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INVESTING IN SOVEREIGN DEBT CLAIMS: AN INVESTOR-BASED APPROACH

***Abstract*:** This research is the culmination of my personal passion for investments. I focused on the fixed income sovereign claims, since they are the most widely safe financial asset, present in almost any portfolio, from the retirement plan of a common citizen, to the balance sheet of big banks and corporations.
The approach followed is the one of an investor who tries to determine which risk factors he or she is exposed to and how to analytically find the best risk-return trade-off.
To this purpose, I carried out an extensive literary review on the topic, reinterpreting it and giving special attention to (presented and integrated a large literature on the subject, with a special attention to) sovereign bonds and sovereign CDS. Then, using pre-existing methodology, I made an empirical analysis to assess the risk of sovereign debt in Italy and France. The results are overall satisfying, but some criticalities highlight the difficulties inherent to a risk-factors analysis in an intercorrelated environment as the world economy is.

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I want to thank first of all my family, for all the support and the opportunities that they have given to me through much sacrifice. All my gratitude also to Professor Trolle for his precious help in drafting this Thesis. I hope that the job done will be appreciated.

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Introduction to the sovereign debt market

The sovereign debt bond market counts around $ 45 trillion of nominal outstanding, of which $ 10 trillion in the Eurozone. If we consider that the world total gross domestic product is estimated to be around $ 80 trillion, we understand the importance of such market for any investor in the world. Moreover, we should add trillions of derivatives whose values is tied in one way or another to sovereign debt securities. The political relevance of sovereign debt, concomitantlymarket, is such that its trading is heavily regulated, as well as its holdings.
In the middle of such high volumes and so many related financial instruments, it is not easy for any investor to orientate and choose the most suitable opportunity for its personal preferences and portfolio structure. Thus, he or she ends up relying on a third-party asset manager, paying relevant fees for a standardized investment strategy that, especially if we refer to developed countries debt, entails very low credit risk. My objective is to ou
tline a guide for an informed investor that would like to understand first-hand how to build his sovereign claims portfolio in order to satisfy his preferences and short and long-term constraints. The focus is therefore not on what to buy or sell, but on what questions we should ask when analyzing such an investment, and which tools we have to answer such questions. To achieve this objec
tive, firstly I will reinterpret and rearrange the existing literature on sovereign debt that I deem to be important for an investing purpose. Subsequently, various analyzing tools that can be implemented will be proposed. I will consider as investment instruments principally government bonds and sovereign Credit Default Swaps. In the following chapter I will explain more in detail why these instruments, that offer a very similar risk exposure, are however still different and how their valuation can sometimes significantly differ. Finally, this paper e
nds with an empirical analysis on the Italian and French sovereign debt. This choice stems from two reasons. Firstly, a great amount of data is available for both the Italian and French market. Moreover, it allows to partially reflect my point of view: the one of an Italian studying and working in France and who is passionate about investments and political dynamics.

Risks of investing in sovereign debt In order to propose a In order to propose a method to properly assess investment decisions in fixed-income sovereign securities, I will proceed breaking down and analyzing the different risk-components.

