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The Double Covered Question
Do Swedish Covered Bonds Adhere to the Covered Interest Parity?

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This thesis looks at the adherence of Swedish covered bonds to the Covered Interest Parity theorem by performing an original data study. In the study real trading data from the Royal Bank of Scotland with matched swaps from ICAP are used. We test the hypothesis that the theory of Covered Interest Parity holds and whether this has changed in wake of the recent financial crisis. After rejecting this hypothesis we analyse if the observed deviations can be explained by liquidity, as suggested in previous research, using the nominal weekly turnover for covered bonds as a proxy. We then search for an alternative explanation for the deviations and are able to show that the price of the cross-currency basis swap has a substantial explanatory power with significance at the 1% level. Based on this a relative measure of adherence is analysed, benchmarking the covered bonds towards government bonds, to exclude the effect from the cross-currency swap. In this setting a clear trend favouring the covered bonds is observed and a strong explanatory power can be attributed to the liquidity, now defined as the relative turnover of covered bonds compared to total turnover of covered and government bonds.

Key Words: Covered bond, Covered Interest Parity, Interest parity, Cross-currency swap, Liquidity

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Contents

1 Introduction

Swedish covered bonds are together with Swedish government bonds the largest security types in the Swedish fixed income market, with a daily turnover of approximately 13 billion SEK and an outstanding stock of more than 1,800 billion SEK in 2012 (Swedish Riksbank, 2012). Covered bonds are the Swedish banks' main financing source for mortgages offered to private residential buildings (Lucas et al, 2008) and are therefore an essential part in determining the mortgage interest rate faced by Swedish homeowners. As covered bonds provide a large and liquid market of triple A (i.e. S&P AAA, and comparable) rated products that offer a higher yield than government bonds, they are an important security type for the Swedish investment community as well (Swedish Riksbank, 2012). The purpose of this thesis is to analyse how Swedish covered bonds denominated in Euro (EUR) are priced compared to Swedish covered bonds denominated in Swedish Krona (SEK) and if there are any arbitrage opportunities by choosing the "right" currency of denomination. More specifically we will address the question:

Do Swedish Covered Bonds adhere to the Covered Interest Parity, and have the recent years of financial turmoil had any impact on this adherence?

The study is performed as an original data study based on weekly trading data for bond prices retrieved from the Royal Bank of Scotland and swap prices from ICAP´s database with historical swap prices for the period from 2005 to early 2013. For each bond and date a Comparable Asset Swap Spread is calculated to compare the ASW of the EUR denominated bonds with those denominated in SEK. This is done by matching EUR denominated bonds by date and maturity with the price for the SEK/EUR cross-currency basis swap in line with what is proposed by Fletched & Taylor (1996) as well as, when appropriate, the 3 month versus 6 month Euribor basis swap (Interviews RBS, 2013). Using this constructed dataset a test of the main hypothesis is performed. Based on the outcome, further regressions to explain the found deviations are conducted. The practice of a neutral band to adjust for transaction cost, as used in previous research, is adopted in this paper as well.

In accordance with previous CIP research, a regression is performed to explain these deviations with the liquidity of the security as an explanatory variable. The SEK/EUR cross-currency swap, used for calculating the comparable values, is later also tested as an explanatory variable for the deviations based on interviews with market professionals.

Finally an additional test of the liquidity, as an explanatory variable, is performed. Instead of explaining the deviations from the CIP for Swedish covered bonds with the absolute liquidity, the deviations for covered bonds are benchmarked against the government bonds deviations

from the theorem. A relative measure of liquidity for Swedish covered bonds compared to Swedish government bonds is then used as the explanatory variable.

This study differs from previous research in that it is, to our knowledge, the first study analysing the Swedish covered bonds' adherence to the CIP. It is interesting for several reasons, one is that due to the short time span since the Covered Bond Issuance Act (CBIA) came into force in 2004 (SFS 2003:1223) the subject is relatively unexplored. Another is the fact that we use a unique set of data that, compared to many previous studies on the CIP, does not consist of indicative prices, but of real trading outcomes.

This paper is also, in contrast to most previous research, looking at the CIP between a large global currency (EUR) and a relatively small one (SEK) instead of two large global currencies. An additional aspect is that this study is analysing the adherence of a security, the Swedish covered bonds, rather than the spot prices in the foreign exchange market. As such, this paper adds both to the research area of the CIP theorem in general and more specifically to the field of Swedish covered bonds adherence to the theorem.

The results from this analysis differ to a significant degree from previous research. Most early research has concluded that the CIP holds in general with minor deviations (Frenkel & Levich, 1975). We found that although this was the case in the years leading up to the financial crisis, for the period following the fall of Lehman Brothers until today, Swedish covered bonds do, with significance at the 1% level, not adhere to the CIP. We were not able to contribute these deviations to the liquidity in the security, which differ from what previous research has suggested. Instead, this thesis largest contribution is probably that it is able to significantly tie the pricing of the SEK/EUR cross-currency swaps to the deviations from the CIP observed for the Swedish covered bonds. With this in mind the proposition that liquidity should be able to explain deviations was once again tested, using the deviations of covered bonds benchmarked against the deviation for government bonds. Through this adjustment the effect from the cross-currency swap could at large be excluded and the relative liquidity did now explain the difference in deviation between the government and covered bonds with an r-square of 0.22 at the 1 % significance level (reg 6).

These findings are interesting as they on a broader level suggest that the CIP theorem that in general has been regarded to hold in the financial markets, does not do so between the Swedish Krona market and Euro market when the cross currency swap is used as the hedge. This is contradictory to the research conducted by Fletcher and Taylor (1996).

In terms of the Swedish covered bond market, the large deviation, based on trading data, suggests that large opportunities for carry trades and near arbitrage should have been available to

market participants. This should have caused the laws of demand and supply to correct the prices when these opportunities were exploited. As this apparently did not happen it triggers the question; what prevents the issuers and investors from taking advantage of these opportunities? From interviews with professional market practitioners we have been able to summarize a couple of probable answers to this question based on the two different types of market perspectives. We argue that for the investors the downgrading of banks and the following increase in counterparty risk for the swap contract is the most prominent factor combined with internal, investor specific, regulations. For issuers, the wish to maintain their stable access to non-domestic markets appears to be an important factor.

2 Previous Research

The area of the Swedish covered bonds and the CIP in combination is to our knowledge undocumented in previous research. A large reason for this is probably the relatively short existence of the Swedish covered bond market. However, there are a number of previous papers looking at the CIP and covered bonds separately; a selected sample of relevant research will be presented below.

The theory of the CIP has become increasingly more popular in the wake of the financial crisis when many academics have made an interest in the crisis' implications on the CIP. This can be shown by the increase in the number of working papers on the subject. Most of this research looks at the large currency pairs and the foreign exchange markets adherence to CIP.

The CIP theorem is a special case of the Interest Parity theorem in which the position is possible to hedge by for example, as shown by Fletcher and Taylor (1996), using a cross-currency swap. Frenkel and Levich (1975) looks at the possibility to gain arbitrage profits in the exchange markets, concluding that when taking the estimated transaction cost into regard the arbitrage opportunities are very limited. However, this is later commented on by McCormick (1979) who points out some data quality issue in their analysis and then uses their method on his own set of data. He concludes that, contrary to what Frenkel and Levich (1975) suggest, the hypothesis considering the transaction cost as a sole explanatory factor for the whole deviation from the CIP does probably not hold. Instead he proposes that an important complementing factor for explaining the deviation is the cost of information.

The question whether or not the deviations from the CIP can be explained by transaction cost have led others to try to determine the level of transaction cost that could reasonably be assumed when testing if the CIP holds. Branson (1969) argues, even before the above studies were published, that transaction cost can be as high as 18 basis points while others later on have found evidence for levels as low as 4 basis points (Taylor 1987). Much of this research is however based on indicative prices, which is a source of error. Clinton (1988) argues that the previous studies have overestimated the importance of transaction cost largely because of the use of indicative prices. He continues by arguing that the maximum deviation that should be attributed to transaction cost when looking at CIP adherence should not be higher than 6 basis points and that a Neutral Band that takes this into consideration should be used and that only deviations outside this band should be regarded as true CIP deviation.

Balke and Wohar (1998) investigate the deviations from the CIP for the GBP/USD spot rates from 1974 to 1993. They find that for the deviations that occur during this time period, the ones that occur inside their calculation of the Neutral Band are almost symmetric while the ones

breaking outside this band are asymmetric. Fong et al. (2010) conducted a similar study in which they look at the USD/HKD currency pair and to what extent deviations from the CIP can be explained by liquidity.

The effect of liquidity on the adherence of the CIP have been analysed by several other authors as well, including Roll et al (2007) and Taylor (1987). Both these studies concludes that the liquidity has a large impact on how correctly priced the assets will be in terms of the Law of One Price and the CIP. Popper (1993) investigates in her paper whether or not there are any differences in terms of adherence to CIP for the long term market compared to the short term market and finds no difference between the two markets.

Fletcher and Taylor (1996) have, as mentioned, looked at how well the CIP works with cross-currency swap as the hedging tool used in the theorem. They find in their empirical study that the cross-currency swap works well when used in the CIP framework as long as transactional costs are accounted for, for example within the concept of the Neutral Band.

As mentioned, there are, to our knowledge, no previous studies looking at the Swedish covered bonds adherence to CIP. There are, however, a number of papers looking at the covered bonds pricing in general. One such study focusing on the Nordic market for covered bonds was published by Sulku and Falkenbach (2011) in which they develop a model for pricing of covered bonds.

Packer et al (2007) looks at the valuation of covered bonds in general and find that the covered bond have been shown to be robust both to idiosyncratic risk in terms of issuer credit risk as well as more systematic chocks affecting, among other things, the value of the cover pool. Stöcker (2011) describes the fundamentals of the covered bond framework in Europe in regards to the legal structures used in different countries and their main differences and Lucas et al. (2008) discuss the European covered bond system as a possible replacement of the American mortgage backed securities in the aftermath of the mortgage backed bonds meltdown that occurred during the financial crisis.

3 Background

3.1 Covered Bonds

Covered bonds are a type of debt securities backed up by cash flows from a pool of loans, referred to as the cover pool. The Swedish legislation for covered bonds was enacted in December 2003, and the legislation came into force on the 1st of July 2004 (SFS 2003:1223).

Holders of Swedish covered bonds have the highest priority (higher than all other creditors including claims regarding taxes and salaries) over the assets in the cover pool. If the issuer of the covered bond would become insolvent the covered bond will not be liquidated as long as the cover pool meets the required loan-to-value ratio. The cover pool will instead, in the event of insolvency for the issuer, be separated from the insolvency estate (Sylvén, 2012) and an insolvency administrator will take over the management of the cover pool (SFS 2003:1223). If the cover pool, however, would become insolvent the covered bond will be liquidated. If the sales from the cover assets do not cover the outstanding debt, the bondholders will still have recourse to the insolvency estate of the issuer. In this case they will though be prioritized at the same level as all other senior unsecured investors (Sylvén, 2012). All assets in the Cover Pool must be entered into a special register that shows the nominal value of the bond and the Cover Pool for the priority claim to work (Ibid).

The Swedish cover pool for mortgage covered bonds in Sweden can consist of real property for residential purposes, agricultural purposes as well as commercial and office purposes and site-leasehold rights for the same purposes. The underlying properties have to be situated in Sweden or in a country in the European Economic Area (Ibid). The ratio of loan relative to the collateral that is allowed is different depending of what the underlying assets are; for residential purpose properties the loan may be up to 75% of the market value of the cover pool assets, for agricultural properties it is 70% and for commercial and office properties it is 60%. There is also an extra limit that only a maximum of 10% of the cover pool may consist of commercial properties (Ibid). The Swedish Financial Supervisory Authority appoints an independent compliance controller that will supervise the management of the cover pool.

There are seven institutes on the Swedish market that are allowed to issue covered bonds: Landshypotek, Nordea Hypotek, Länsforsakringar Hypotek AB, Spintab (Swedbank Hypotek AB), Stadshypotek AB (Svenska Handelsbanken), Swedish Covered Bond Corp and SEB. To be allowed to issue covered bonds on the Swedish market, a license from the Swedish Financial Supervisory Authority is required (Swedish Riksbank, 2012). For an issuer to obtain a covered bond license the issuer is required to convert all outstanding mortgage bonds to covered bonds or in some other way give the bondholders an equal treatment (SFS 2003:1223).

In the secondary market all benchmark covered bonds, bonds with an outstanding loan amount of more than 3-5bn SEK, have a market maker agreement with one of six possible market makers. The available market makers are Nykredit Bank A/S, Danske Bank, Nordea, SEB, Handelsbanken and Swedbank. The market maker agreement implies that the market making bank need to assist in the trading on the secondary market, at all times quote indicative rates and, under normal market conditions, hold a bid ask spread of a maximum of 2 basis points. The market makers also need to assist the issuer in selling bonds via taps of the benchmarks bonds that are already trading on the secondary market (Sylvén, 2012).

3.2 Swedish Government Bonds

Swedish government bonds are government debt securities issued by the Swedish National Debt Office and guaranteed by the Swedish government. The Swedish government uses Swedish government bonds ("statsobligationer" and "statsskuldväxlar") to fulfil their lending needs (SFS 2007:1447).

The Swedish National Debt Office issues bonds in foremost SEK, but also in a wide variety of other currencies, where EUR and USD make up a significant part. Apart from the ordinary bonds they also issue a number of inflation-adjusted bonds. The reason for issuing inflation-adjusted bonds as well as bonds denominated in other currencies is for risk management purposes (Ibid).

The primary market of Swedish government bonds are the auctions held by the Swedish National Debt Office. In both the primary and the secondary market investors are allowed to invest as little as 1 million SEK which opens up for a much larger group of investors compared with most other bonds that often demand considerably larger amounts.

The secondary market for Swedish government bonds is often very liquid and is commonly viewed as effective and well-functioning. Money market information is reported via the Swedish National Debt Office press releases and via SIX and Reuters (Swedish National Debt Office, 2011).

3.3 Swaps

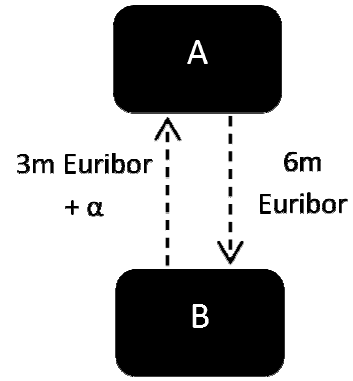
3.3.1 3 month vs. 6 month Euribor basis swap

An interest rate swap is a contract in which one party agrees to make a specified interest payment during a certain time and at the same time receiving a different interest payment form the other party. The payments are tied to different indexes such as the US Libor, Euribor etc. For the 3 month versus 6 month Euribor basis swap (hereafter referred to as the 3vs6 swap), these two indexes are the Euribor floating 3 month rate and the Euribor 6 month floating rate. The price

of the swap is quoted in basis points and reflects the markets perception of how the two indexes will differ over the tenor of the swap. In case of the 3vs6, as shown in figure 1 below, the price is the number of basis points (alpha) one receive in addition to the 3 month rate while paying the 6 month rate (Malhotra, 1997).

