Debt trap - monetary indicators of Hungary's indebtedness

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In the circumstances of the financial crisis, sovereign debts have increased with an effect on foreign exchange rates (NEERs), CDS spreads, market liquidity and debt exposures in foreign currencies. This study aims to examine the features of the Hungarian sovereign debt by analysing the possible interactions among the variables and also the monetary aspects of debt financing. At the end, some conclusions are drawn from a monetary perspective.

Keywords: nominal FX rate, real effective FX rate, CDS

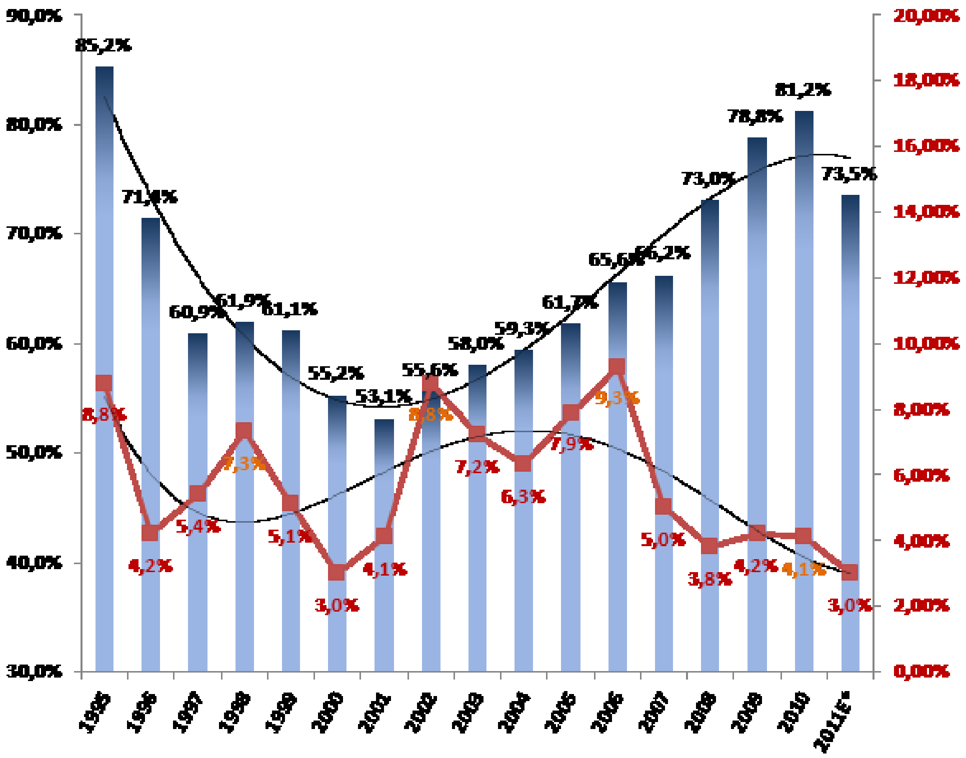
1. Introduction

While acknowledging the growing magnitude of credit derivatives and credit default swap contracts worldwide, and being aware of the current debates that are held around the riskiness of these instruments, this study sets out to explore the significance of CDSs in pricing sovereign debt exposures bearing in mind that under a CDS agreement the probability of a credit default is considerable.

In the next section this paper explores the characteristics of credit default swaps, foreign exchange rate behaviour and the concept of equilibrium exchanges rates. I assume that the change in the CDS spreads may influence the movements in the FX rates. By estimating an empirical model, data on Hungarian sovereign CDS spreads, and nominal HUF/EUR and HUF/CHF rates for the period 2010-2011 are to be considered. One prediction from this model that has not previously been tested empirically is that there should be a robust and significant positive relation between the growth of CDS spreads and the level of the nominal FX rates.

In the circumstances of the financial crisis – in many countries and likewise in Hungary (see Figure 1) – sovereign debt exposures and debt to GDP ratios increased, with severe consequences for the market (financing) conditions. In case of Hungary, (re)financing of the sovereign debt has been carried by foreign denominations up to nearly 50% which takes high foreign exchange rate risk, and by a redemption profile of debt maturing within 5 years at approximately 75% which encompasses high refinancing risk.

