech Republic	Hungary	Poland	Slovakia
α	0.1	0	0	0
Log-likelihood	294.3	154	230	255
Schwarz criterion	–5.84	–4.2	–4.41	–5.2
Sample mean of ρ_t	3.8	5.2	4.1	5.4
Sample standard dev. of ρ_t	1.9	3.4	4.7	5
Sample correlation of $v_{t+2,t+3}$ and u_t	–9	–14	–29*	–19

Notes: Annualised figures in percentages (except for the parameter ϕ, the log-likelihood and the Schwarz criterion figures).

** Significant at 5% level.*

[5] Theoretically, the case of when $\phi = 1$ and $\alpha \neq 0$ is of importance, as this would imply an explosive path for the premium. In our results, however, none of the α coefficients are significantly different from zero at a 5% level.

Table 5

Likelihood-ratio tests for time variation and a random walk process in the risk premium

	Czech Republic	Hungary	Poland	Slovakia
Time-variation	58.6**	12.2**	194**	232.5**
Random walk	0.92	1.58	1.16	1.49

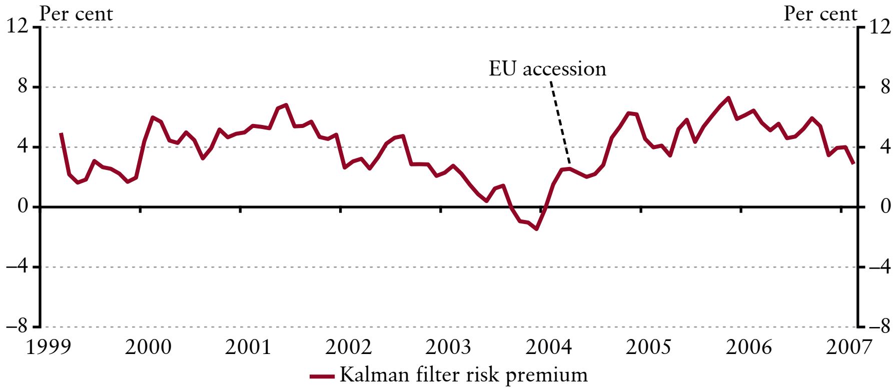
*Notes: *, ** significant at 5% and 1% level respectively.*

Table 5 show the likelihood-ratio tests for the time variation and a random walk process in the risk premium. As it turns out, the hypothesis of no time variation ($\phi = 0$) can be rejected with high confidence in all the four cases. On the other hand the hypothesis of a random walk process in the premium ($\phi = 1$) cannot be rejected at 5% level.

Charts 4-7 plot the evolution of the risk premia estimated with the random walk specification for the four currencies. The favourable impact of EU accession on risk premia can be detected for all the currencies except the zloty. The premium series for the forint reflect a number of important episodes that are likely to have influenced the level of the premium in line with the intuition. In addition, the favourable effect of the ERM II entry of the Slovak koruna is also detectable.

Chart 4

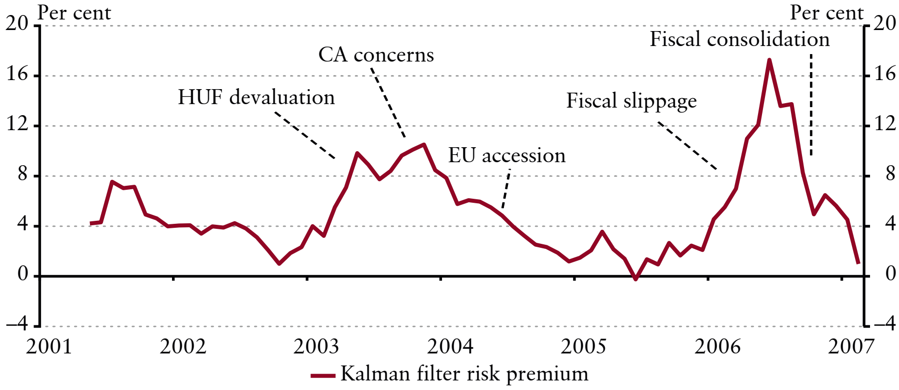
Evolution of 3-month risk premia in the Czech Republic using Kalman filter risk



Notes: Annualised values.