Figure 1

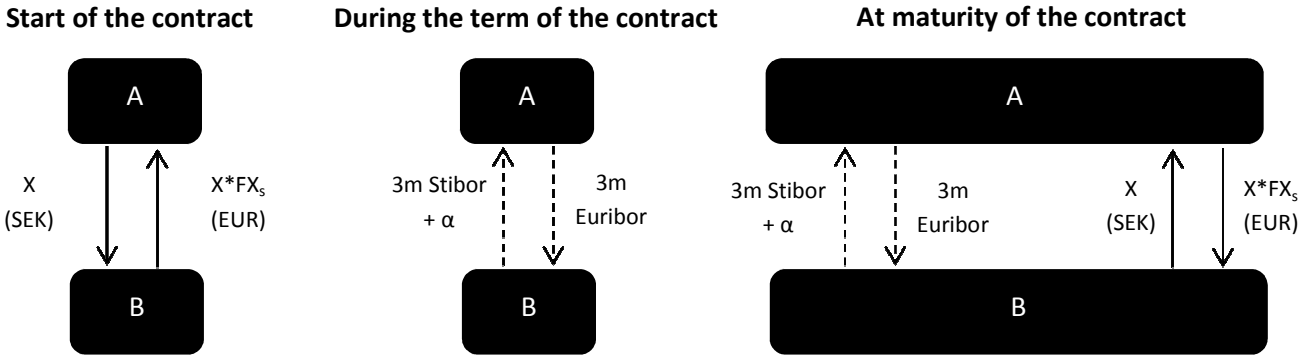
During the term of the contract



3.3.2 Cross-Currency basis swap

The cross-currency basis swap is a contract in which one party agrees to at the start of the contract borrow one amount in one currency and at the same time lends the corresponding amount (given current spot exchange rates) in another currency to the second party. Over the term of the contract the two parties will then exchange rates payments where party A pays the 3 month rate in the currency party A borrowed and receives the 3 month rate + alpha in the currency it lent. The alpha is reflecting the current views of the future rates for the currency pairs and the corresponding interest rates. The price of the in our study used cross-currency basis swap is quoted as alpha that is the number of basis points added to the received Stibor based interest payments. At the end of the contract the final interest payment exchange is made as well as a repayment of the borrowed and lent amounts (the same spot exchange rate as in the inception of the contract is used). The transactions occurring as part of the cross-currency swap is shown in figure 2 below. Cross-currency swaps are mainly used by financial institutions or by corporations through a financial institution acting as an intermediate for its customers. The cross-currency basis swap normally exists in maturities spanning from 1 to up to 30 years (Baba and Sakurai, 2011). The cross currency swap has been found appropriate to use as the hedge in the CIP framework by Fletcher and Taylor (1996). From here on the Swedish Krona/Euro cross-currency swap will be referred to as the cross-currency swap or XCCY.

Figure 2



FX_s= The FX spot rate for EUR/SEK at the start of the contract

3.3.3 Asset Swap Spread (ASW)

The asset swap spread is the spread between an assets yield to maturity compared to the corresponding swap curve. The asset swap spread for a Swedish covered bond is the difference in basis points between the bond's yield to maturity compared to the Swedish swap curve. The swap curve has generally been interpreted as the level where high rated banks are able to fund themselves, i.e. the bank funding level in general and this is one of the reason that have made the asset swap spread popular as a measure (Garcia Pascual et. al., 2007). However, as this was at large the truth in the years before the crisis, it is no longer the case.

At the time of this paper, as stated by a Vice President at the Royal Bank of Scotland Debt Capital Market team (Interviews RBS, 2013), there are less than a handful of banks still enjoying this high rating (Svenska Handelsbanken, Nordea Bank and Rabo Bank) in Europe. Despite this, the asset swap spread as a value has continued to be as commonly used as before. It is therefore important to remember that a 10 bps asset swap spread does not represent the same thing today as it did during the years before the crisis. Given that this paper looks at the difference in asset swap spread (after taking additional swaps into account) and only compare the values per date to get the difference we have decided to neglected this shift in what the asset swap spread represent. The ASW is well used in the market as a value, together with the yield and the actual price, for bonds. The reason for using the ASW in this paper instead of the two other commonly used measures is that the ASW adjust the value after the swap curve and by doing this making them comparable to a large extent regardless of size of coupon etc. It also makes the values easier to use in conjunction with the previously presented swaps.

3.4 Swedish Riksbank – Emergency Fixed Rate Loans

During the turbulent times after the Lehman crash, the Swedish Riksbank saw the needs, in the Swedish financial markets, for extraordinary monetary policies. The repo-rate was lowered from 4.75% in October 2008 to the historical low of 0.25% in July 2009, a decrease with 450 basis points in less than a year. The view from the Riksbank was that these measures alone was not enough, therefore they launched a series of emergency fixed-rate loans of 100 billion SEK each (a total of 3 loans) and a total of 296.5 billion SEK were lent out in the end. The loans had allocation rates of 0.45/0.43/0.40 % respectively and tenure of around 1 year (Elmer et al, 2012)

When launching these extraordinary measures the Swedish Riksbank was clear with their exit strategy of the loans, and that they would not continue with them for a second period. The last one of the emergency fixed-rate loans was repaid in October 2010, and even though the market knew about the exit, the market still entered a state of a chock (Ibid).

4 Theoretical framework

4.1 The Law of One Price

The Law of One Price is one of the most fundamental laws of economics, or as stated by Lamont and Thaler (2003), the second in rank only to the law of supply and demand. The idea is that if the same good is sold at different prices, there would be an opportunity to buy at the cheaper price and sell at the more expensive price and buy doing this create an arbitrage (the free lunch). At this point in time the first law of economics steps in and the increased demand created by the arbitrage for the low priced "version" will cause the price to increase just as the increased supply of the more expensive version will cause that price to drop (Lamont and Thaler 2003). In most basic finance literature this relationship is usually described in a setting where apples or cars are sold at different prices in different countries. The law is however just as, if not more, important in the financial world where many of the limitations faced by the initial example with cars and apples does not exist, for example transport costs and total similarity.

Some of the most famous examples of research that have looked at the effect of the Law of One Price in finance are those looking at the Siamese stocks of for example Royal Dutch Shell. However, there is no limit regarding what the law is applicable for, making it possible to use for the most complex financial securities. The problem with the homogeneity does however increase with the level of complexity for the security, not because the security in itself is not homogenous but, because market participants have problems verifying the comparability. For interest rates and currencies, the Law of One Price is demonstrated as the Interest Parity theorem (Fratianni & Wakeman 1982).

4.2 Interest Parity Theorem

4.2.1 Uncovered Interest Parity (UIP)

The Uncovered Interest Parity suggests that the difference in interest rates for two currencies should be reflected in the spot exchange rates making an investor unable to achieve arbitrage by choosing to invest in the currency with the higher interest rate (Mishkin 1984). This relationship can be expressed using the equation 1 below:

Equation 1:

$$\frac{F-S}{S} = \frac{i-i^*}{1+i^*}$$

Where F is the forward exchange rate and S is the spot exchange rate while i and i* are the interest rates on securities that are identical in all aspects except the currency of denomination (Frenkel, 1973). In this paper, the return on SEK and EUR denominated covered bonds represent the i and the i* respectively even though the bond in reality may differ slightly and not conform with the identical assumption at a 100 % level. If the difference in yields is not explained by the expected change in the spot rate there is an opportunity to create an arbitrage position by buying the, in accordance to the Interest Parity, cheaper security and selling the more expensive. Thereby an investor can reap a profit as the prices of the securities converge.

In testing the assumptions of Interest Parity, studies have in general not demanded the deviations from Interest Parity to be zero for the theorem to hold. Instead an interval around zero is used, called the Neutral Band. The Neutral Band is defined as the interval in which deviations from the interest parity can be explained by transaction costs in the market (Frenkel 1973). We will in this study, due to the complexity of calculating the true Neutral Band as shown by Frenkel (1973), use a band width of 5 basis points as an approximation based on previous research [1] as well as interviews with market professionals. However, deviations from the Uncovered Interest Parity do not present opportunities of true arbitrage since there is no guarantee to when the deviations will diminish and the position is not hedged (McCallum 1993).

4.2.2 Covered Interest Parity

The Covered Interest Parity (CIP) theorem relies on the same theoretical foundations as the UIP. However, thanks to the existence of the cross-currency interest rate swaps, a portfolio can be arranged to eliminate the risk faced in the UIP framework (Fletcher and Taylor, 1996) and, at least in theory, true arbitrage positions can be created (McCallum 1993). Following from the Law of One Price any arbitrage opportunities should instantly be exploited and the opportunity would evaporate. Therefore, no arbitrage opportunities should be available as a result of the currency of choice for an investment in an asset as stated by Fratianni & Wakeman (1982) and Balke & Wohar (1998).

The idea is that the cross-currency basis swap price is reflecting all the expected changes in the exchange and interest rates (Fletcher and Taylor, 1996). Instead of using a cross-currency basis swap one could use other types of instruments for hedging depending on the type of market. For example in the foreign exchange market, forward exchange contracts are commonly used. As this thesis investigates the adherence of covered bonds to the CIP, the cross-currency swap will be used as it is a common hedging instrument for this market (Interviews RBS, 2013).

[1] (Clinton, 1988) (Frenkel, 1973) (Fletcher and Taylor, 1996) (Taylor, 1987)

5 Data & Methodology

5.1 Bond Data:

To be able to test our hypothesis an entirely new set of data have been constructed with matched bonds and swaps in terms of both date and maturity. The bond data used is retrieved from the Markets Department at The Royal Bank of Scotland (RBS) and swap data from ICAP. All data is based on actual trades.

The bond pricing data consists of weekly ASW (mid) for Swedish covered bonds and Swedish government bonds issued in either EUR or SEK that was active sometime during the period 2005-01-01—2013-03-15. The reason for using weekly data instead of daily data (which was also available) was because the extra data points from daily data added more noise than valuable information, due to the already large and comprehensive size of the dataset. Covered bonds issued from 6 of the 7 Swedish issuers (Landshypotek, Nordea Hypotek, Länsforsakringar Hypotek AB, Swedbank Hypotek AB, Stadshypotek AB, Swedish Covered Bond Corp) were included. Bonds issued by SEB are not included since SEB´s hypothec was incorporated into the rest of the bank in 2006, making it more difficult to get reliable data.

Apart from the ASW data the following information is included; "Issuer", "Currency", "Issue date", "Maturity date", "Bid and Ask Yield", "Coupon Type", and "Collateral Description". In addition to this the turnover per week from covered bonds denominated in SEK and government bonds denominated in SEK was added.

For government bonds there is a period in 2008-2009 without any EUR denominated bonds being traded. This is not due to limitations in the data, instead it is the result of the Swedish National Debt Office not having any EUR denominated bonds outstanding during this period (Interviews RBS, 2013).

The turnover volumes, for both covered bonds and government bonds are retrieved from Statistic Sweden. Unfortunately Statistic Sweden only has data available for the SEK denominated turnover for each bond type. In this paper the SEK denominated turnover is used as an approximation for the liquidity in the bond types in general. Descriptive statistics regarding the turnover data is shown in table 1 for covered bonds and government bonds suggesting the turnover to be quite volatile in general.

5.2 Swap Data

The swap data was retrieved from the Markets Department at the Royal Bank of Scotland through their access to ICAP´s database with historical swap prices. Weekly data was retrieved (matching the bond data) for the EUR/SEK cross-currency prices for 1-10 years maturity swaps. However, due to illiquid markets for cross-currency swaps with maturities of 6, 8 and 9 year these swaps were not included, see table 2 for descriptive statistics over the cross-currency swaps. Weekly pricing data for the 3vs6 swaps was in addition extracted for the maturities of 1-10 years (table 3). All swap data are, as the bond prices, based on actual transaction prices.

5.3 Construction of the Dataset

The dataset was first down sampled to match the intended study. The most active spectrum in the Swedish covered bond market is the 1-5 years maturity span. Therefore this maturity span was chosen for this study. Market participants generally group bonds into one year buckets and consequently a 5.3 year bond would be treated as a 5 year bond etc. Bonds with a tenure above 0.7 and lower than 5.3 was therefore kept. Due to the strict legal framework, low number of different issuers, high activity and the large number of bonds issued in these maturities they are in large an homogenous market and even though not identical per see the bonds could be perceived as highly similar. Bonds with longer maturities are rarer and therefore each one to a larger extent becomes a special investment opportunity, and is as stated not included in the study.

All data before 2005 were also omitted due to too few observations in that period to be able to perform a reliable analysis. This is to a large extent related to the very few issuances that were made in EUR before the implementation of the Covered Bond Issuance Act since European investors did not have much appetite for the Swedish mortgage bonds when they were not as generic and homogenous (Interviews RBS, 2013).

Once this dataset was constructed the data was cleaned from "wrong" or extreme values. We searched through the data for any extreme values and found that dates adjacent to issue or maturity dates sometimes present extreme values. After discussing this with experienced market practitioners at the Royal Bank of Scotland we concluded that the extreme values found were due to incorrect registration of the price. These observations were therefore omitted. All inflation-adjusted bonds were also omitted since they are not comparable with the other bonds.

The average tenure per date for covered bonds as well as government bonds is calculated for each currency separately. As shown in graph 1 and 2 bonds are comparable in terms of maturity with differences in the initial period of less than 1.5 years and for most other parts less

than 0.75 years. A large difference in tenure could have explained later found deviations from the CIP, but given the small differences they are deemed to not be an issue. Although the data is data of actual trades, to further minimize the effects from incorrect registered trades, not found in the above cleaning process, we chose to exclude the few data points for covered bonds with a yield bid ask spread greater than 20 basis points as they most likely are incorrect registered trades. The data set used in this study is summarized in table 4 & table 5, showing a confirmation for that the tenures overall are in general similar.

5.4 Definition and Construction of the CIP Deviation

The aim with the thesis is to test Swedish covered bonds adherence to the CIP. To be able to test this hypothesis the EUR denominated covered bonds need to be made comparable with the SEK denominated bonds. The same method is later applied for government bonds.

5.4.1 Comparable ASW

For the Comparable ASW the SEK denominated bonds are used as the base and hence the Comparable ASW for the SEK denominated bonds is equal to the ASW as shown in equation 2 below.