Figure 1: Hungary's sovereign debt exposure and fiscal deficit (in % of GDP)



Source: own from Hungarian Government Debt Management Agency (www.akk.hu)

Due to the increased financial risk as perceived by foreign and domestic institutional investors, the credit rating for Hungary's long term sovereign debt has been downgraded to Ba1 with a negative outlook by Moody's, and to BB+ also with negative outlook by Standard & Poor's. In parallel, the financial markets' view on the Hungarian State's creditworthiness has worsened, which was reflected by increased risk premiums and credit default swap rates.

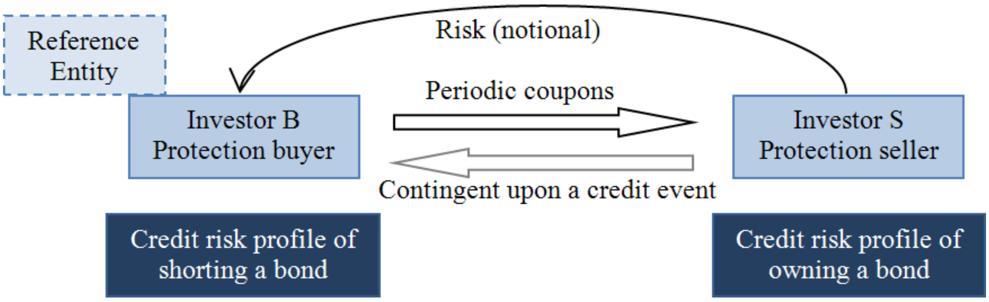
2. The significance of Credit Default Swap agreements

Credit derivatives, in general, are applicable for investors to express a positive or negative credit view on a single entity, and thus to take or reduce credit exposure, preferably on bonds or loans of a sovereign or corporate entity. Within credit derivatives, single-name credit default swaps represent a major share, accounting for approximately one third of the contracted volumes (Barrett and Ewan, 2006).

By definition, a credit default swap (hereafter referred as: "CDS") is "an agreement in which one party buys protection against losses occurring due to a credit event of a reference entity up to the maturity date of the swap. The protection buyer pays a periodic fee for this protection up to the maturity date, unless a credit event triggers the contingent payment. If such trigger happens, the buyer of protection only needs to pay the accrued fee up to the day of the credit event (standard credit default swap), and deliver an obligation of the reference credit in exchange for the protection payout" (Beinstein and Scott, 2006).

By explanation, the CDS is an agreement between two parties to exchange the credit risk of an issuer (reference entity). The buyer of the credit default swap is said to buy protection, against losses in the event of bankruptcy, the issuer failing to pay outstanding debt obligations, or in some CDS contracts, a restructuring of a bond or loan (called as credit event). The seller of the credit default swap is said to sell protection in the case of a credit event.

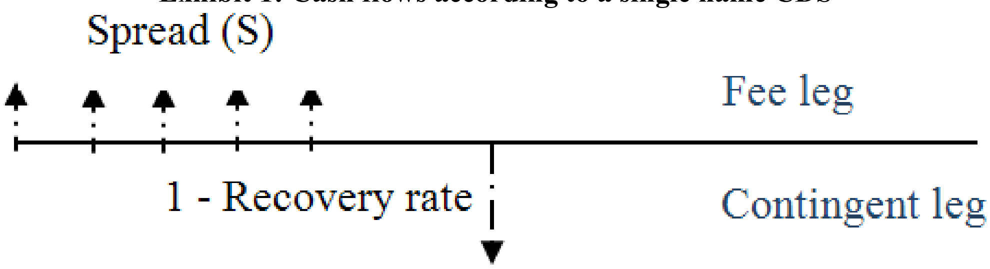
Figure 1: Single name CDS



Source: author's own construction

Under a CDS contract, the buyer usually pays a periodic fee and profits if the reference entity has a credit event, or if the credit worsens while the swap is outstanding. At the same time, the seller collects the periodic fee and profits if the credit of the reference entity remains stable or improves while the swap is outstanding. According to the ISDA standards, CDS market price is quoted in basis points (bp) paid annually, and is a definite measure of the reference entity's credit risk (the higher the spread the greater the credit risk is). The CDS market price, also called as CDS spread or fixed rate, should be multiplied by the notional amount of the swap in order to calculate the regular payment due under the swap agreement.