Chart 5

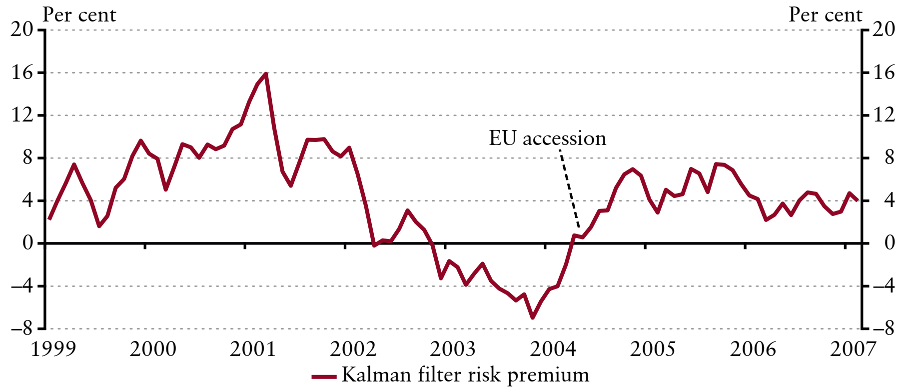
Evolution of 3-month risk premia in Hungary using Kalman filter



Notes: Annualised values.

Chart 6

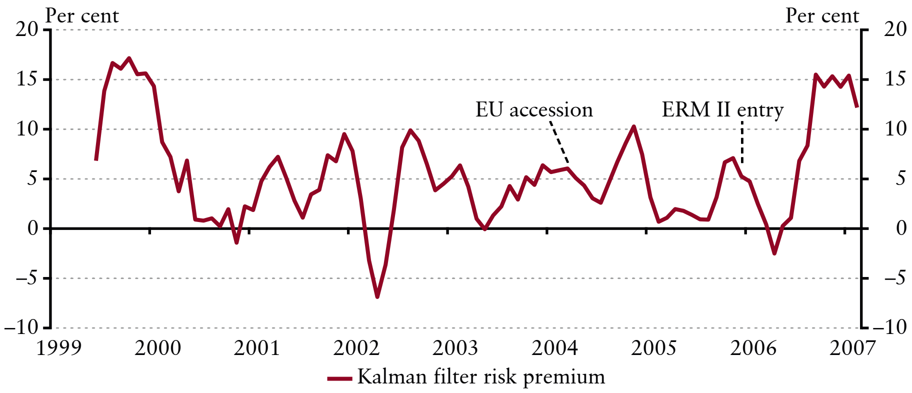
Evolution of 3-month risk premia in Poland using Kalman filter



Notes: Annualised values.

Chart 7

Evolution of 3-month risk premia in Slovakia using Kalman filter



Notes: Annualised values.

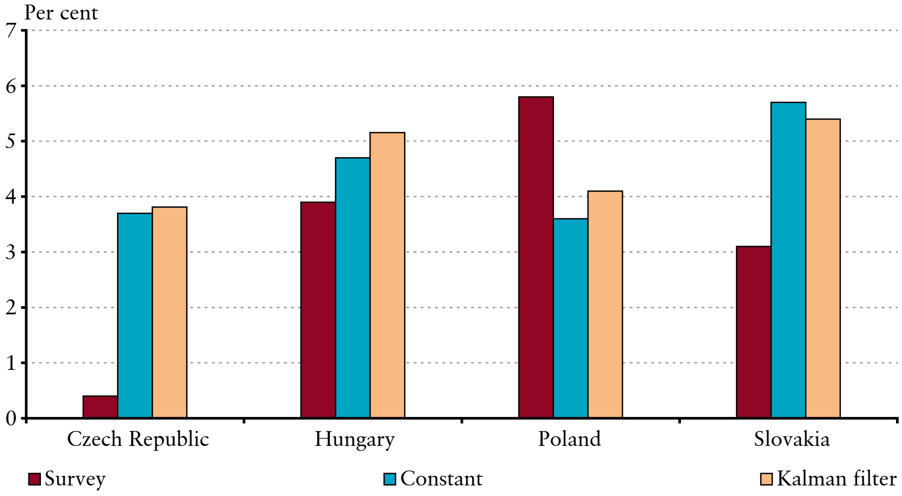
3.5 CROSSCHECK AND ROBUSTNESS OF THE RESULTS

Looking at the three approaches to estimate risk premia applied in this paper, it is clear that all of them have their shortcomings. Therefore, to examine the reliability of the results I do a crosscheck of the premium series with each other and with historical and implied volatility series. The reason for the latter is that the risk premium, as a compensation for the riskiness of investing in one currency, generally tends to be associated with the volatility of the currency. If the methods give similar results and show comovement with the volatility measures, this means that one can be more trustful regarding the validity of the results.

Firstly, Chart 8 compares the average premium levels obtained with the three different methods for all the four currencies. The ideal case would be that for any given currency, the three methods give similar estimates of the average premium. In particular, there are two important things to be checked: if the survey estimate is substantially different from the other two, this suggests a systematic bias in the expectations; and if the constant and the Kalman filter method show a large difference, this suggests problems with the Kalman filter approach. The problem of a bias in expectations is severe in the Czech, Polish and Slovakian cases, while it is less of a problem for the forint. One must note that if the surveys are closer to the true market expectations than the rational expectations hypothesis, then the Kalman filter and the constant methods will contain a bias. Looking at the empirical results, this would imply an upward bias in the Kalman filter and the constant method in all the four currencies except the zloty, where it would imply a downward bias. On the other hand, the averages of the Kalman filter results are very close to the constant premia, which – though not surprising – is still an encouraging sign for the reliability of the Kalman filter results.