Equation 2

$$Comparable\ ASW_{SEK} = ASW_{SEK}$$

To create a Comparable ASW for the EUR denominated bonds different calculations have to be applied depending on whether the bond pays a fixed or a floating coupon. According to market standard, the ASW for EUR denominated bonds that pays a fixed coupon is calculated benchmarked to the 6 month curve whereas the SEK bonds are benchmarked towards the 3 month curve. Therefore the, per date and maturity matched, 3vs6 swaps were used to adjust for this. Floating EUR denominated bonds are, however, benchmarked against the 3 month curve and an adjustment with the 3vs6 swap is therefore not necessary. All EUR denominated bonds are then matched by date and maturity to the corresponding cross-currency swap. The maturity matching of the swaps are made using linear interpolation. The calculations for the Comparable ASW for EUR denominated bonds are shown below in equation 3.1 and 3.2.

Equation 3.1

$$Comparable\ ASW_{EUR} = ASW_{EUR\ fixed} + 3vs6 + XCCY$$

or

Equation 3.2

$$Comparable\ ASW_{EUR} = ASW_{EUR\ floating} + XCCY$$

5.4.2 CIP Deviations

The Covered Interest Parity Deviation (CIP Deviation) is in this paper defined as the difference between the average value per day of the Comparable ASW for EUR denominated bonds and the average value per date of the Comparable ASW for SEK denominated bonds. This is measured in basis points and the calculation is shown below.

Equation 4

$$CIP\ Deviation = Per\ date\ average\ Comparable\ ASW_{EUR} - Per\ date\ average\ Comparable\ ASW_{SEK}$$

5.5 Hypothesis Testing

To analyse if the CIP holds for the Swedish covered bond market multiple hypothesis tests are performed. As a neutral band of plus minus 5 basis points is used, one-sided tests are performed in regard of the absolute CIP Deviations. The hypothesis tests are done for three different time periods: Total period (2005-01-01 – 2013-04-05), First period (2005-01-01 – 2008-09-14) and Second Period (2008-09-15—2013-04-05). For all these periods two corresponding one-sided tests are made. The two different null hypothesises and the alternative hypothesises are then defined as:

Hypothesis test 1:

$$H_0: Absolute\ CIP\ Deviation = 5$$

$$H_1: Absolute\ CIP\ Deviation > 5$$

Hypothesis test 2:

$$H_0: Absolute\ CIP\ Deviation = 5$$

$$H_1: Absolute\ CIP\ Deviation < 5$$

Even though the smallest sample period, the First Period, have a relatively large sample size of 193 observations we do not want to assume normal distribution. Instead we test if the CIP Deviations are normal distributed. This is done by first graphing the kernel densities for all the periods and then compare them with a normal density (graph 3-5). This did not support the hypothesis of normal distribution. After that Shapiro-Wilk tests are conducted (Table 6-Table 8) that shows that the null hypothesis, that the CIP Deviations are normal distributed, can be rejected with significance at less than the 1% level.

Since the CIP Deviations are clearly not normally distributed an ordinary students t-test should not be used to perform our hypothesis tests. Instead, a "Sign test" is used as it only tests the null hypothesis that the median of the CIP Deviations should be equal to zero and therefore does not demand a normal distributed sample (Snedecor and Cochran 1989).

5.6 Interviews

Interviews with experienced market practitioners are used in this thesis as a complement to econometric models. By using the valuable insight possessed by the market practitioners we are able to identify the cross-currency swap as an interesting variable in regard of the observed CIP Deviations. Based on the interviews we are also able to recognise some other factors that can work against a total adherence to the CIP which we will describe in further detail.

5.7 Definition and Construction of the Comparative CIP Deviation

As a way of testing the adherence to the CIP, keeping the effect from the XCCY in principal excluded, the CIP adherence of covered bonds are benchmarked against the similar government bonds by using the Comparative CIP Deviation presented below.

Comparative CIP Deviation – Is in this paper defined as the difference between the absolute CIP Deviations for covered bonds and governments bonds in basis points as shown in equation 5.

Equation 5:

$$Comparative\ CIP\ Deviation = absolute\ CIP\ Deviation_{CB} - absolute\ CIP\ Deviation_{GB}$$

5.8 Definition and Construction of the Relative Turnover Covered Bonds

Relative Turnover Covered Bonds - This is here defined as the percentage of the sum of the turnover of covered bonds and government denominated in SEK bonds that the covered bond turnover represents as shown in equation 6.

Equation 6:

$$\text{Relative Turnover Covered Bonds} = \frac{\text{Turnover Covered Bonds}_{SEK}}{(Turnover\ Covered\ Bonds_{SEK} + Turnover\ Government\ Bonds_{SEK})}$$

5.9 Regressions

5.9.1 Covered Bonds

As previous research have suggested liquidity to have a strong explanatory power for the deviations from the CIP the nominal turnover for SEK denominated covered bonds, as a proxy for liquidity, is tried as an explanatory variable for the found deviations. This regression model is shown in regression 1 below.

Regression 1:

$$CIP\ Deviation_i = \beta_0 + \beta_1 * Nominal\ Turnover\ Covered\ Bonds_i + \varepsilon_i$$

To be able to evaluate the suggestions made in the interviews regarding the XCCY as a reason for the deviations, regressions with the XCCY as the explanatory variable are performed. The regressions are done for the total period as well as the first and second period respectively and finally for the period after the Riksbank's Emergency Fixed Rates Loans were revoked. The model used in these regressions is then defined as:

Regression 2-5:

$$CIP\ Deviation_i = \beta_0 + \beta_1 * XCCY_i + \varepsilon_i$$

The fact that the XCCY is used when calculating the Comparable ASW and therefore is included in the calculation of the CIP Deviation could possibly present a statistical problem. However, as shown below in equation 7, this is not the case for the used regressions. If the XCCY is excluded from the calculation of the Comparable ASW, the CIP Deviation* will be defined as follows (equation 7):

Equation 7:

$$CIP\ Deviation^* = CIP\ Deviation - XCCY$$
$$= (Comparable\ ASW_{EUR} - XCCY) - Comparable\ ASW_{SEK}$$

The Regression 2 will then be*

$$CIP\ Deviation^*_i = \alpha_0 + \alpha_1 * XCCY_i + \varepsilon_i$$

where

$$\alpha_1 = \beta_1 - 1$$

That the above reasoning is correct is shown by comparing the result of Regression 2 with that of the Regression 2*. The coefficient in the Regression 2* (α_1) is exactly 1.00 lower in than the one in Regression 2 (β_1) as suggested by the condition $\alpha_{1=}\ \beta_1$-1 in Equation 7.

5.9.2 Comparative to Government Bonds

A regression is also performed to test if the difference between the CIP Deviation for covered bonds and the CIP Deviation for government bonds can be explained by the Relative Turnover Covered Bonds (defined above). The Regression model is shown in equation 8.

Regression 6:

$$Comparative\ CIP\ Deviation_i = \beta_0 + \beta_1 * Covered\ Bonds\ Relative\ Turnover_i + \varepsilon_i$$

5.9.3 OLS Regressions

The regressions made in this thesis are all simple Ordinary Least Squares-regressions (OLS-regressions). A simple OLS regression has 5 underlying Gauss-Markow assumptions for its optimal condition. However, the optimal condition is in most cases not satisfied by real data. The assumptions stated are the following (Wooldridge 2008):

SLR1: Linear in Parameters – This means that the relationship between the independent variables and the outcome variable should be linear.

SLR2: Random Sampling: The dataset should be comprised of a random sample, following the population model in assumption SLR1.

SLR3: Sample Variation in the Explanatory Variable: The sample outcomes from the independent variable should not all have the same value.

SLR4: Zero Conditional Mean: Expected value of error-term should be zero for any value of the independent variables.

SLR5: Homoskedasticity – The error term should, given any value of the independent variable, have the same variance.

To test whether or not it is appropriate to use a simple OLS regression the data used for the regressions is tested against each one of these five assumptions.

First, regarding SLR1, to be able to measure the linearity, an augmented partial residual plot was made (graph 6-11). Although some deviations from linearity can be observed, for example in graph 11 where there is one data point with a very high value of Relative Turnover Covered Bond causing the deviation, we consider the results linear enough to make the use of OLS appropriate.

Regarding SLR2 on the Random Sampling, a large, in principal exhaustive, sample for the covered bond data, government bond data as well as the swap data is retrieved to present a fair picture of the market. Although the covered bonds issued by SEB are being excluded, the Random Sampling assumption can be considered to be satisfied. In regard of the turnover data a problem from random sampling occurs as the turnover is only available for the SEK denominated bonds which could lead to biased results. The missing data problem is encountered, as we do not have all data for all observation (Wooldridge, 2008). However, there is no reason to assume that this missing data problem leads to non-random samples, but it might still be a source of error.

The SLR3 assumption does hold since the independent variables in our sample consists of many different values for all the periods used in the regressions.

For SLR4, the condition that the expected value of the error term is zero for any value of the independent variables is not proven and is as such a possible source of error.

For SLR5 (Homoskedasticity) a Breusch-Pagan Test for Heteroskedasticity and a White Test for Heteroskedasticity is used for each regression to be able to test if the homoskedasticity assumption for OLS holds (Wooldridge 2008). As shown in Table 9 and 10 the regressions regarding CIP Deviation over XCCY, for all of the tested periods, show that the null hypothesis of homoskedasticity can be rejected with significance on a less than the 5% level. Therefore the STATA option "robustness" is used when making the regressions as it then takes into consideration heteroskedasticity as well as lack of normality. Even though we are not able to reject the hypothesis regarding homoskedasticity for the CIP Deviation over the nominal turnover for covered bonds or for the Comparative CIP deviations over Relative Turnover Covered Bonds, the robustness option is still used for these regressions as the results are not strong enough to assume homoskedasticity.

6 Results

This section shows both the empirical findings as well as the results from the interviews with practitioners at the Royal Bank of Scotland that were achieved using the methods in section 5. We will start by presenting and analysing the results related to the CIP Deviation for covered bonds. Then we will continue with presenting the results related to the relative comparison between the CIP Deviation for covered bonds and the CIP Deviation for government bonds. We find that the Swedish covered bonds do not adhere to the interest parity theorem after the financial crisis, or for the period as a whole. We also find explanatory variables for these deviations from the theorem.

6.1 CIP Deviation

6.1.1 Descriptive Statistics

Due to the difference between the periods before and after the offset of the financial crisis the analysis is made for three different periods, the total period (2005-01-01 – 2013-04-05), the first period (2005-01-01 – 2008-09-14) and the second period (2008-09-15 – 2013-04-05). In addition, a subset of the second period (2010-11-01—2013-04-05) is analysed to take the Riksbank's Emergency Rate Loans into consideration.

The Comparable ASW for EUR and SEK denominated bonds should be the same according to the CIP. Table 11, where we summarize the comparable ASW as well as the CIP Deviations for the different periods shows that the theorem might not hold. The mean deviation is 15 basis points for the whole period, which is far beyond the 5 basis points we assume, are able to be attributed to transaction costs, in accordance to our Neutral Band. For the second period an even larger mean value is shown, suggesting that the CIP does not hold for this period either. This is visually shown in graph 12, where the comparable ASW for the covered bonds are plotted and in graph 13 where the CIP Deviations over time is shown. Both in terms of the standard deviation shown in the table and from the graphs it is clear that the deviation is volatile, reaching lows at -25 basis points and peaking at over 75 basis points. For the first period the deviations are lower, possibly low enough to support adherence to the CIP.

The distribution of the absolute CIP Deviation is shown in the histograms (graphs 14-16) where the differences between the periods become even more evident. Here the first period (graph 15) has a high concentration of observations with CIP Deviations of less than 5 basis points from the CIP and that the periods largest deviations are less than 20 basis points. For the Second period however (graph 16), the majority of the observations deviated with more than 20 basis points.

Table 2 shows that the mean price of the cross-currency swaps is clearly higher than the median for all maturities used. Comparing this finding with graph 17 where both the CIP Deviation and the average cross-currency swap price in basis points is shown. Here it is evident that the price is higher than in the second period reaching over 50 basis points. The 3vs6 swaps do instead show more stable prices, the means do not deviate as much from the median values and the standard deviations are lower.

As a complement to this empirical data interviews with market professionals (Interviews RBS, 2013) are conducted. The discussion regarding the found CIP Deviations suggested that the cross-currency swap, used in the construction of the comparable ASW, probably was mispriced in the period after Lehman and that this could explain a substantial part of the observed deviations. The interviewees also stressed that the cross-currency swap is a difficult product to price correctly, both in theory and in practice. For the second period, the financial turmoil should also have been especially problematic for the traders. This is both because of an increased counterparty risk, in terms of financial institutions having problems, as well as increased sovereign risk. In these interviews, the emergency fixed-rate loans conducted by the Swedish Riksbank, are suggested to have had a large effect on the market in general.

6.1.2 Main Results

The results from the performed hypothesis tests shows that, given a Neutral Band of 5 basis points, the CIP theorem holds during the first period with a significance at the 0.01% level (table 13). For the period as a whole and for the second period (table 12 & 14) the test show that the hypothesis that the Swedish covered bonds adhere to the CIP theorem, can be rejected with significance at less than the 1% level.

The result from the regression, trying to explain the deviation using nominal turnover as a proxy for liquidity, shows that the nominal turnover cannot significantly explain the found deviations (Reg 1).

The tests using the cross-currency as the explanatory variable give significant results. For the total period (Reg 2) an explanatory power, measured in R-square, of 0.52 with significance on less than the 1% level is observed. The differences between the periods are though apparent. Both the first and the second period alone show less explanatory power than the total period did (Reg 3 and Reg 4). The period, starting after the Swedish Riksbank's emergency fixed-rate loans had been revoked, did however show an R-square of 0.75 with the result still significant at the 1% level (Reg 5).

These results give credibility to the theory that the CIP Deviations can be attributed to the mispricing of the cross-currency swap after the financial crisis. During the time of the emergency-fixed rate loans, it does however seem to have been marginalized by the larger effect from these loans.

6.2 Comparative CIP Deviation

6.2.1 Descriptive Statistics

In regard of the relative comparison the results show a large difference between the Comparable ASW for the government bonds as well as it did for covered bonds (graph 18). This graph together with table 15 also show that the Comparable ASW were at lower levels, on average negative, compared to the Comparable ASW for covered bonds. Graph 18 shows that during a period a from mid-2008 to mid-2009 data is missing for EUR denominated covered bonds, as a result of no outstanding bonds in the analysed maturity span during this period.

When comparing the absolute differences in CIP Deviations for covered bonds and government bonds (graph 19) it shows that the deviations actually are larger for the government bond on average. From graph 20 a trend, although volatile, can be observed indicating that the covered bonds' adherence to the CIP do increase in relation to the government bonds' adherence. This relative comparison should theoretically neutralize most of the effect of the incorrectly priced XCCY swap as it should affect both the covered bonds and the government bonds in the same way.