Exhibit 1: Cash flows according to a single name CDS



The value of a single name CDS can be interpreted as a scenario analysis where the credit survives or defaults. The protection seller (long risk) hopes the credit survives, and discounts the expected annual payments by the probability of this scenario (called the fee leg). The protection buyer (short risk) hopes the credit defaults, and discounts the expected contingent payment (Notional Value less Recovery Rate) by the probability of this scenario (called the contingent leg).

Since one type of CDS may be contracted for different maturities, each maturity represents a spread that ensures the present value of the expected spread payments (Fee Leg) equals the present value of the payment on default (Contingent Leg). The formula for a Par CDS contract (with a Notional of 1) can be written as:

$$S_n \sum_{i=1}^{n} \Delta_i Ps_i DF_i + Accrual\ on\ Default = (1-R) \sum_{i=1}^{n} (Ps_{i-1} - Ps_i) DF_i \qquad (1)$$

Where,

- S_n = Spread for protection to period n
- Δ_i = Length of time period i in years
- Ps_i = Probability of Survival to time i
- DF_i = Risk-free Discount Factor to time i
- R = Recovery Rate on default

Without further details of the calculation methods, it is a crucial point that the valuation theory of the CDS contracts certainly implies that default under the CDS is interpreted as

- the Cumulative Probability of Default (the probability of there having been any default up to a particular period),
- the Conditional Probabilities of Default or Hazard Rates (the probability of there being a default in a given period, conditional on there not having been a default up to that period), and also as
- Unconditional Default Probabilities (the probability of there being a default in a particular period as seen at the current time).

From our perspective this means that the credit event (default) under the CDS agreement is contingent upon the time period considered in the agreement, and also the expectations of the market agents. For longer periods, the probability of defaulting increases over time; however, the investors' behaviour attains more dependence on previous market trades. I applied the ISDA standard model for interpreting CDS spreads.[1]

3. Foreign exchange rate behaviour

Foreign exchange rate behaviour and the concept of equilibrium exchanges rates are frequently cited in academic discussions, and the uncovered interest rate parity or the fundamental equilibrium exchange rates are the most common ones.

Table 1: Factors of exchange rate alignments to an estimated equilibrium

	Theoretical assumptions	**Relevant time horizon**	**Statistical assumptions**	**Dependent variable**
Uncovered Interest Rate Parity	The expected change in the FX rate determined by interest differentials	Short run	Stationarity (of change)	Expected change in the real or nominal
Purchasing Power Parity	Constant equilibrium FX rate	Long run	Stationary	Real or nominal
Balassa-Samuelson	PPP for tradable goods. Productivity differentials between traded and non-traded goods	Long run	Non-stationary	Real
Monetary and Portfolio-balance Models	PPP in the long run plus demand for money	Short run	Non-stationary	Nominal
Capital Enhanced Equilibrium Exchange Rates	PPP plus nominal UIRP without risk premia	Short run (forecast)	Stationary, with emphasis on speed of convergence	Nominal

[1] http://www.cdsmodel.com/cdsmodel/; http://www.cdsmodel.com/cdsmodel/fee-computations.page

Intermediate Term Model-based Equilibrium Exchange Rates	Nominal UIRP including risk premia plus expected future movements in real exchange rates determined by fundamentals	Short run (forecast)	None	Future change in the nominal
Behavioural Equilibrium Exchange Rates	Real UIRP with risk premia and/or expected future movements in real exchange rates deter-mined by fundamentals	Short run (also forecast)	Non-stationary	Real
Fundamental Equilibrium Exchange Rates	Real FX rate compatible with both internal and external balance	Medium run	Non-stationary	Real-effective
Natural Real Exchange Rates	As with FEERs, but with the assumption of portfolio balance (so domestic real interest rate is equal to the world rate)	Long run	Non-stationary	Real
Structural Vector Auto Regression	Real FX rate affected by supply and demand shocks in the long run	Short (and long) run	As with theoretical	Change in the real

Source: own from (Driver – Westaway, 2004)

This paper is related to earlier empirical work of Moreno and Villar (2010) that explains foreign exchange market disruptions, as indicated by large and persistent deviation from uncovered interest parity, and measured by high sovereign default risk. Other recent empirical works (Rezessy, 2010) have documented a significant affirmation of the risk premium-extended UIRP for Hungary, especially as compared to other Central- and Eastern European countries.