Chart 8

Comparison of the average premium level estimates for each currency[6]

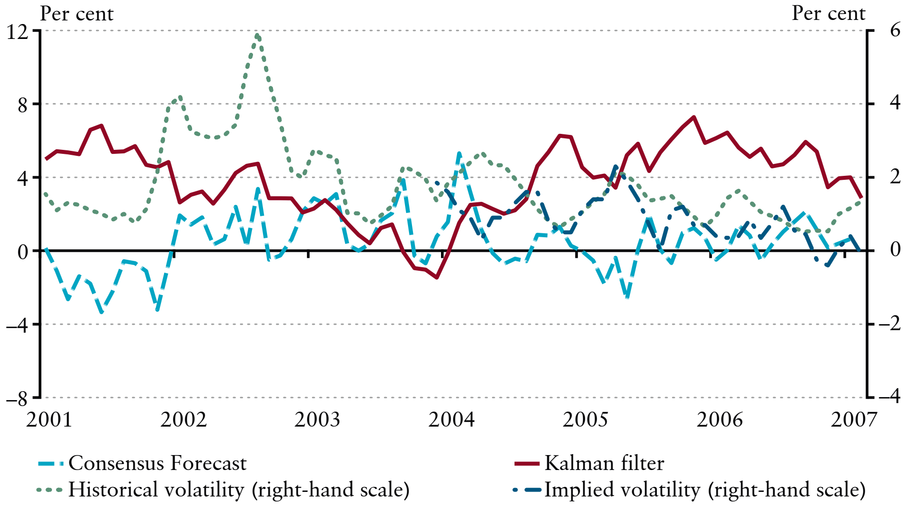


In what follows, I do a crosscheck of the evolution of the Kalman filter and the survey results and the volatility figures. In the case of the Czech koruna (Chart 9 and Table 6) there is little comovement between the two premium series and with the volatility measures, and there are even some negative correlations among the variables.[7] The Kalman filter results are not too robust in the Czech case, and in addition to this, the survey premia is also little correlated with the volatilities. The reason to these findings may be the relatively low level of premia and the small shocks to the risk premium, which may be overshadowed by measurement errors in the survey data and by forecast errors in the case of the Kalman filter.

In contrast, the crosscheck provides reassuring results for the Hungarian forint. Chart 10 and Table 7 show strong comovement between the two premium series and with the volatility measures as well. There are only two notable instances

Chart 9

Crosscheck for the Czech koruna



[6] The survey and the constant premia have a horizon of 1 year, the Kalman filter premia have a horizon of 3 months. The time-frame of the comparison is the period 2001–2007 due to the length of the survey data series.

[7] On Charts 9-12, the volatility measures are rescaled to illustrate the comovements. Implied volatilities are shifted downwards by 4 percentage points, which can be motivated by the fact that implied volatilities for the anchor currencies must also be above zero. The historical volatility in any given time period is calculated as the variance of the daily percentage changes in the period starting 30 days before and ending 30 days after the same time period. The historical volatility figures are multiplied by 100 to match the scale of the other series.

Table 6

Correlation matrix for the Czech koruna

	Consensus Forecast	Kalman filter	Implied volatility	Historical volatility
Consensus Forecast	100			
Kalman filter	–36*	100		
Implied volatility	–21	–33*	100	
Historical volatility	30*	–26*	42*	100

Notes: All figures in percentages.

** Significant at 5% level.*

when the two risk premium series show divergence for a longer period: in the second half of 2002 and in the second half of 2006. One reason behind this may be a change in the term structure of the risk premium, as the Kalman filter results show the 3-month premia, while the survey series are 1-year premia. The divergence of the two series in 2006 for instance may be partly explained by this phenomenon, i.e. that uncertainty may have risen more on the short horizon than on the long term. However, there is another important technical reason to the occasional divergence. The Kalman filter decomposes the ex-post forward bias into a forecast error term and a risk premium term. In mid-2006 the forward bias shifted up by some 70 percentage points on an annualised basis in a few months. While the filter does recognise that most of this was a shift in the forecast error, it probably does so insufficiently and this introduces some upward bias in the Kalman filter premium series in this period. This argument is reinforced by the survey series and also the volatility measures. In mid-2002, the opposite happened, as the forward bias shifted up, but the filter attributed this mainly to a change in the forecast errors thus probably underestimating the risk premium.