As stated earlier, previous literature identify the liquidity as an explanatory power for the CIP adherence. Even though this could not be observed at any significance regarding the nominal turnover for covered bonds explaining the CIP deviation for covered bonds (possibly due to the XCCY effect) it could possibly explain the Comparative CIP Deviation. Graph 21 and 22 shows that a majority of the observations for the Relative Turnover Covered Bonds are under 40% in period 1, but over 40% in period 2. Given that the Comparative CIP Deviation has a downward trend the Relative Turnover Covered Bond could possibly have explanatory power based on these observations.

6.2.2 Main Results

In this regression the Relative Turnover Covered Bonds is tested as the explanatory variable to the Comparative CIP Deviation. The results clearly support the theory that the Comparative CIP Deviation can be explained by the liquidity when using the Relative Turnover Covered Bonds as a proxy (**reg 6)**. These results are significant at less than the 1 % level. The negative coefficient is

in line with the prior beliefs that a higher relative volume for covered bonds should make the Comparative CIP Deviation decrease.

6.3 Further Discussion

This thesis shows that in the years following the collapse of Lehman Brothers, marking the offset of the financial crisis, the CIP does not hold for Swedish covered bonds. Rather the deviations are substantial, at times reaching above 75 basis points. Although it can be argue that the Swedish covered bond market is not as homogenous as, for example, the foreign exchange market, the rigorous legal framework and the small number of issuers of Swedish covered bonds should together with the found large deviation from the CIP present a great opportunity for investors. The findings regarding the XCCY´s ability to explain a large part of this deviation does not preclude investors to take advantage of the opportunities since the prices used in this thesis are real trading data which an investor would have been able to trade on.

Although no qualitative interviews are made, lengthy sessions have been held with several market professionals at the Royal Bank of Scotland discussing possible reasons that could have prevented investors, as well as issuers, to take advantage of these opportunities. The conclusion from these discussions is that there probably are different factors affecting investors and issuers. The factors discussed are summarised below for the two perspectives separately.

6.3.1 Investor Perspectives

A possible reason for investors to not exploit the opportunities is the investor's mandate. The primary investors in covered bonds are investors with a mandate to invest in triple A (AAA) or double A (AA) rated assets. To lock in the profit from the opportunity, the investor would need to buy the EUR denominated bond, the 3vs6 swap and the XCCY swap. Prior to the financial crisis, most banks acting as counterparty for such swaps enjoyed high ratings, often making the swaps high rated enough to be included in the mandate. This changed with the fall of Lehman Brothers and now many investors are unable to exploit the opportunity due to national or internal regulations prohibiting them to invest in the, relatively, low rated swap. These rules usually take a long time to change, and the investor face severe consequences if exceeding their mandates, especially if the trade caused an unfavourable outcome (Interviews RBS, 2013).

6.3.2 Issuer Perspective:

An issuer of covered bonds could save a substantial amount by buying back their EUR denominated bonds and then issue bonds in SEK for a lower yield. A reason for the issuer not to pursue this strategy could be due to the risk for higher funding costs in the long term caused by cutting themselves of from the European capital market and solely putting their funding

needs in the hands of the SEK investor collective. For an issuer to, without a prolonged process, have access to issue bonds in the euro market they need to keep an active stock of bonds traded in the market. The previous, for investors, stated problem considering the rating of the swap should in many times be less important for issuers, due to the issuer's possibility to perform the swap with the parent bank.

There is a similar issue for the Swedish Government when the Swedish National Debt Office takes the roles as issuer of the government bonds. The EUR denominated bonds are not always issued at the lowest funding price, although the reason for not doing this differ from those of the general issuer. The reason why the Swedish National Debt Office does not always aim for the cheapest funding is because the EUR denominated bond (and bonds denominated in other foreign currencies) is occasionally issued as a way for the Swedish Riksbank to manage the foreign exchange reserves (Interviews RBS, 2013).

6.4 Robustness Test

We have in this thesis made every effort to check for possible errors and misinterpretations. However, it should be noted that the thesis has been written within the framework of a bachelor thesis and hence have for example not been a subject to any peer review to any notable extent. In terms of data problems, the fact that we only have had access to the turnover in the SEK denominated securities and used this as a proxy for the turnover in the security in SEK and EUR in general make room for possible errors. Also the fact that covered bonds issued by SEB are left out, for complexity reasons, creates a possibility for bias although there are no indications that suggest such a bias.

Even though the possibility to use data from the Royal Bank of Scotland have been invaluable when writing this thesis it also presents a possible bias as the data used is recorded by them. This could, at least in theory, deviate from that of other banks but, most importantly, it could be biased in some way compared to the actual market. Based on the scale of the deviations found any such biases would probably have only a marginal effect.

When matching the bonds with the appropriate swaps we used linear interpolation of the swaps with adjacent maturities. This is the method often used in practice, but it might differ slightly from the prices actually faced by the investor. This effect should however also be marginal.

The regressions made in this thesis are simple OLS regressions. As shown under data and methodology we commented on why we consider it possible for us to use this type of

regressions and receiving correct results. The measures we have used for taking heteroskedasticity into account might not fully correct for this and could therefore be a source of error. The same applies to the assumption regarding zero conditional mean where the time frame of a bachelor thesis was apparent as we, due to the complexity and time factors, have not tested the correlation with the error term. Our assumption of linearity could as well be a possibly source for error as we could see that we did not have perfect linearity but considered this to be a valid approximation.

Finally we would once again like to thank all the people that have been of assistance in improving this thesis. Any remaining flaws and mistakes are to be credited to the authors and the authors alone.

7 Conclusion

This thesis aims to test whether or not Swedish covered bonds adhere to the Covered Interest Parity using covered bonds denominated in EUR and in SEK. The result shows, with a high level of significance, that this is the case from the enactment of the Swedish covered bonds regulatory framework up until the offset of the financial crisis when a 5 basis points wide neutral band is taken into consideration. For the period following the crisis we can also reject the hypothesis that the CIP holds, with the same high significance

When using the nominal turnover for covered bonds as a proxy, we do not find any support for the theory that the deviations from the CIP can be explained by liquidity. However, based on the results from the interviews with market professional we conducted a statistical analysis on the cross-currency basis swap and are able to show its explanatory power for the deviations from the CIP with a high level of significance. This is most evident for the period after the financial crisis once the emergency measures of the Swedish Riksbank had been revoked, but the results are significant for all the tested time periods. Based on these findings we test the liquidity approach again, but in a relative setting for the deviations in Covered Interest Parity comparing covered bonds and government bonds. We use the difference between the deviations of covered bonds and the deviations of government bonds to neutralize the effect of the mispriced cross-currency swap. We are then, in accordance with previous mentioned research, able to attribute explanatory power to the liquidity in regard of the difference between the covered and government bonds adherence to CIP. The result is once again significant at the 1 % level. With these results this paper adds further to the idea of liquidity as an explanatory power to deviations from the Covered Interest Parity although the cross-currency swap might marginalise the effect because of its larger influence.

On the other hand, our findings contradict previous research regarding the view that when CIP deviations occur, they are in general small and temporary. In our study we observe a long consecutive period during which the Covered Interest Parity does not hold. We are also able to confidently propose the cross-currency swap to be largely responsible for this, and can hopefully contribute to further research being undertaken to investigate this further. When discussing our findings with market professionals, the fact that the levels used are prices at which investors have and could have traded raises the question how these deviations could persist. Although not academically tested, the main factors suggested as answer to this question are the down-rating of banks and the following increased counterparty risks as well as the issuers wish to keep the access to a non-domestic market.

7.1 Future Research

An interesting area for future research would be to analyse more specifically what caused the mispricing of the cross-currency swap that this paper demonstrates. In light of the, relative unpredicted findings in this thesis it would be relevant to perform additional studies looking at this for other currency pairs as well as other securities. As this could possibly be done within the framework of an empirical study an area where the empirical method was not suitable is to further investigate what factors prevented the demonstrated deviations from being exploited at any larger scale. Such a paper would be able to at a deeper level analyse both the factors suggested by the authors of this paper as well as other factors. In terms of Swedish Covered bonds in general, a paper analysing the differences between the relatively young Swedish market and the more matured German Pfandbrief market would be interesting.

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9 Appendix

Table 1:

This table provides summary statistics for the weekly turnover data on SEK denominated bonds in SEK million.

Turnover on SEK denoted Bonds	Number of Obs	Mean	Median	StdDev
Covered Bonds	430	41099	39932	19716
Government Bonds	430	54592	47430	30343
Total	430	95691	92590	39629

Table 2:

This table provides summary statistics for the SEK/EUR cross-currency basis swaps prices per maturity, measured in basis points. In this thesis the cross-currency swap is used as the hedging instrument in the Covered Interest Parity.

Variable: Cross Currency Swaps SEK/EUR (XCCY)	Number of observations	Mean	Median	StdDev
1 year XCCY Price (bps)	589	2,03	-4	14,073
2 year XCCY Price (bps)	587	5,879	-2,25	15,705
3 year XCCY Price (bps)	595	8,065	0,25	16,494
4 year XCCY Price (bps)	597	9,474	0,5	16,806
5 year XCCY Price (bps)	599	10,466	1	17,027
7 year XCCY Price (bps)	598	10,883	1,5	17,293
10 year XCCY Price (bps)	597	10,92	1,25	17,675

Table 3:

This table shows the number of observations for all the bonds used in the study. That is after all data not matching our maturity span and otherwise not correct data has been excluded. Apart from the number of observations it contains the mean, median and standard deviation for tenure and the asset swap spread. As shown in the table the number of observations is much larger for the SEK denominated bonds (as one could expect as it is the domestic currency for the issuers), but the sample is still large for the EUR denominated ones.

	Variable	Number of obs	Mean	Median	Standard Dev
Covered Bonds (EUR)	**Tenure (years)**	3974	2.987	2.921	1.234
	Asset Swap Spread (bps)	3974	18.937	15.110	26.617
Covered Bonds (SEK)	**Tenure (years)**	11492	2.842	2.769	1.306
	Asset Swap Spread (bps)	11492	24.223	15.490	34.126
Government Bonds (EUR)	**Tenure (years)**	666	2.264	1.978	1.151
	Asset Swap Spread (bps)	666	-33.103	-31.732	24.832
Government Bonds (SEK)	**Tenure (years)**	2253	2.559	2.390	1.378
	Asset Swap Spread (bps)	2253	-44.728	-31.700	30.428

Table 4:

This table shows the number of observations for the covered bonds used in the study; it is sorted per currency of denomination and issuer. Apart from the number of observations it contains the mean, median and standard deviation for tenure and the asset swap spread. As shown in this table we do not have any covered bonds denominated in EUR from Landshypotek but otherwise a sample with many observations, divided between multiple issuers.

Bond Type	Issuer	Variable	Number of Obs	Mean	Median	StdDev
Covered Bonds EUR	Länsförsäkringar	Tenure (years)	187	3.040	2.806	1.059
		Asset Swap Spread	187	23.174	26.680	19.095
	Nordea Hypotek	Tenure (years)	738	2.856	2.687	1.292
		Asset Swap Spread	738	23.531	15.755	32.281
	Stadshypotek AB	Tenure (years)	849	3.226	3.313	1.195
		Asset Swap Spread	849	15.862	16.310	24.260
	Spintab	Tenure (years)	1383	2.963	2.921	1.184
		Asset Swap Spread	1383	21.601	18.520	24.320
	Swedish Covered Bond Corp	Tenure (years)	817	2.885	2.825	1.306
		Asset Swap Spread	817	12.505	4.077	26.932
Covered Bonds SEK	Landshypotek	Tenure (years)	1979	2.553	2.368	1.240
		Asset Swap Spread	1979	26.233	13.720	31.744
	Länsförsäkringar	Tenure (years)	1143	2.751	2.543	1.308
		Asset Swap Spread	1143	34.531	31.341	35.094
	Nordea Hypotek	Tenure (years)	1869	2.873	2.831	1.273
		Asset Swap Spread	1869	17.951	7.051	31.786
	Stadshypotek AB	Tenure (years)	2636	2.992	2.984	1.328
		Asset Swap Spread	2636	20.069	7.345	33.303
	Spintab	Tenure (years)	2301	2.914	2.908	1.313
		Asset Swap Spread	2301	27.070	18.85	35.835
	Swedish Covered Bond Corp	Tenure (years)	1564	2.881	2.850	1.316
		Asset Swap Spread	1564	24.451	20.480	35.336

Table 5:

This table provides summary statistics for the Euribor 3 versus 6 month basis swap per maturity, measured in basis points. In this thesis the Euribor 3 versus 6 month swap is used to swap the EUR denominated bonds with fixed coupons to make them comparable to the 3 month curve. This is because we use 3 curve is used for all SEK denominated bonds and the SEK Bonds are used as the base when constructing our Comparable ASW. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).

Variable - Euribor 3vs.6 Month Swap	Number of observations	Mean	Median	StdDev
1 year Euribor 3vs.6 month	506	11,552	8,025	11,262
2 year Euribor 3vs.6 month	506	9,466	5,925	9,125
3 year Euribor 3vs.6 month	506	8,385	4,825	8,278
4 year Euribor 3vs.6 month	506	7,615	3,9	7,612
5 year Euribor 3vs.6 month	506	7,104	3,475	7,167
6 year Euribor 3vs.6 month	506	6,629	3,075	6,731
7 year Euribor 3vs.6 month	506	6,215	2,875	6,354
8 year Euribor 3vs.6 month	506	5,857	2,675	6,019
9 year Euribor 3vs.6 month	506	5,553	2,55	5,726
10 year Euribor 3vs.6 month	506	5,32	2,425	5,481

Table 6: Whole period Shapiro-Wilk test for normal data

This table shows the result from the Shapiro Wilk test for the normal distribution for the absolute CIP Deviation for covered bonds in the period (2005-01-01 – 2013-04-05). The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).

Absolute CIP Deviation - Shapiro Wilk W test- Total (2005-01-01 - 2013-04-05)

Variable	Obs	W	V	z	Prob>z
t	431	0.816	54.031	9.526	0.00000

Table 7: Before Lehman period Shapiro-Wilk test for normal data

This table shows the result from the Shapiro Wilk test for the normal distribution for the absolute CIP Deviation for covered bonds in the in this thesis defined 1 period (2005-01-01 – 2008-09-14). The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW SEK and Comparable ASW EUR for the same bond type The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).

Absolute CIP Deviation - Shapiro Wilk W test- Period 1 (2005-01-01 - 2008-09-14)

Variable	Obs	W	V	z	Prob>z
t	193	0.803	28.558	7.698	0.00000

Table 8: After Lehman period Shapiro-Wilk test for normal data

This table shows the result from the Shapiro Wilk test for the normal distribution for the absolute CIP Deviation for covered bonds in this thesis defined period 2 (2008-09-15 – 2013-04-05). The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW SEK and Comparable ASW EUR for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).