Following the outburst of the financial crisis, it is crucial to know whether an observed change in the value of exchange rate is justified by perceived shocks to the macroeconomic environment. In our point of view, different scenarios may apply to small and open - and specifically, emerging – economies. Notwithstanding, the liquidity measures of sovereign debt markets may differ in these economies.

Concerning the HUF exchange rate, a question could be raised as to whether the increased sovereign indebtedness has been followed by the depreciation trend of the domestic currency. In order to answer accurately, nominal and real effective exchange rates are to be considered. The nominal effective exchange rate (NEER) is an index of some weighted average of bilateral exchange rates; in this sense, the domestic currency is valued in relation to a basket of foreign currencies. The real effective exchange rate (REER) is the NEER adjusted by some measure of relative prices or costs.

According to the methodology of the Bank for International Settlements (BIS), the International Monetary Fund (IMF), the OECD and some leading central banks throughout the world[2], the NEER is calculated as the geometric weighted average of a basket of bilateral exchange rates, and the REER is the NEER adjusted with the corresponding relative consumer prices.

[2] e.g. the European Central Bank (ECB), the Bank of England (BoE) and the Federal Reserve Board (FED)

The BIS formula is the following:

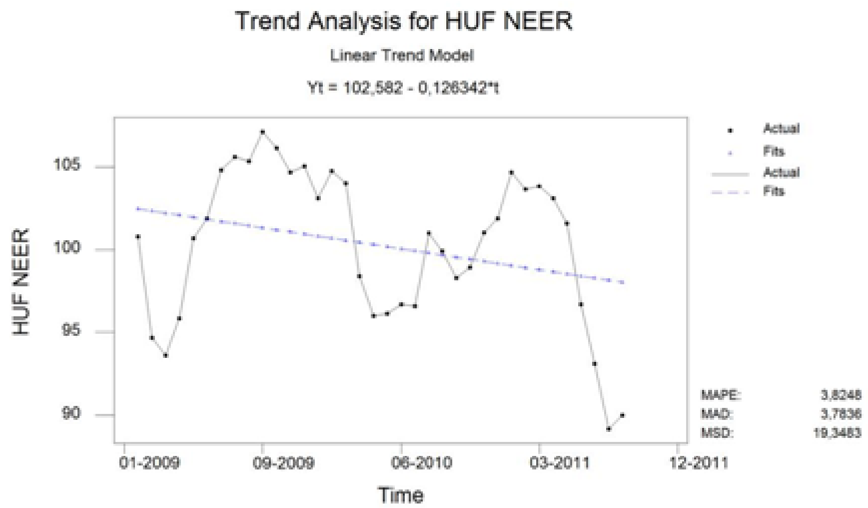
$$E_{it} = \prod_{j=1}^{n} \left(\frac{P_{it}S_{ijt}}{P_{jt}^{*}}\right)^{\omega_{ij}} \tag{2}$$

whereas:

- P_i is the domestic rate of inflation;
- P_j is the inflation rate of the other country;
- S_{ij} is the spot FX rate;
- ω_{ij}, the weighting scheme for the basket is trade-based and captures direct and third market competition within export and import markets.

Since there is a comprehensive database of the EER indices and the associated weights, released mid-month through the BIS website on a regular (monthly) basis, both the nominal and the real exchange trends can be analyzed. Throughout the period 2009-2011, the HUF in nominal terms has depreciated compared to its 2010 year's base (as illustrated by Figures 2).