Chart 10

Crosscheck for the Hungarian forint

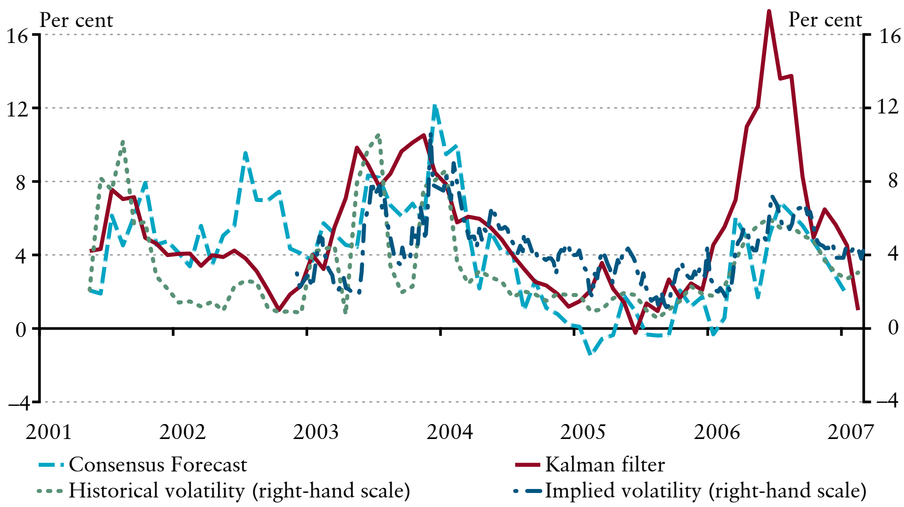


Table 7

Correlation matrix for the Hungarian forint

	Consensus Forecast	Kalman filter	Implied volatility	Historical volatility
Consensus Forecast	100			
Kalman filter	62*	100		
Implied volatility	77*	50*	100	
Historical volatility	70*	65*	73*	100

Notes: All figures in percentages.

** Significant at 5% level.*

In addition, Chart 18 in the Appendix provides evidence that the Kalman filter results are robust to the choice of the sample period. The method gives roughly the same results in twelve different shortened sample periods analysed. As the Kalman filter results are reassuring only in the Hungarian case based on the crosscheck, this exercise is not implemented for the other currencies.

One might find it somewhat peculiar that the Hungarian premium fell from very high levels close to zero throughout 2004-2005 given that there was hardly any improvement in the economic fundamentals – especially regarding the twin deficit problem – in that period. However, there can be several plausible explanations to that. As mentioned earlier, part of this fall can be attributed to an improvement in the credibility of exchange rate policy following the problematic devaluation of 2003. Another part can be explained with a global improvement in risk appetite, as shown by the decline in at least some of the premium measures of other countries (primarily the Consensus Forecast series). Finally, one should not forget that foreign exchange markets do not always react exclusively to changes in the economic fundamentals. From the low of January 2004, the forint strengthened by some 10% in this period and the central bank lowered its policy rate by around 600 basis points in the same period, which, in the lack of improved fundamentals, can only be attributed to a fall in the perceived riskiness of the currency. Indeed, in its communication in this period, the central bank continuously justified its policy rate cuts with an improvement in the risk assessment of forint-denominated assets alongside with an improvement of the country's inflationary performance and outlook.

In addition, the crosscheck provides a theoretically important corollary. We can say that the comovement of the premium series obtained with the Kalman-filter and the survey data for the forint shows that the survey expectations are in line with both the risk-premium-extended UIP and the rational expectations hypothesis. This is because we could arrive at largely the same premium results with a method that does not use survey data but assumes the UIP and rational expectations – i.e. the Kalman filter – as with the survey data also assuming the UIP. This in turn is only possible if the Kalman filter decomposes the ex-post forward bias into premium and forecast error (which is nothing else but the difference of exchange rate expectations and future realised exchange rate) with the expectations being in line with the survey expectations. All this is theoretically important because in the end the UIP is centred on exchange rate expectations, i.e. it relates the expected change in the exchange rate to the interest rate differential.

The crosscheck of the Polish zloty is not this convincing but somewhat more so than the Czech case. Firstly, the Polish case was the only one where the 3-month survey premia showed notable comovement with the other variables, and for this reason, both the 3-month and the 1-year survey premia are shown in the correlation matrix. The 1-year survey premium shows a high comovement with the implied volatility, which indicates that the survey results probably contain valuable information regarding the premium on a longer horizon. In turn, the 3-month survey premium shows a notable comovement with the historical volatility. The Kalman filter results fare rather poorly in the robustness check and show only a modest and insignificant correlation with the historical volatitility.