Absolute CIP Deviation - Shapiro Wilk W test- Period 2 (2008-09-15 - 2013-04-05)

Variable	Obs	W	V	z	Prob>z
t	238	0.946	9.374	5.194	0.00000

Table 9:

This table shows the result from the White Homoscedasticity test for the 6 regressions performed.

White - Homoscedasticity Test

Variables	chi2	df	p
Reg 1: CIP Deviation over Covered Bonds Nominal Turnover (2005-01-01—2013-04-05)	2.19	2	0.3339
Reg 2: CIP Deviation over XCCY Swap (2005-01-01—2013-04-05)	34.98	2	0.0000
Reg 3: CIP Deviation over XCCY Swap (2005-01-01—2008-09-14)	9.19	2	0.0101
Reg 4: CIP Deviation over XCCY Swap (2008-09-15—2013-04-05)	11.42	2	0.0033
Reg 5: CIP Deviation over XCCY Swap (2010-11-01—2013-04-05)	12.97	2	0.0015
Reg 6: Comparative CIP Deviation over Relative Turnover CB (2005-01-01—2013-04-05)	9.02	2	0.0110

Table 10:

This table shows the result from the Breusch-Pagan - Heteroskedasticity test for the 6 regressions performed.

Breusch-Pagan - Heteroskedasticity Test: Ho: Constant variance		
Variables	**chi2**	**p**
Reg 1: CIP Deviation over Covered Bonds Total Turnover (2005-01-01—2013-04-05)	0.00	0.9939
Reg 2: CIP Deviation over XCCY Swap (2005-01-01—2013-04-05)	15.29	0.0001
Reg 3: CIP Deviation over XCCY Swap (2005-01-01—2008-09-14)	16.07	0.0001
Reg 4: CIP Deviation over XCCY Swap (2008-09-15—2013-04-05)	17.30	0.0000
Reg 5: CIP Deviation over XCCY Swap (2010-11-01—2013-04-05)	10.26	0.0014
Reg 6: Comparative CIP Deviation over Relative Turnover CB (2005-01-01—2013-04-05)	1.62	0.2030

Table 11:

This table shows the Comparable Asset Swap Spreads for covered bonds in three different time periods, the total period (2005-01-01 – 2013-04-05), the first period (2005-01-01 – 2008-09-14) and the second period (2008-09-15 – 2013-04-05). The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW). It also contains summary statistics for the CIP Deviation, in our thesis defined as the per date average difference between the Comparable ASW EUR and the Comparable ASW SEK for the same bond type.

Covered Bonds	Variable	Number of Obs	Mean	Median	StdDev
2005-01-01 - 2013-04-05	Comparable ASW SEK	431	22.074	24.195	24.370
	Comparable ASW EUR	431	37.722	32.920	40.764
	CIP Deviation	431	15.648	7.212	21.085
2005-01-01 - 2008-09-14	Comparable ASW SEK	193	-1.773	-3.422	6.362
	Comparable ASW EUR	193	-1.517	-2.196	8.730
	CIP Deviation	193	0.257	-1.577	5.657
2008-09-15 - 2013-04-05	Comparable ASW SEK	238	41.412	39.522	14.357
	Comparable ASW EUR	238	69.541	67.055	26.125
	CIP Deviation	238	28.130	26.016	20.768

Table 12: Sign test for total period

This table shows the result for the sign test performed for the period (2005-01-01 – 2013-04-05), testing if the Covered Interest Parity holds by performing two one-sided tests. The CIP is considered to hold if the Absolute CIP Deviation is less than 5 basis points. The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).

SignTest	Total Period (2005-01-01 - 2013-04-05)
Positive Observed	252
Positive Expected	215.5
Negative Observed	179
Negative Expected	215.5
Zero Observed	0
Zero Expected	0
Total number of Obs	431
One-sided tests:	
Ho: median of Absolute CIP Deviation - 5 = 0 vs.	
Ha: median of Absolute CIP Deviation - 5 > 0	
Pr(#positive >= Positive Observed) =	0.0003
Ho: median of Absolute CIP Deviation - 5 = 0 vs.	
Ha: median of Absolute CIP Deviation - 5 < 0	
Pr(#negative >= Negative Observed) =	0.9998

Table 13: Sign test in period before Lehman

This table shows the result for the sign test performed for the in this thesis defined period 1 (2005-01-01 – 2008-09-14), testing if the Covered Interest Parity holds by performing two one-sided tests. The CIP is considered to hold of the Absolute CIP Deviation is less than 5 basis points. The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).

SignTest	First Period (2005-01-01 - 2008-09-14)
Positive Observed	42
Positive Expected	96.5
Negative Observed	151
Negative Expected	96.5
Zero Observed	0
Zero Expected	0
Total number of Obs	193
One-sided tests:	
Ho: median of Absolute CIP Deviation - 5 = 0 vs.	
Ha: median of Absolute CIP Deviation - 5 > 0	
Pr(#positive >= Positive Observed) =	1.0000
Ho: median of Absolute CIP Deviation - 5 = 0 vs.	
Ha: median of Absolute CIP Deviation - 5 < 0	
Pr(#negative >= Negative Observed) =	0.0000

Table 14: Sign test in period after Lehman

This table shows the result for the sign test performed for the in this thesis defined period 2 (2008-09-15 – 2013-04-05), testing if the Covered Interest Parity holds by performing two one-sided tests. The CIP is considered to hold of the Absolute CIP Deviation is less than 5 basis points. The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW EUr and Comparable ASW SEK for the same bond type The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).

SignTest	Second Period (2008-09-15 - 2013-04-05)
Positive Observed	210
Positive Expected	119
Negative Observed	28
Negative Expected	119
Zero Observed	0
Zero Expected	0
Total number of Obs	238
One-sided tests:	
Ho: median of Absolute CIP Deviation - 5 = 0 vs.	
Ha: median of Absolute CIP Deviation - 5 > 0	
Pr(#positive >= Positive Observed) =	0.0000
Ho: median of Absolute CIP Deviation - 5 = 0 vs.	
Ha: median of Absolute CIP Deviation - 5 < 0	
Pr(#negative >= Negative Observed) =	1.0000

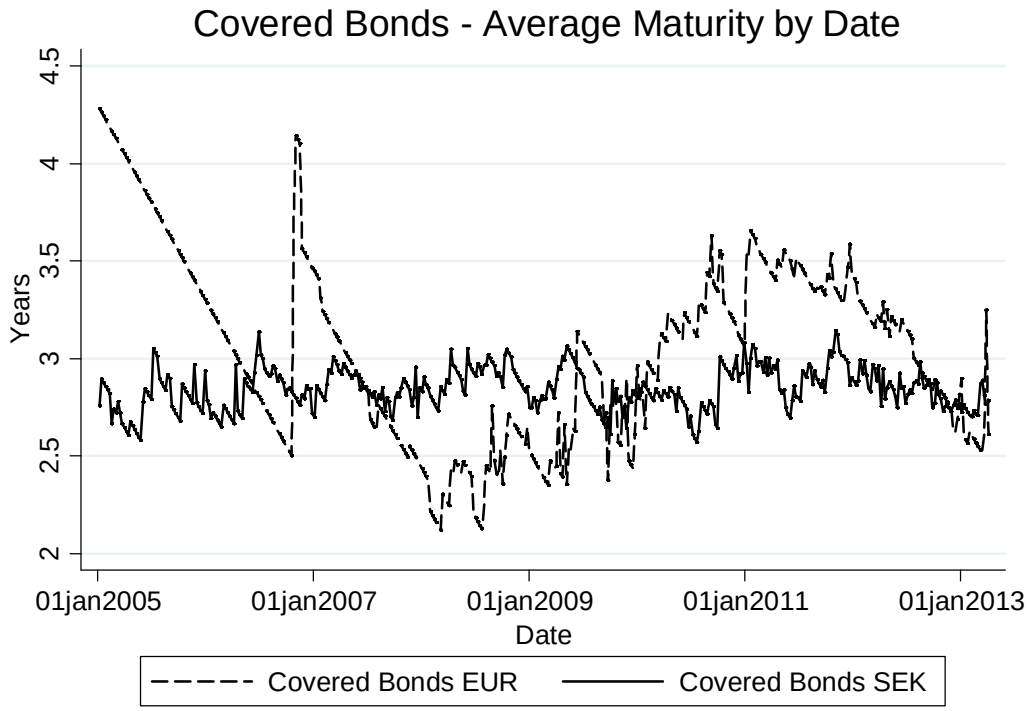
Table 15:

This table shows the Comparable Asset Swap Spreads for government bonds for the period (2005-01-01 – 2013-04-05). The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW). The table also contains summary statistics for the Comparative CIP Deviation, which we define as the difference between the absolute CIP Deviation for covered bonds and the absolute CIP Deviation for government bonds. The CIP Deviations is in our thesis is defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. Furthermore it includes summary statistics for the Relative Turnover Covered Bonds which we define as the nominal turnover for SEK denominated covered bonds divided by the nominal turnover for SEK denominated covered bonds and SEK denominated government bonds.

2005-01-01 - 2013-04-05	Variable	Number of Obs	Mean	Median	StdDev
Government Bonds	Comparable ASW SEK	431	-50.523	-44.39	28.933
	Comparable ASW EUR	381	-10.040	-11.756	21.783
Relative	Comparative CIP Deviation	381	-19.065	-13.629	21.484
	Relative Turnover Covered Bonds	430	0.446	0.443	0.148

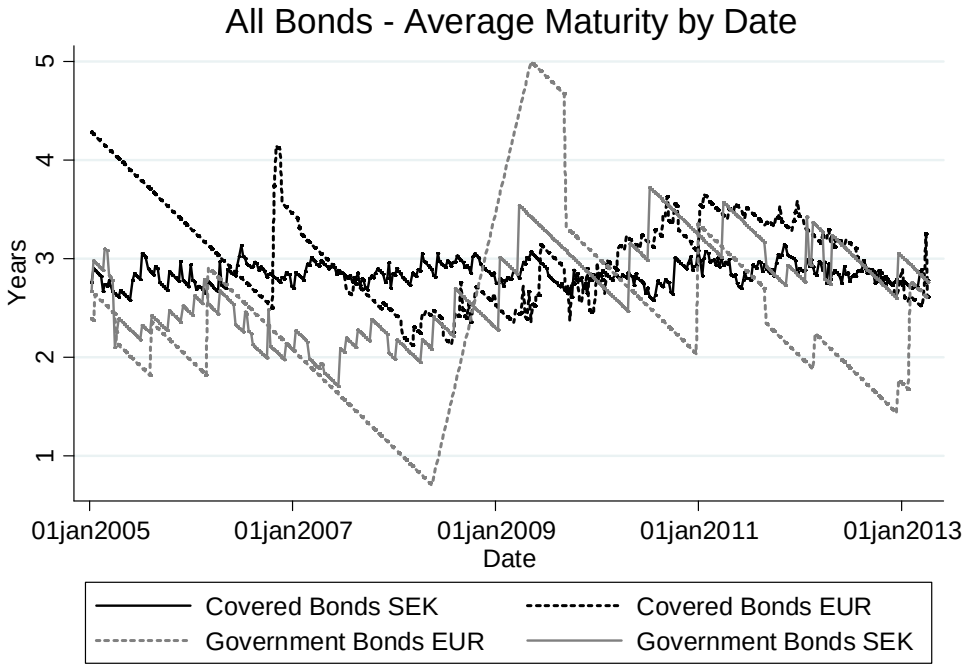
Graph 1:

This graph shows the average maturity per date for the covered bonds denominated in SEK and in EUR in this study, separated by currency.



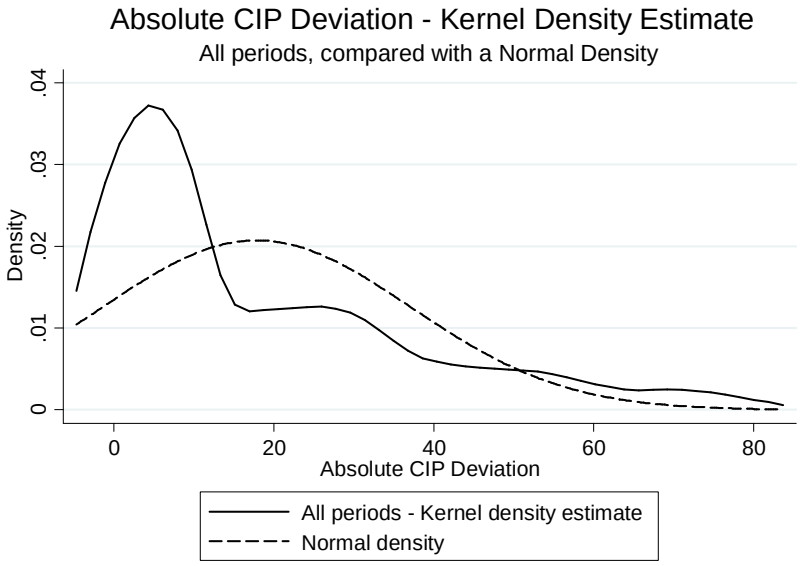
Graph 2:

This graph shows the average maturity per date for covered bonds as well as government bonds denominated in SEK and in EUR used in this study, separated per currency.