Figure 2: Nominal Effective Exchange Rates for the HUF in 2009-2011



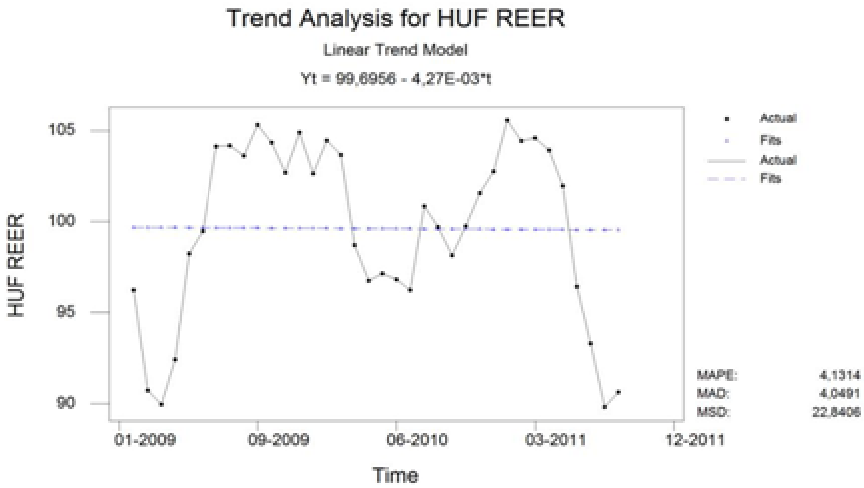
Source: own from BIS data

Despite the fact that the HUF in real terms has kept constant (Figures 3), there has been fluctuations around its 2010 year's reference value. In the beginning of 2009 and since the second half of 2011 the REER for the HUF has depreciated significantly, presumably referring to a correction through FX rate alignment to the debt markets' risk awareness.

An alternative way to estimate FX rate alignments is variance analysis for the 5-years CDS spreads and the HUF REERs. In order to do so, I defined the predictor as the value of the CDS spread at the beginning of the eligible month (to be referred in Figure 4 as 'CDS (-1)). The response of the HUF REERs is strong, 77.1%. The regression equation is:

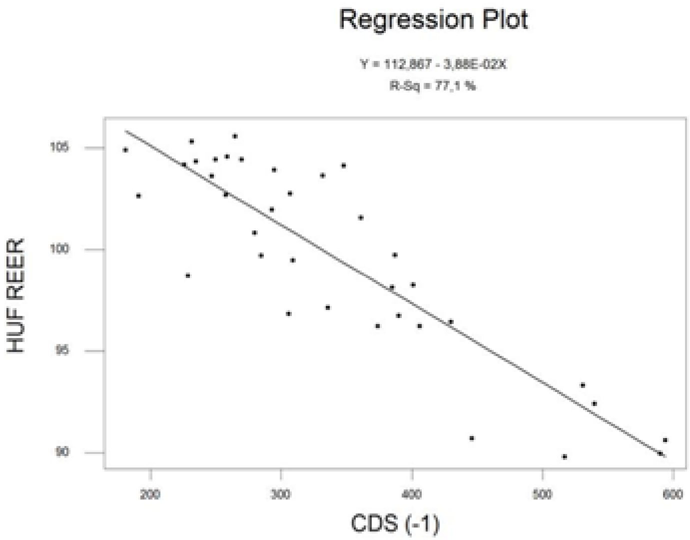
$$HUF\ REER = 113 - 0{,}0388\, CDS\,(-1) \tag{3}$$

Figure 3: Real Effective Exchange Rates for the HUF in 2009-2011



Source: own from BIS data

Figure 4: Real Effective Exchange Rates for the HUF in 2009-2011



Source: own from BIS data

These results imply that REERs' divergences from the reference value – with a high degree of certainty – can be explained by changes in the sovereign CDS spreads. However, in attempting to interpret movements in the foreign exchange rate it is necessary to examine the variables in more detailed subsequent periods of time.