Chart 11

Crosscheck for the Polish zloty

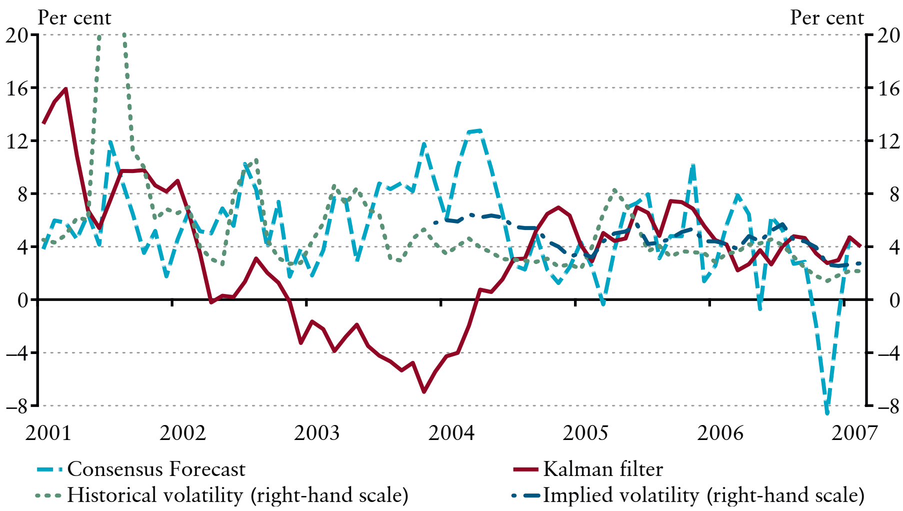


Table 8

Correlation matrix for the Polish zloty

	Consensus Forecast 1 year	Kalman filter	Implied volatility	Historical volatility
Consensus Forecast 1 year	100			
Kalman filter	-45*	100		
Implied volatility	60*	-42*	100	
Historical volatility	16	5	18	100
Consensus Forecast 3 months	1	25	-2	42*

Notes: All figures in percentages.

** Significant at 5% level.*

Finally, the crosscheck for the Slovak koruna is not too reassuring either. The Kalman filter premium shows a significant correlation with the survey results, but in effect this correlation is rather low, only 30%. The survey results exhibit significant correlations with all the variables, but again they are low. The survey results probably have valuable information but they are heavily contaminated by measurement error.

Chart 12

Crosscheck for the Slovak koruna

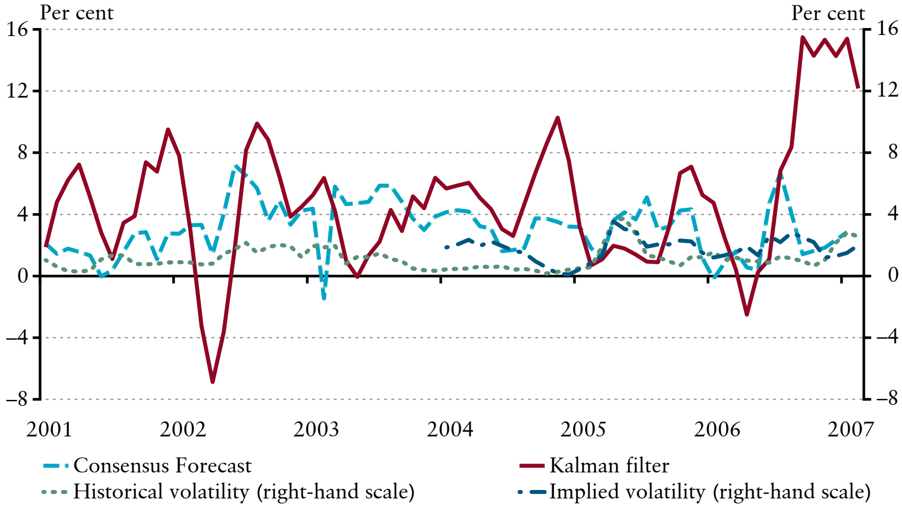


Table 9

Correlation matrix for the Slovak koruna

	Consensus Forecast	Kalman filter	Implied volatility	Historical volatility
Consensus Forecast	100			
Kalman filter	30*	100		
Implied volatility	49*	-14	100	
Historical volatility	30*	2	50*	100

Notes: All figures in percentages.

** Significant at 5% level.*

Finally, I propose another crosscheck that is basically an alternative but very informative illustration of the figure on the comovements. Since the results are only favourable for the Hungarian case, this exercise is done only for this currency. The exercise entails creating a derived spot exchange rate series based on the UIP identity with the use of the premium results, survey forecasts and market interest rate data and comparing this derived series with the true spot exchange rate. Naturally if the premium results and the survey forecasts are close to the true risk premium and market expectations respectively, the two exchange rate series should also be close to each other.