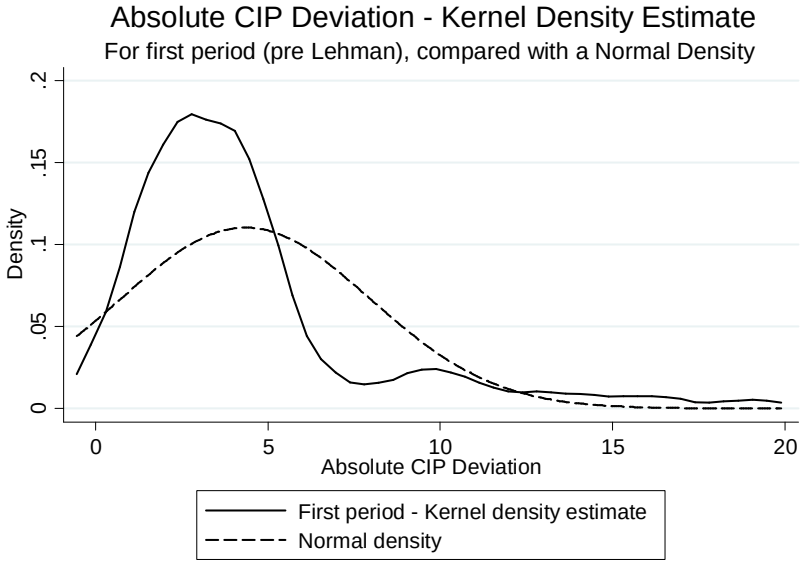
Graph 3: Whole period Kernel Density estimate:

This graph shows the Absolute CIP Deviations Kernel Density Estimate for the in this thesis defined total period (2005-01-01 – 2013-04-05), compared with a normal density curve. The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



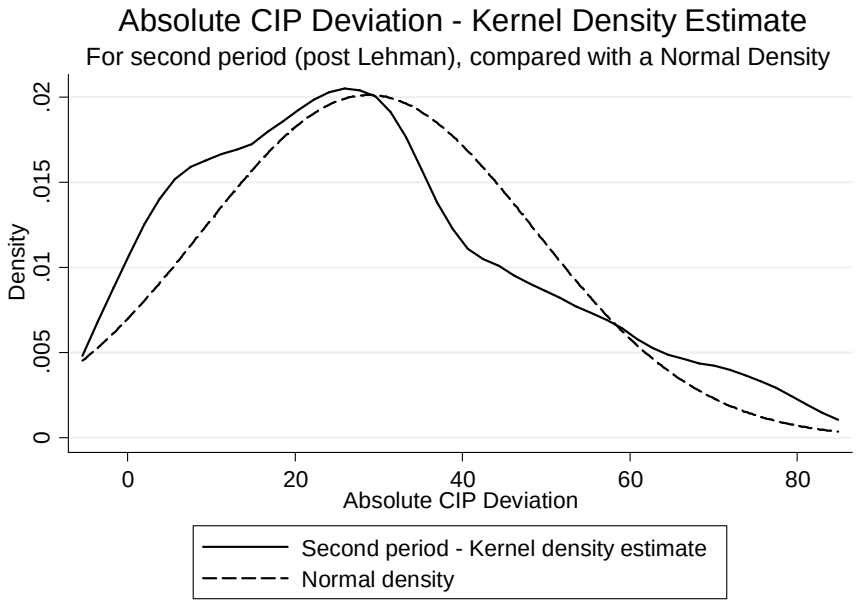
Graph 4: Before Lehman Kernel Density estimate:

This graph shows the Absolute CIP Deviations Kernel Density Estimate for the in this thesis defined period 1(2005-01-01 – 2008-09-14), compared with a normal density curve. The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



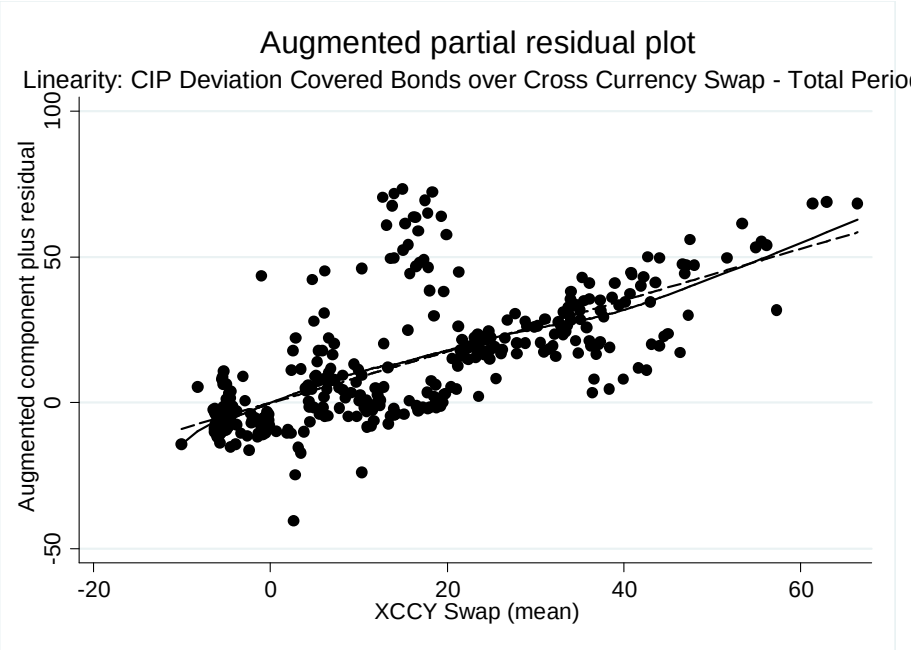
Graph 5: After Lehman Kernel Density estimate:

This graph shows the Absolute CIP Deviations Kernel Density Estimate for the in this thesis defined period 2(2008-09-15 – 2013-04-05), compared with a normal density curve. The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



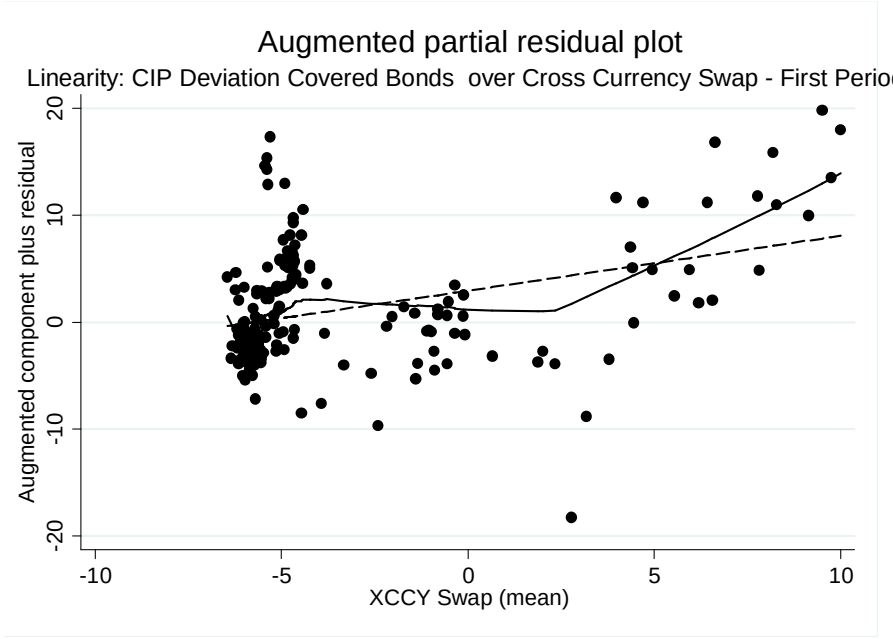
Graph 6:

This graph depicts a test for linearity for the regression of the CIP Deviation for covered bonds over the SEK/EUR cross-currency basis swap for the period (2005-01-01 – 2013-04-05). The CIP Deviations is in our thesis is defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



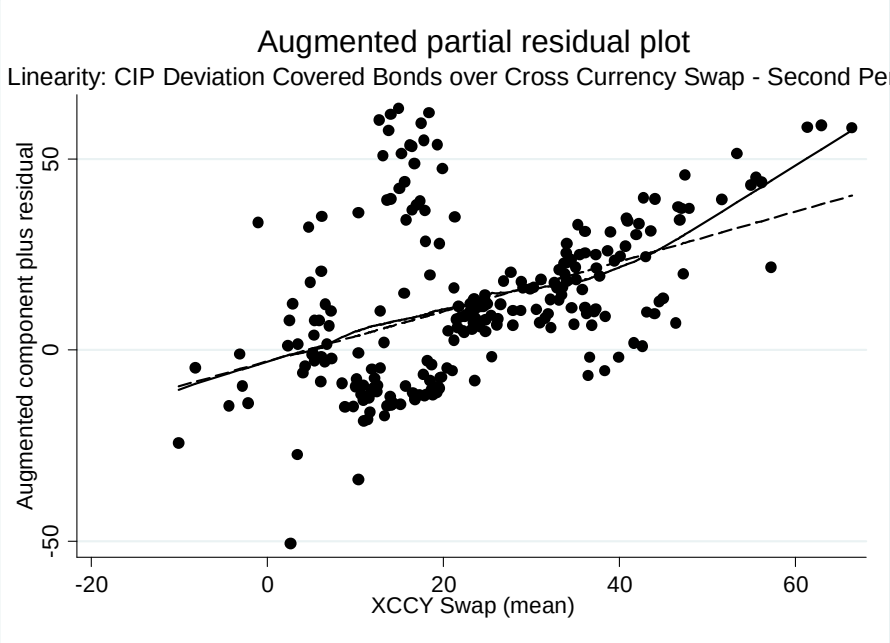
Graph 7:

This graph depicts a test for linearity for the regression of the CIP Deviation for covered bonds over the cross-currency swap for the period (2005-01-01 – 2008-09-14). The CIP Deviations is in our thesis is defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



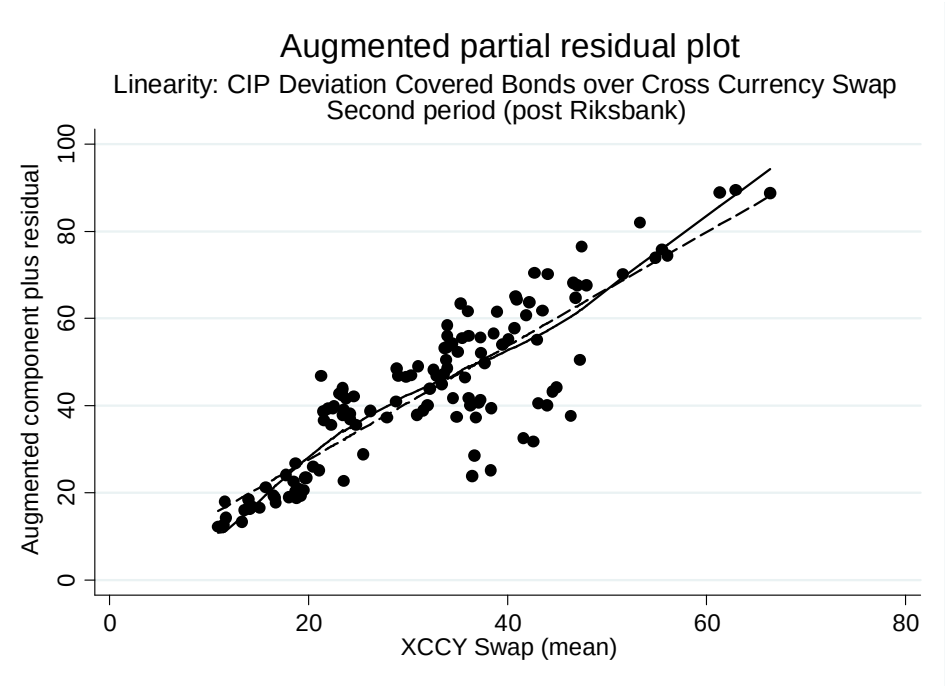
Graph 8:

This graph depicts a test for linearity for the regression of the CIP Deviation for covered bonds over the cross-currency swap for the period (2008-09-15 – 2013-04-05). The CIP Deviations is in our thesis is defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



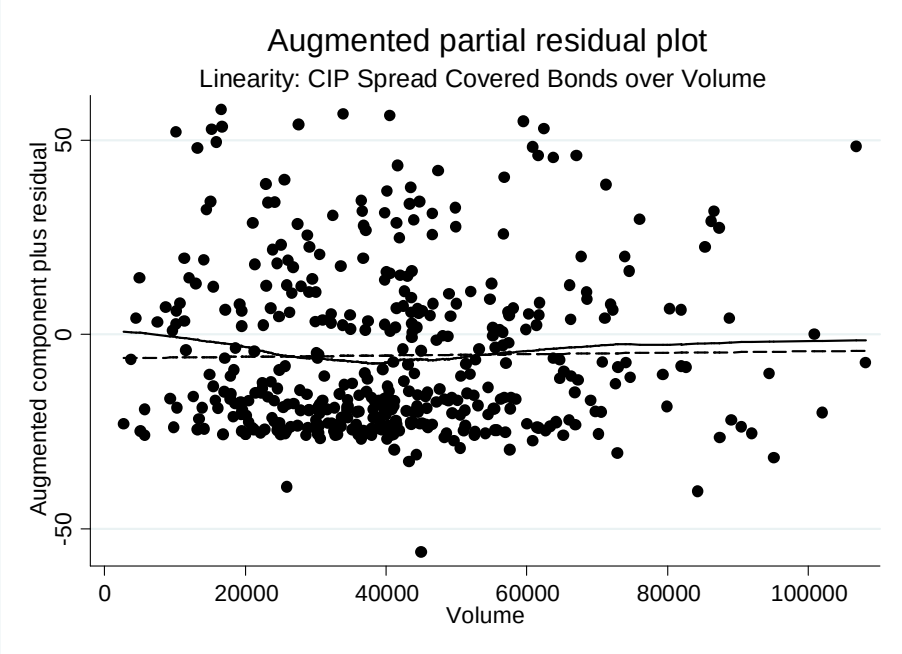
Graph 9:

This graph depicts a test for linearity for the regression of the CIP Deviation for covered bonds over the cross-currency swap for the period (2010-11-01 – 2013-04-05). The CIP Deviations is in our thesis is defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



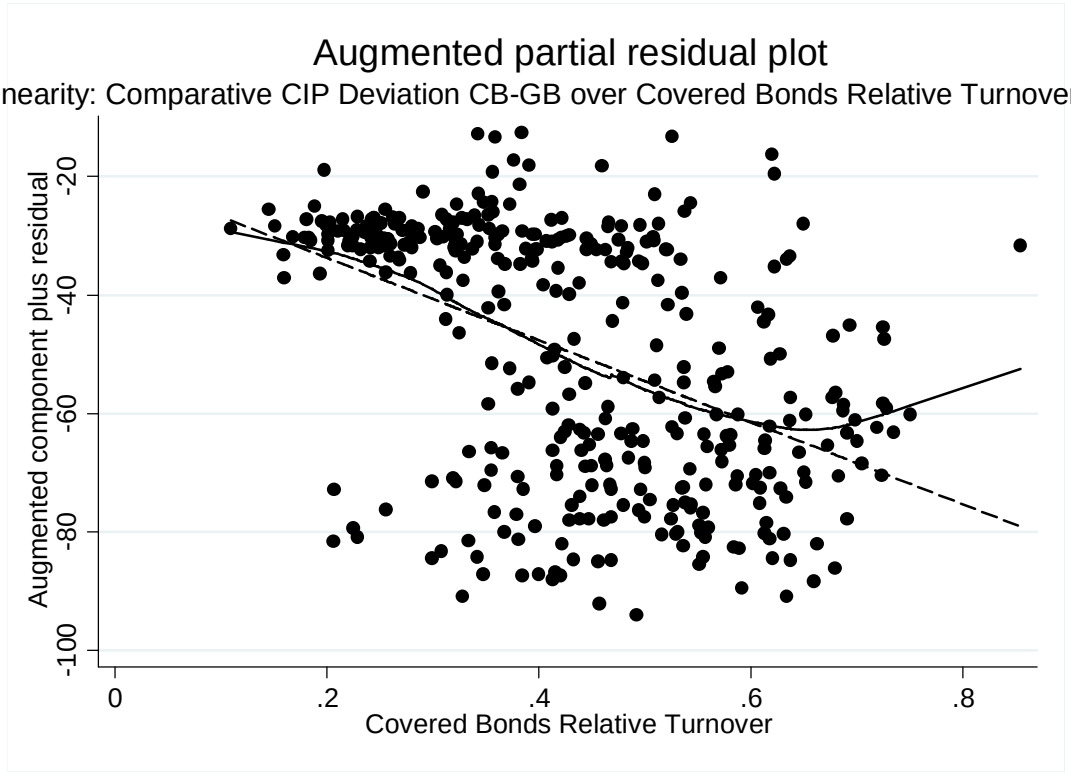
Graph 10:

This graph depicts a test for linearity for the regression of the CIP Deviation for covered bonds over the nominal turnover for SEK denominated covered bonds for the period (2005-01-01 – 2013-04-05). The CIP Deviations is in our thesis is defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



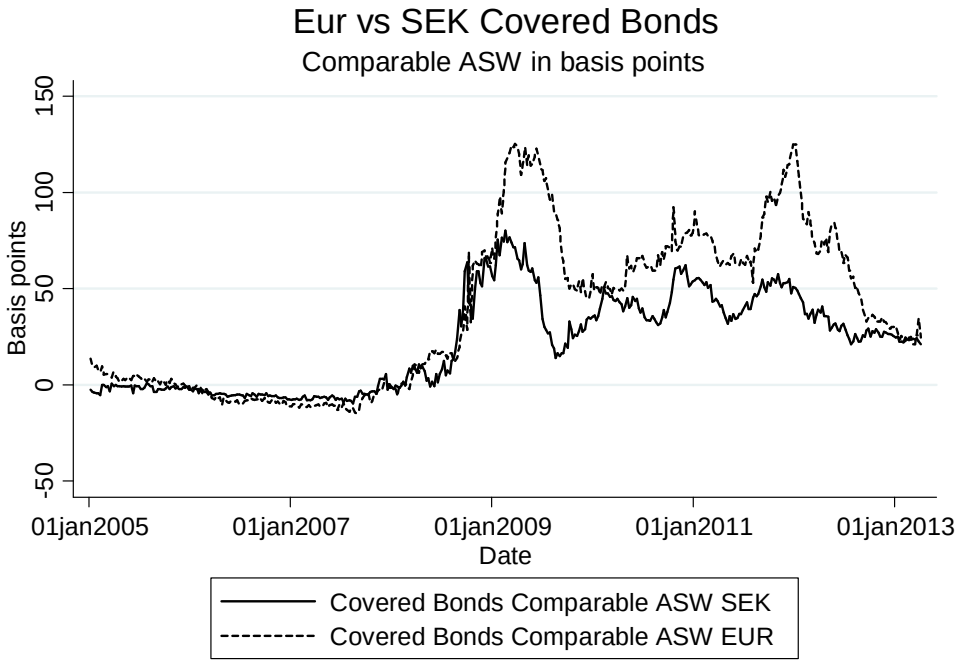
Graph 11:

This graph depicts a test for linearity for the regression of the Comparative CIP Deviation for covered bonds over Covered Bonds Relative Turnover for the period (2005-01-01 – 2013-04-05). We define the Comparative CIP Deviation as the difference between the CIP Deviation for covered bonds and the CIP Deviation for government bonds. The CIP Deviations is defined as the per date average difference between the Comparable ASW SEK and Comparable ASW EUR for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



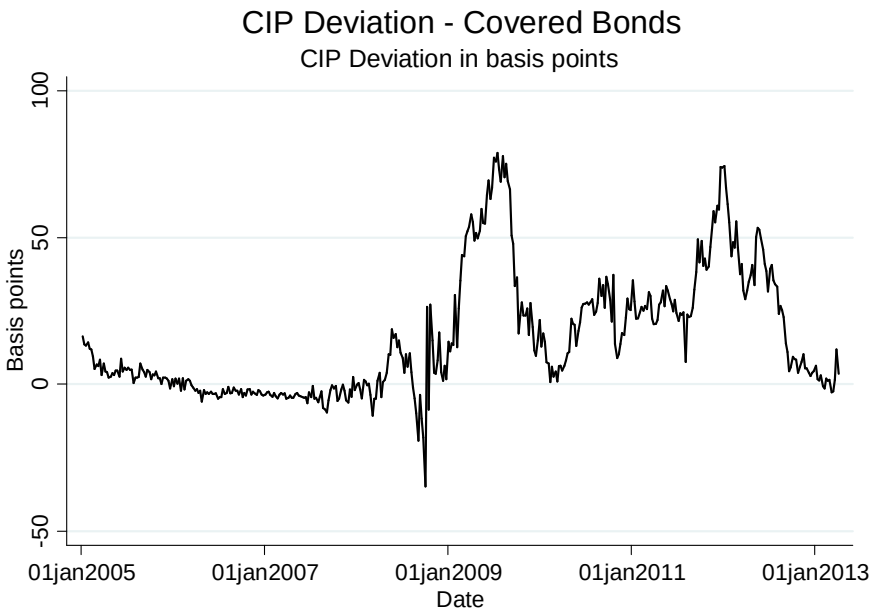
Graph 12:

This graph shows the Comparable Asset Swap Spreads for EUR and SEK denominated covered bonds The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



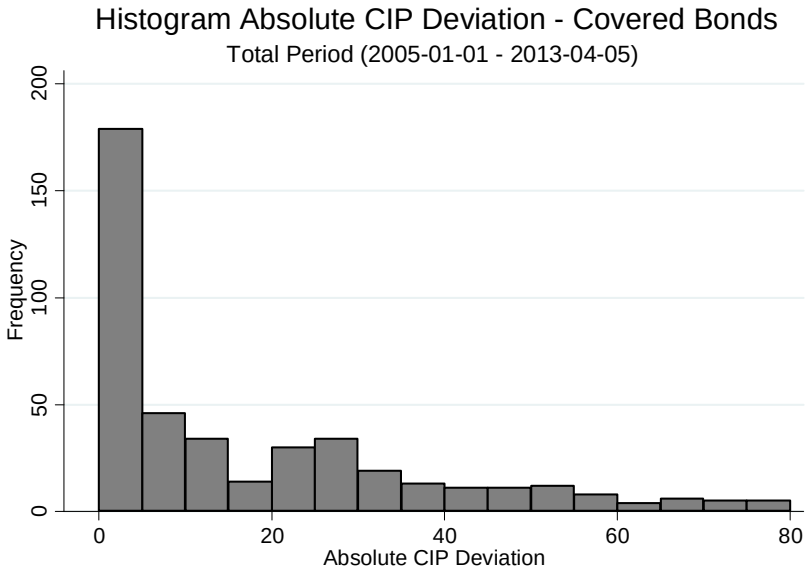
Graph 13:

This graph shows the CIP Deviation for covered bonds. The CIP Deviations is in our thesis is defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



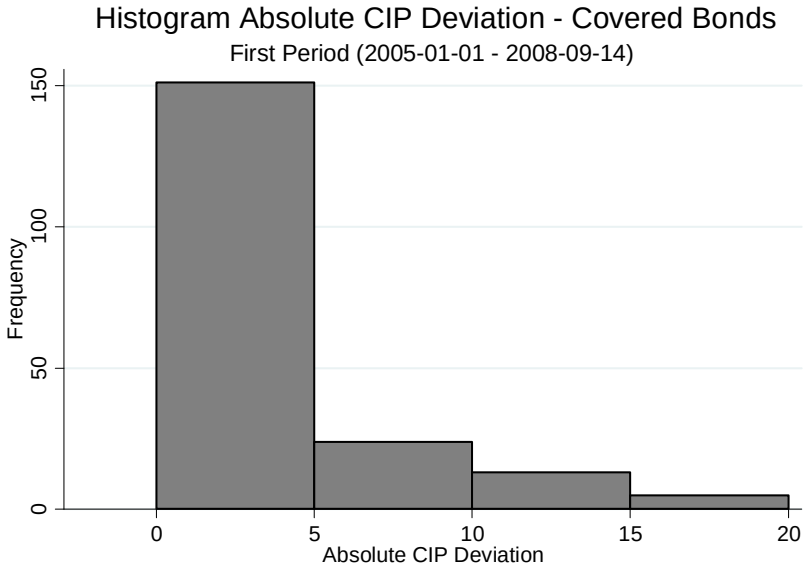
Graph 14:

This histogram depicts the distribution of the Absolute CIP Deviations for covered bonds in basis points for the period (2005-01-01 – 2013-04-05). The CIP Deviations is in our thesis is defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



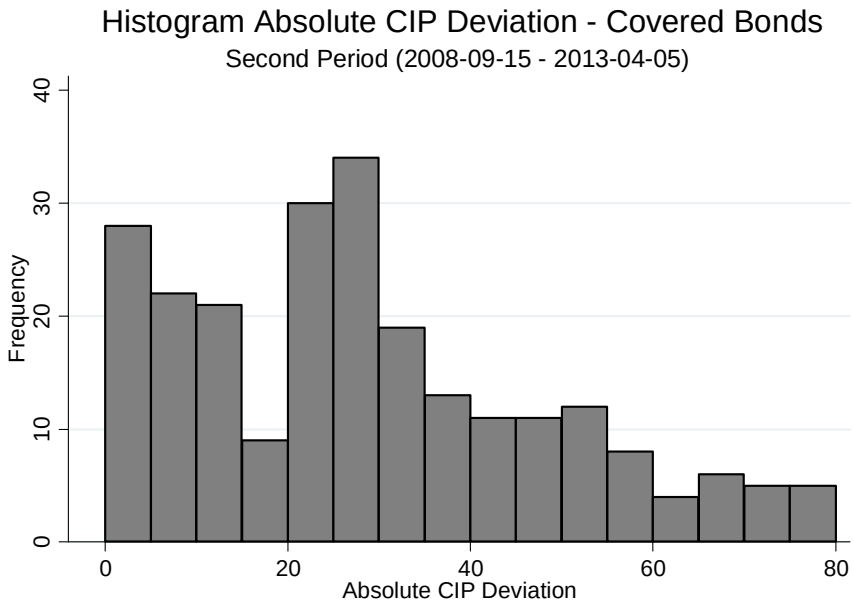
Graph 15:

This histogram depicts the distribution of the Absolute CIP Deviations for covered bonds in basis points for the period (2005-01-01 – 2008-09-14). The CIP Deviations is in our thesis is defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



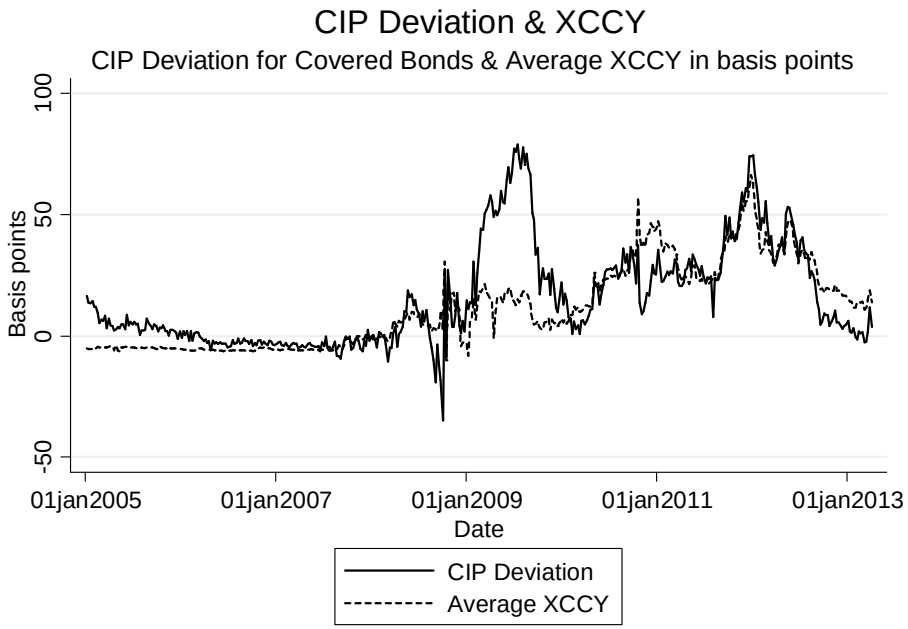
Graph 16:

This histogram depicts the distribution of the Absolute CIP Deviations for covered bonds in basis points for the period (2008-09-14 – 2013-04-05). The CIP Deviations is in our thesis is defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



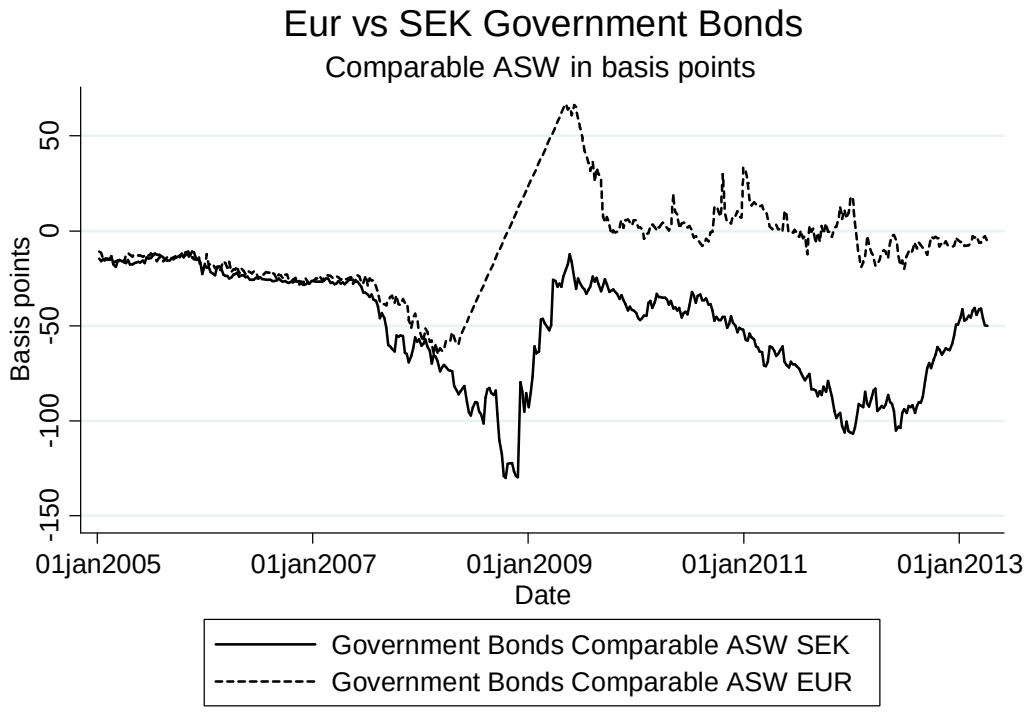
Graph 17:

This graph shows the CIP Deviation for covered bonds together with the SEK/EUR cross-currency basis swap price, both in basis points. The CIP Deviations is in our thesis is defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



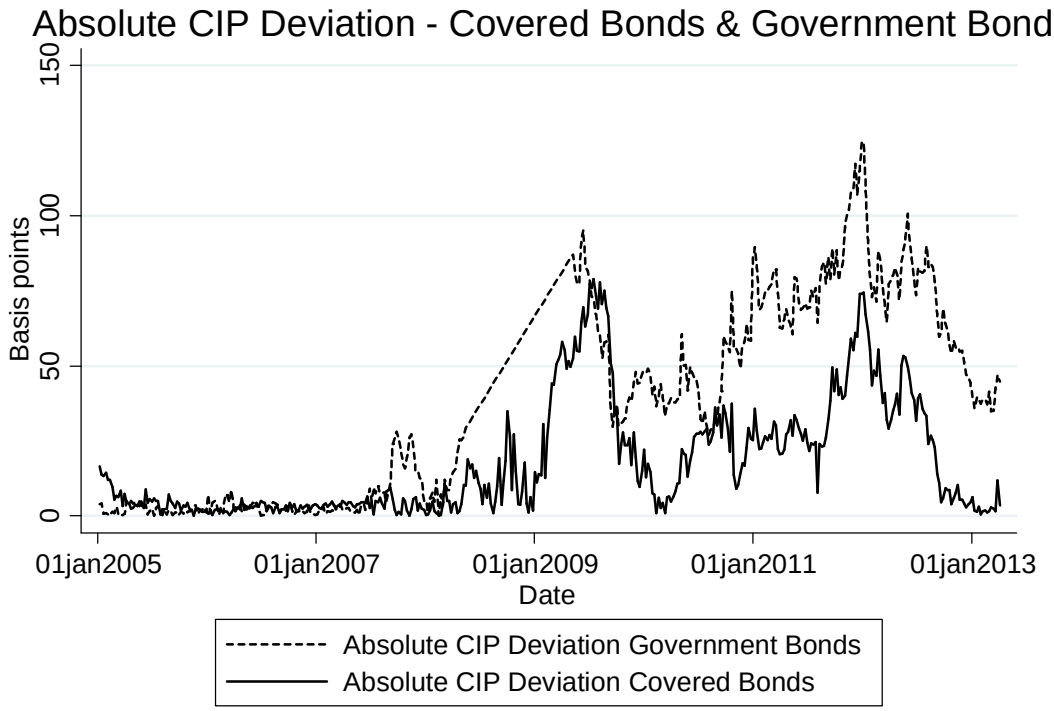
Graph 18:

This graph shows the Comparable Asset Swap Spreads for EUR and SEK denominated government bonds. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW). The straight line in mid-2008 – mid-2009 is a period when there was no EUR denominated government bond fitting our maturity span.



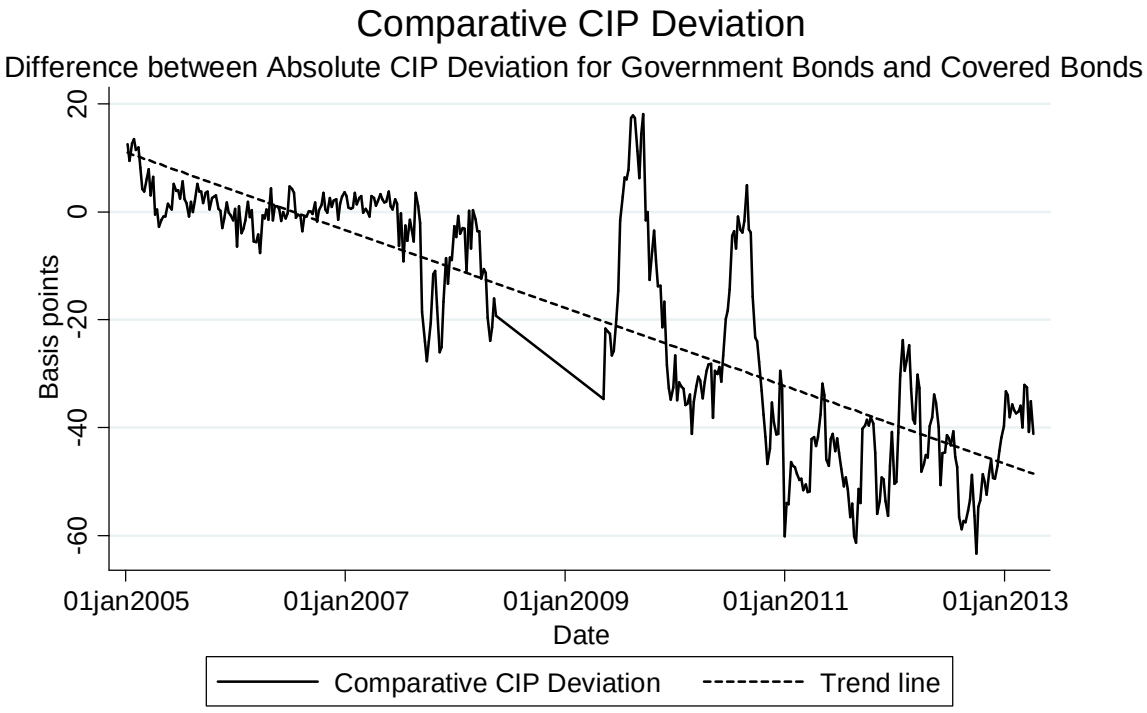
Graph 19:

This graph shows the absolute CIP Deviation for covered bonds as well as government bonds. The CIP Deviations is in our thesis is defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



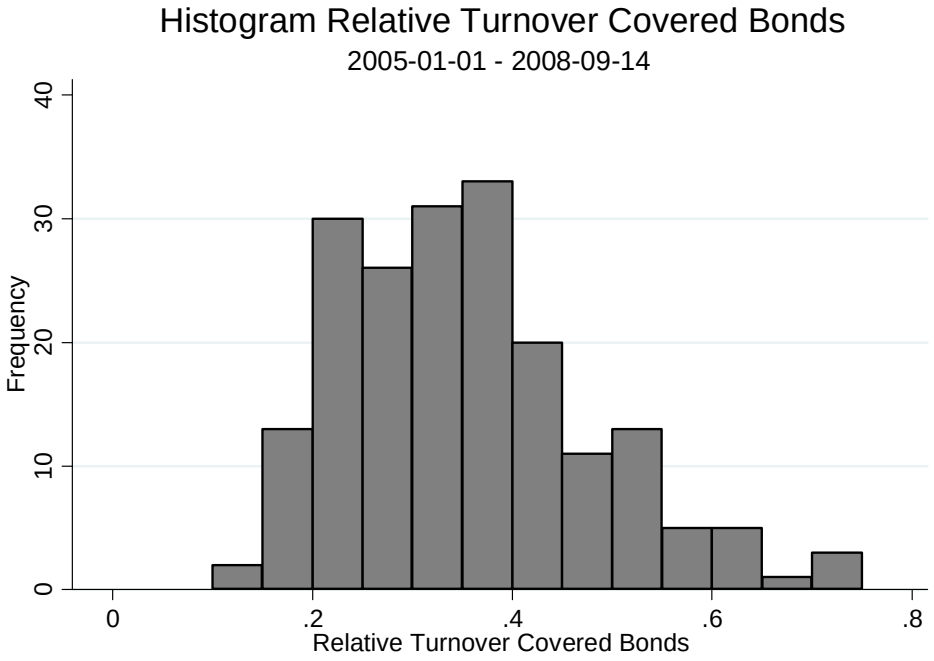
Graph 20:

This graph shows the Comparative CIP Deviation. The Comparative CIP Deviation is defined as the difference between the absolute CIP Deviation for covered bonds and the absolute CIP Deviation for government bonds. The CIP Deviations is defined as the per date average difference between the Comparable ASW SEK and Comparable ASW EUR for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).



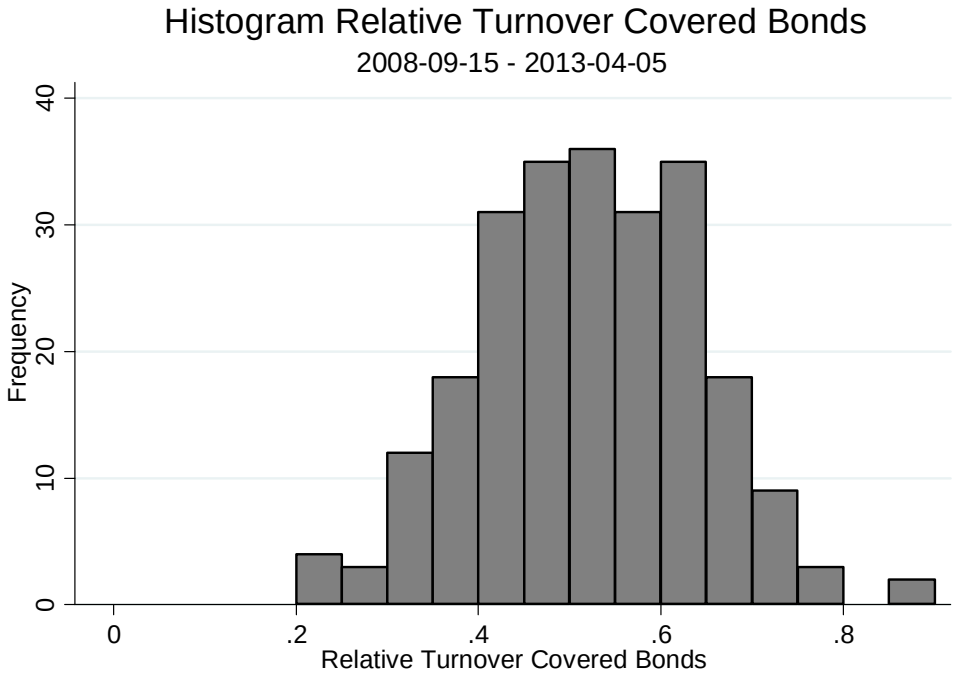
Graph 21:

This histogram depicts the distribution of the Relative Turnover Covered Bonds for the in this thesis defined total period (2005-01-01 – 2008-09-14). We define Relative Turnover Covered Bonds as the turnover for SEK denominated covered bonds divided by the total turnover for SEK denominated covered bonds and SEK denominated government bonds.



Graph 22:

This histogram depicts the distribution of the Relative Turnover Covered Bonds for the in this thesis defined period 2 (2008-09-15 – 2013-04-05). We define Relative Turnover Covered Bonds as the turnover for SEK denominated covered bonds divided by the total turnover for SEK denominated covered bonds and SEK denominated government bonds.



Reg 1: 2005-01-01—2013-04-05

This table shows the results from the CIP Deviations being regressed over the nominal turnover for SEK denominated covered bonds for the in this thesis defined period 1 (2005-01-01 – 2013-04-05). The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).

	CIP Deviation
CB Total Turnover	0.000
	(0.31)
Intercept	14.957
	(5.98)**
R^2	0.00
N	430

* $p<0.05$; ** $p<0.01$

Reg 2: 2005-01-01—2013-04-05

All regressions are simple OLS regressions. This table shows the CIP Deviations being regressed over the prices of the SEK/EUR cross-currency basis swap, for the in this thesis defined total period (2005-01-01 – 2013-04-05). The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW SEK and Comparable ASW EUR for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).

	CIP Deviation
XCCY	0.881
	(30.06)**
Intercept	5.542
	(8.42)**
R^2	0.52
N	431

* $p<0.05$; ** $p<0.01$

Reg 2*: 2005-01-01—2013-04-05

In this regression we did not include the XCCY swap when calculating the CIP Deviation*. The difference in the coefficient should then be 1 lower than in **regression 2**, as shown in the equation in section 6.9. The result the coefficient was here, in regression 2* -0.119 and in **regression 2** it was 0.881, therefore the difference was: 0,881-(-0.119) = 1.

	CIP Deviation*
XCCY	-0.119
	(4.07)**
Intercept	5.542
	(8.42)**
R^2	0.02
N	431

* $p<0.05$; ** $p<0.01$

Reg 3: 2005-01-01—2008-09-14

This table shows the results from the CIP Deviations being regressed over the prices of the SEK/EUR cross-currency basis swap, for the in this thesis defined period 1 (2005-01-01 – 2008-09-14). The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).

	CIP Deviation
XCCY	0.514
	(4.35)**
Intercept	1.984
	(3.14)**
R^2	0.14
N	193

* $p<0.05$; ** $p<0.01$

Reg 4: 2008-09-15—2013-04-05

This table shows the results from the CIP Deviations being regressed over the prices of the SEK/EUR cross-currency basis swap, for the in this thesis defined period 2 (2008-09-15 – 2013-04-05). The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).

	CIP Deviation
XCCY	0.653
	(8.51)**
Intercept	12.777
	(4.99)**
R^2	0.20
N	238

* $p<0.05$; ** $p<0.01$

Reg 5: 2010-11-01—2013-04-05

This table shows the results from the CIP Deviations being regressed over the prices of the SEK/EUR cross-currency basis swap, for the in this thesis defined period 2 subperiod (2010-11-01 – 2013-04-05). The CIP Deviations is in this paper defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW).

	CIP Deviation
XCCY	1.302
	(22.97)**
Intercept	-13.297
	(8.43)**
R^2	0.75
N	127

* $p<0.05$; ** $p<0.01$

Reg 6: 2005-01-01—2013-04-05

This table shows the results from the Comparative CIP Deviations being regressed over the Relative Turnover Covered Bonds, for the in this thesis defined total period (2005-01-01 – 2013-04-05). We define the Comparative CIP Deviation as the difference between the absolute CIP Deviation for covered bonds and the absolute CIP Deviation for government bonds. The CIP Deviations is defined as the per date average difference between the Comparable ASW EUR and Comparable ASW SEK for the same bond type. The Comparable ASW is for EUR bonds the yield measured in basis points over the swap curve (ASW), with the SEK swap curve as the base when appropriate swaps have been used to convert the bonds to be compared to SEK bonds and for SEK bonds it is the yield in basis points over the swap curve (ASW). The Relative Turnover Covered Bonds is defined as the turnover for SEK denominated covered bonds divided by the total turnover for SEK denominated covered bonds and SEK denominated government bonds.

	Comparative CIP Deviation
Relative Turnover CB	-69.392
	(11.42)**
Intercept	10.894
	(4.04)**
R^2	0.22
N	380

* $p<0.05$; ** $p<0.01$