4. FX rate alignments to Credit Default Swaps

In line with the formulas commonly applied in various exchange rate models (Driver and Westaway, 2004), foreign exchange rates can be characterised in terms of a dynamic reduced-form relationship which relates it to a set of explanatory variables as follows:

$$e_t = \beta^t Z_t + \Theta^t T_t + \epsilon_t \quad (4)$$

whereas

- e_t refers to the exchange rate in time t,
- Z is a vector of economic fundamentals that are expected to influence the exchange rate in the medium to long term,
- T is a vector of transitory factors (including current and lagged variables as well as dynamic effects from the fundamentals, Z) which has an impact on exchange rate in the short term,
- ϵ_t is a random disturbance and β and Θ are vectors of coefficients.[3]

Within this framework, I have supposed that the CDS spread behaves as a T vector, influencing the HUF (to the CHF, and to the EUR) exchange rates within the occurrence of the financial crisis. I extended the period of investigation to recent times, beginning with December 2009 and ending in August 2011. The eligible period can be split into three distinct phases (see Figure 5), such as follows:

In a beginning neutral period from December 2009 until March 2010, the HUF-CHF exchange rate stayed within an ascending triangle. The trend regression was: 1 CHF=179,5 HUF+[0,016*CDS] HUF. During this time, there has been nearly the same foreign exchange rate level (182.3 – 183.9), even though the Hungarian CDS spreads have increased sharply (175 – 275). The elasticity of the HUF-CHF rate at CDS 275 was extremely low, 1-179.5/(179.5+0.016*CDS = 2%.

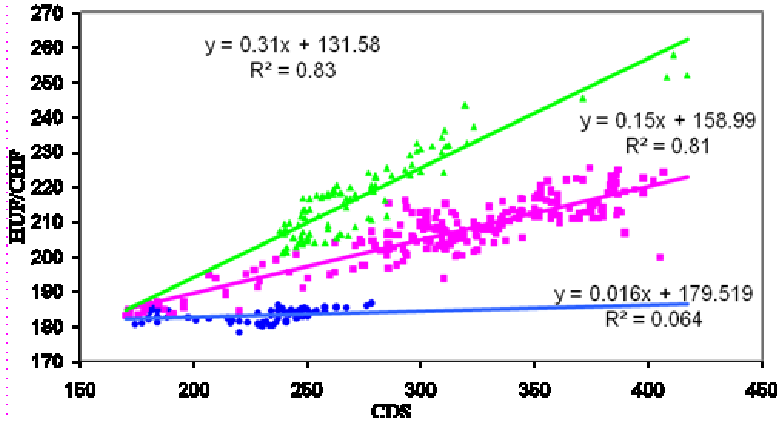
During an intermediate period since March 2010 until March 2011, the trend regression was: 1 CHF=159.0 HUF+[0.15*CDS] HUF, which implies a much higher correlation between the two variables. Throughout this period, the CDS spreads varied from 170 to 400. At the different levels of CDS spreads of 175, 275, and 400, the HUF-CHF rates climbed to 185.3, 200.3, and 219.0 respectively. The elasticity of the HUF-CHF rate at CDS 275 was 1-159.0/(159.0+0.15*CDS = 21%.

Under the latest period from March 2011 until August 2011, there has been a strong correlation between the HUF-CHF exchange rate and the Hungarian CDS, with a trend regression to be expressed as: 1 CHF=131.6 HUF+[0.31*CDS] HUF. The CDS spreads fluctuated in abroad range of 220-420. At the different levels of CDS spreads of 275 and 400, the HUF-CHF rates reached 216.8 and 255.6, respectively. The elasticity of the HUF-CHF rate (written by an equation of 1-131.6/(131.6+0.31*CDS) at CDS 275 was 39%, at CDS 420 was 50%.
More specifically, when we track the origin of the trend regression plots, we conclude with an equilibrium of CDS 170 and HUF-CHF 185.

I asked the question if what could explain the shift from the starting to the intermediate period (in March 2010), and then from the intermediate to the final one (in March 2011), whereby the elasticity of the HUF-CHF rates has resulted in an increased trend path. What surprised me is that these shifts occurred at the same time as the REER for the HUF was at its periodical maximum. Even though there are uncertainties about what drives the relation of the lowest CDS level to FX rate trend elasticity, it is clear that it has happened when the HUF became over appreciated compared to its periodical fundamental value.