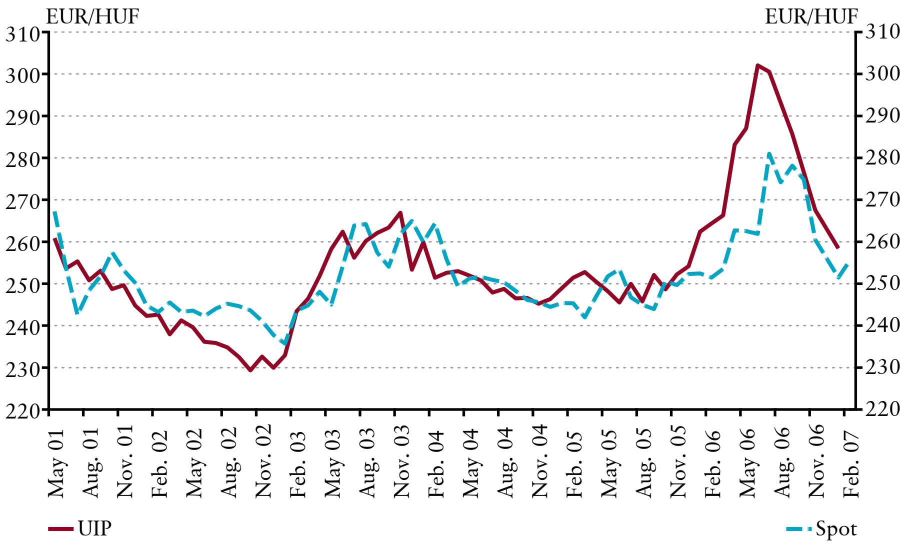
Expressing the logarithm of the spot exchange rate from equation (1) we can create this derived spot exchange rate variable by adding up the logarithm of the expected exchange rate from the survey and the Kalman filter risk premium and deducting the interest rate differential[8] [equation (10)].

$$s_t = E^{survey}(s_{t+k}) + \rho^{Kalman-filter}{}_t - (i_{t,k} - i^*_{t,k}) \tag{10}$$

Chart 13 plots this variable – raised to the exponential power – as UIP and the spot exchange rate. As it can be expected from the high correlations shown in the earlier crosscheck, these two series also show a strong comovement.

Chart 13

The alternative crosscheck: the derived and the original spot exchange rate



[8] The interest rate differential is directly observable on the market.

4 Conclusion

The paper estimates currency risk premia for the Czech Republic, Hungary, Poland and Slovakia applying three different approaches: a constant premium approach based on rational expectations, a method using financial market analysts' surveys and finally a Kalman filter technique. The constant premium method is a simple way to gauge the average level of risk, however, it cannot capture time-varying premium and hinges upon the assumption of unbiased expectations. The main advantages of the survey approach are that we do not have to assume a constant premium and can thus obtain time-varying premium estimates and that we do not assume rational expectations. One problem associated with this method, however, is that surveys may not be representative of the whole market. Finally, the main advantage of the Kalman filter approach is that we can obtain time-varying premium series estimates without having to rely on potentially problematic survey data. On the other hand, this method also hinges upon the assumption that the market forecasts of the exchange rate are unbiased, i.e. the unobservable forecast errors should on average be close to zero in the time period under review.

A novelty in this paper is a crosscheck based on the comparison of the three different results and also making use of implied and historical volatilities. The reason for the latter is that the risk premium, as a compensation for the riskiness of investing in one currency, generally tends to be associated with the volatility of the currency. If the methods give similar results and show comovement with the volatility measures, this means that one can be more trustful regarding the validity of the results.

The results highlight the importance of such a crosscheck: in the case of the Czech and the Slovak koruna and the Polish zloty this exercise reveals severe problems with the results, which otherwise would not have been discovered. On the other hand, the estimation methods produce convincing results for the Hungarian forint. The estimated Hungarian premium series – beside showing strong comovement with each other and with the volatilities – reflect the major events that intuitively may have shaped currency risk in the country.

In addition, we can say that the comovement of the premium series obtained with the Kalman-filter and the survey data for the forint shows that the survey expectations are largely in line with both the risk-premium-extended UIP and the rational expectations hypothesis. This is because we could arrive at largely the same premium results with a method that does not use survey data but assumes the UIP and rational expectations – i.e. the Kalman filter – as with the survey data also assuming the UIP. This in turn is only possible if the Kalman filter decomposes the ex-post forward bias into premium and forecast error (which is nothing else but the difference of exchange rate expectations and future realised exchange rate) with the expectations being in line with the survey expectations. All this is theoretically important because in the end the UIP is centred on exchange rate expectations, i.e. it relates the expected change in the exchange rate to the interest rate differential.

The paper suggest that the reason to the poor results in the Czech case may be the relatively low level of premia and the small shocks to the risk premium, which may be overshadowed by measurement errors in the survey data and by forecast errors in the case of the Kalman filter. In the Polish and Slovak case, a low variation in the premium may be a potential problem, while the high variation in the Hungarian premium is probably helpful in obtaining reliable estimates. In addition to this, a comparison of the average premium levels obtained with the different methods indicates the problem of a bias in expectations in the case of the Czech and the Slovak koruna and the Polish zloty, which can be the reason behind the poor results obtained with the Kalman filter in these cases. On the other hand, the bias in expectations is not a concern for the Hungarian forint.

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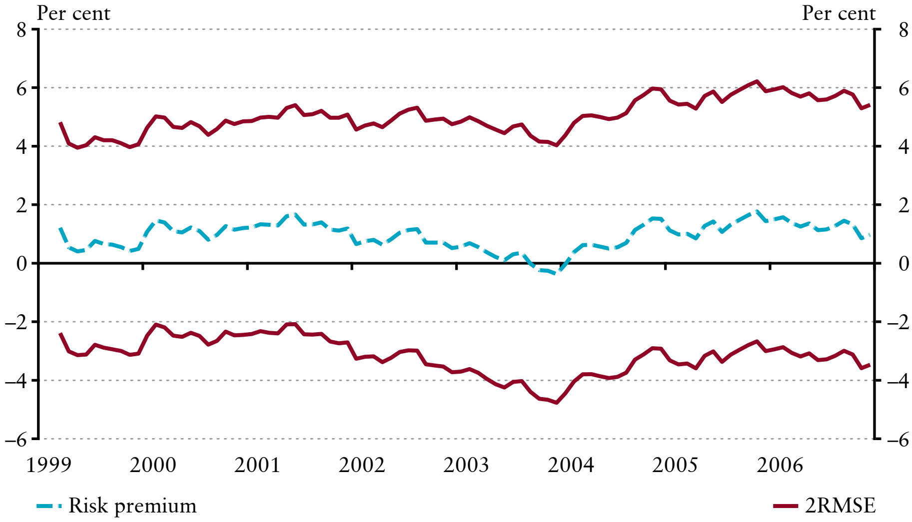
Appendix

Chart 14

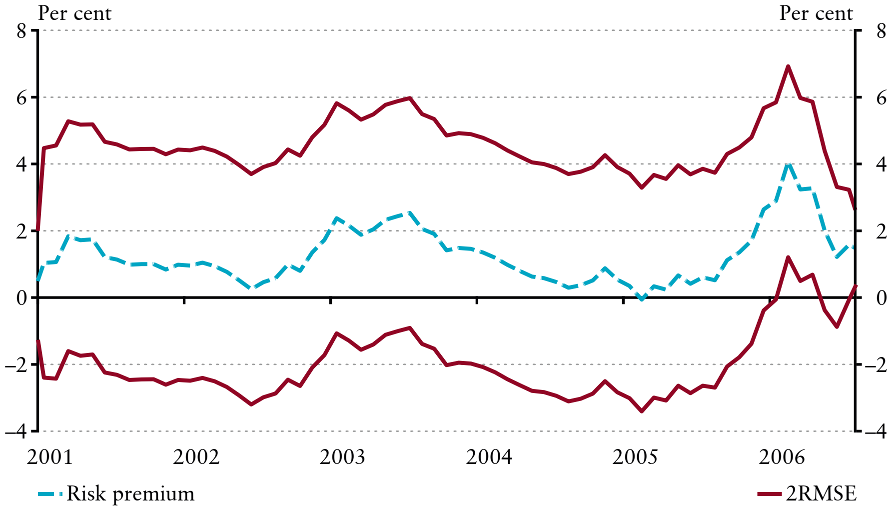
The Kalman filter risk premium with confidence bands for the Czech koruna



*Notes: 3-month premium, the series are not annualised. The confidence bands are ±2 * root mean squared errors.*

Chart 15

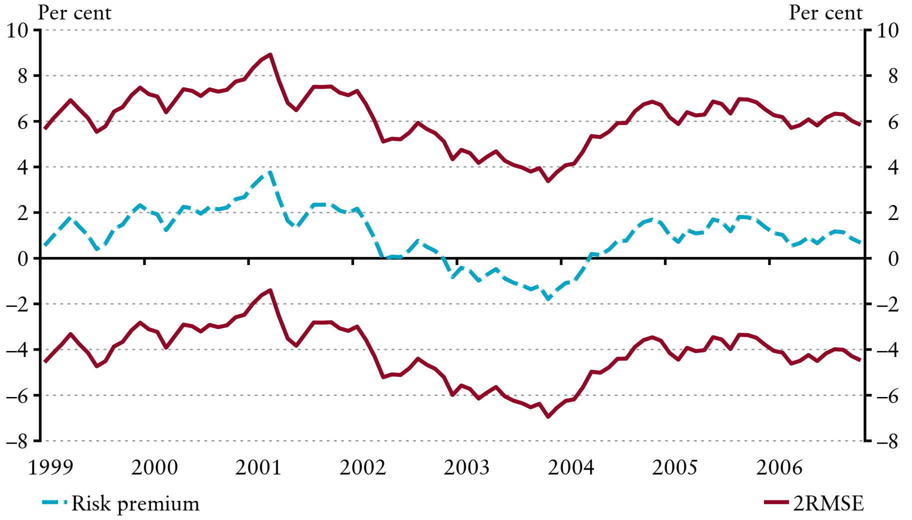
The Kalman filter risk premium with confidence bands for the Hungarian forint