[3] [5], page 8.

Figure 5: HUF/CHF exchange rates
(since 08/Dec/2009 in blue; 30/Mar/2010 in purple; 21/Mar/2011 in green)



Source: own from DBR data

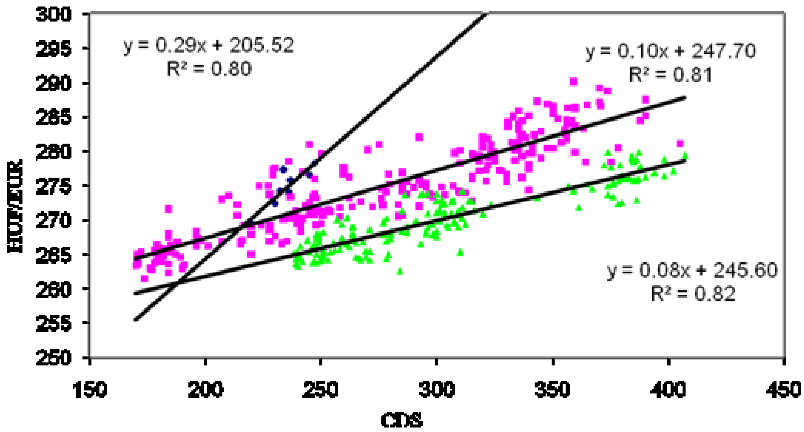
I then examined the HUF-EUR relation, whether different periods can be distinguished in similar patterns, in line with weakening or strengthening elasticity. In case the EUR depreciated in relation to the CHF, trend elasticity of HUF-EUR is expected to be weakening. In details (see also Figure 6):

The beginning period – represented by the upper line in the chart – was relatively short, it lasted from December 08, 2008 until December 21, 2008. The trend regression was: 1EUR = 205.5 HUF + [0.29*CDS] HUF. The elasticity of the HUF-EUR rate at CDS 250 was 1-205.5 HUF + 0.29*CDS = 26%.

The intermediate period – depicted by the middle line in the chart – lasted for about a year, from December 21, 2009 until December 03, 2010. The trend regression for the period was: 1EUR = 247.7 + HUF + [0.10*CDS]. The trend elasticity of the HUF-EUR rate at CDS 250 was only 9%.

The latest period – being represented by the lower line in the chart – from December 03, 2010 until August 12, 2011 was quite similar to the previous (intermediate) period, with a trend regression of: 1EUR = 245.6 + HUF + [0.08*CDS]. The trend elasticity of the HUF-EUR rate at CDS 250 was only 7.5%.

Figure 6: HUF/EUR exchange rates
(since 08/Dec/2009 in blue; 21/Dec/2009 in purple; 03/Dec/2010 in green)



Source: own from DBR data

Despite the partial mismatch of the HUF-CHF and HUF-EUR periods, it can be stated that with equal CDS, the EUR in the course of devaluation has been driven to a lower elasticity trend.

5. Conclusions

This study, considering the increasing Hungarian sovereign indebtedness, set the hypothesis that in the course of the financial crisis the difference in CDS spreads – similar to the difference in inflation rates or in interest rates – may have a significant effect on the foreign exchange rate. The results imply that REERs' divergences from the reference value – with a high degree of certainty – can be explained by changes in the sovereign CDS spreads.

This paper has also explored the characteristics of the 5-years CDS spreads of the Hungarian sovereign debt, in the period between December 2009 and August 2011. The empirical relationship between foreign exchange rates and CDS spreads is close within shorter periods of time, then with a change after some months or a year. These results imply that within the course of an eligible trend (regardless the appreciating or depreciating nature of the trend), the higher CDS spreads contributed to devaluating HUF rates. During the eligible period the CHF has appreciated to the EUR, with strengthening elasticities for the CHF rates, and weakening elasticities for the EUR rates.

One prediction from the analysis, that has not been tested empirically, is that in case of other non-eurozone EU member states there could be similar (or similar to different) relations between the CHF rates and the CDS spreads, or the EUR rates and the CDS spreads.

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