*Notes: 3-month premium, the series are not annualised. The confidence bands are ±2 * root mean squared errors.*

Chart 16

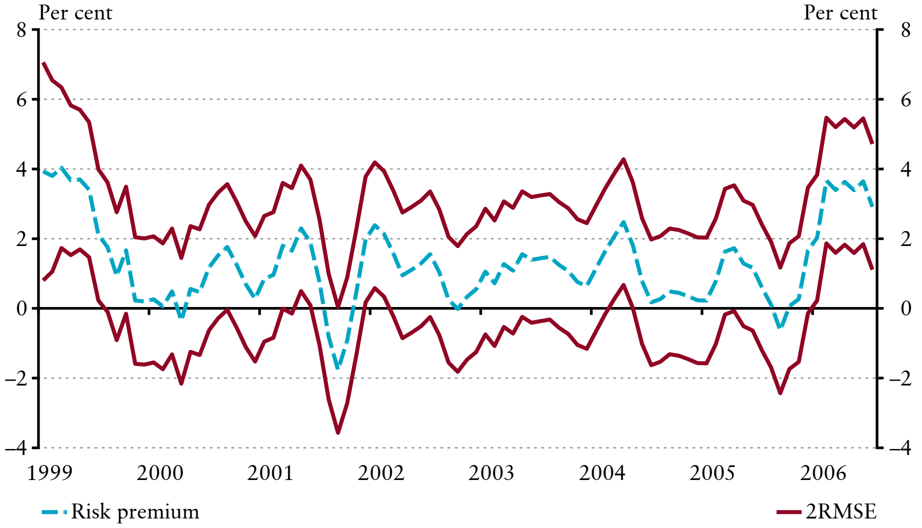
The Kalman filter risk premium with confidence bands for the Polish zloty



*Notes: 3-month premium, the series are not annualised. The confidence bands are ±2 * root mean squared errors.*

Chart 17

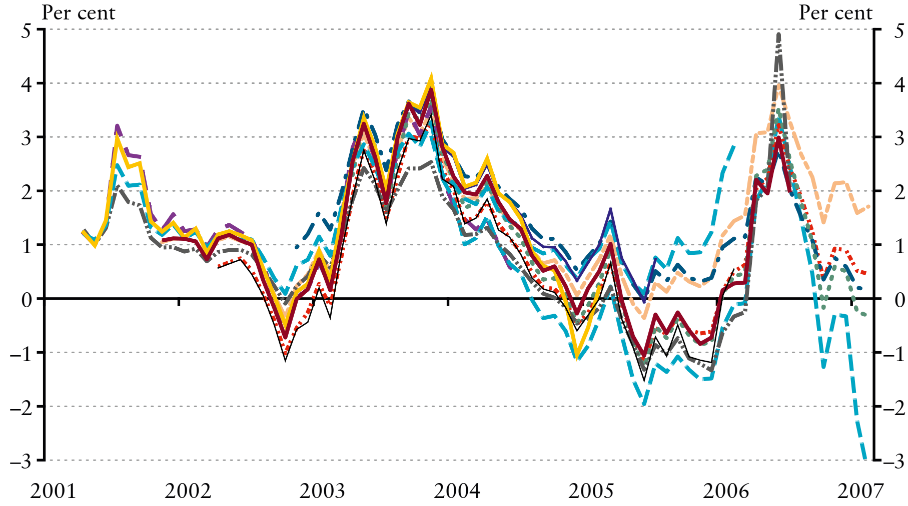
The Kalman filter risk premium with confidence bands for the Slovak koruna



*Notes: 3-month premium, the series are not annualised. The confidence bands are ±2 * root mean squared errors.*

Chart 18

Robustness of the Kalman filter results to the choice of the sample period, Hungarian forint



Notes: 3-month premium, the series are not annualised. The sample periods are:

Nov. 2001–Feb. 2007; Apr. 2002–Feb. 2007; Nov. 2002–Feb. 2007; Apr. 2003–Feb. 2007; Nov. 2003–Feb. 2007; Apr. 2001–July 2006; Apr. 2001–Feb. 2006; Apr. 2001–July 2005; Apr. 2001–Feb. 2005; Apr. 2001–July 2004; Nov. 2001–July 2006; Apr. 2002–Feb. 2006.

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