Then, resorting to several papers, I try to identify and present the most appropriate methodology to treat each of them.
For an informed asset allocation, it is fundamental a distinction between the different risk factors. Each of them presents different features, both in term of cross-correlation with other sovereign bonds and asset classes, and in terms of time-correlation with changes on the investors' liabilities and total wealth.
The focus of the project is on the Eurozone, but the results are widely applicable to every set of countries with comparable characteristics. first and simplestThe first and simplest component of a sovereign yield is a term-premium: the investors require a premium in order to lend money to the government, for the simple fact of having to postpone their reimbursement in the future. In standard economic theory, this premium derives from the fact that the investor is renouncing to the immediate availability of his purchasing power, deferring its consumption and thus asking for a compensation in exchange to do so. Moreover, being the claim in nominal terms, inflation represents an opportunity cost for the lender if we consider alternative investments in real assets.
The term-premium is the reason why in normal times we observe positive interest rates even in absence of credit risk. As a proxy of the term-premium effect we can use either financial variables, such as LIBOR, central banks' refinancing, and deposit rates, or macro-economic variables, such as inflation and e Per-Capita GDP growth rate.
However, in the last years, we can observe negative risk-free rates in most developed economies. That seems to contradict what just said about the term-premium as a compensation for deferring consumption. The most sensible explanation to such phenomenon is that, apart from single agents' general economic considerations, the market as a whole has to reach a financial equilibrium. Therefore, in case of extraordinary monetary expansions and lack of investment opportunities, it is possible that there is so much liquidity in the system that many players do not know how to employ it, and therefore they are willing to pay a premium to keep their purchasing power and deferring consumption. In parallel, on the demand side, there is a lack of borrowers, because of insufficient real investment opportunities. If these effects are larger in size than the ones increasing the term risk-premium, the resulting term-premium will be negative, and this is what we see in most of the Eurozone economies nowadays.ditionally, the second main component is the credit risk. In Investopedia, credit risk is defined as *"the possibility of a loss resulting from a borrower's failure to repay a loan or meet contractual obligations"*. From an investor analyFrom an investor analysis perspective, this definition is too general. The reasons why a borrower, in our case a sovereign state, fails to meet its obligation can be so many that their determinants must be well distinguished. Moreover, not all failures to repay are the same: recovery rates and parties impacted by the default are very flexible, especially in the sovereign market.
Therefore, after an analysis of the literature, I will propose a double-layer breakdown of credit risk. In first place, we need to separate the yield premium that is required to compensate the expected credit loss in the long-term, and the risk-premium that provide compensation for bearing the uncertainty in the default probability estimation and the impact of a sudden jump-to-default. Such breakdown is not at all obvious. From the quoted CDS spreads, assuming a Poisson process for the default event and fixing a recovery rate, we can immediately infer the default

intensity under the risk-neutral measure. However, prices tell us very little on the true default estimated probability, exactly because in order to express the real default probability we would need to separate the risk-premium. The importance of risk premium in actual pricing is highlighted by this difference between the parameter governing the default intensity under the risk neutral measure, and the effective default frequency in data (for example, see Pan and Singleton – 2008). Therefore, empirical method to separate the two components are of great help for investment decisions.
The second layer regards the determinant factors of the credit risk. A large literature has discussed whether the main determinants of credit risk were inherent to the local economy or to the global one. Our approach is in line with the idea that both matters, but their relevant importance can vary through time. On top of that, we try to separate the part of risk dynamics that is due not directly to fundamental, but to cross-changes in them. Such break-down is particularly useful in order to use the right explanatory variables and econometric techniques to analyze credit spreads.
The local element of credit risk is largely idiosyncratic, and it represents the risk that the sovereign entity defaults due to purely internal dynamics. The variables with which we will try to explain it regards the local economic and political situation, such as indicators of the fiscal space.
In second place, we take into account source of commonalities among similar countries credit risk: this is the global component. The explaining factors should have an impact spread across different geographies and should explain a large fraction of the co-movement of the sovereign credit spreads.
Finally, we distinguish the co-movements due to a reciprocal feedback effect among different countries credit risks: this factor is called in theory contagion or spillover. It is important to keep it distinct from the global component since it can lead to self-fulfilling dynamics apparently unexplained by pure fundamentals, and so need a separate investment consideration. Moreover, to study it we would use econometric techniques that consider diffusion and cross-correlation, such as S-VAR models
The risk is always expressed and traded in term of some kind of currency as numeraire. This fact by itself creates another source of risk: the currency risk. The risk is the more relevant the more devaluation or revaluation are correlated with payments in the contract. Since credit events on sovereign are very likely to significantly impact the ForEx market, the currency risk for sovereign bonds is important and not easy to assess. Another layer of complexity is added in the Eurozone, as in any currency union, since the currency risk incorporate a more specific redenomination risk. The possibility of a future break of the currency union, with a reintroduction of a local currency by one or more current members, exposes holders of outstanding sovereign bonds to the currency redenomination risk.

The empirical discussion will focus on the Euro group countries, with a particular attention to Italy and France. This choice is due to both personal and practical consideration. The situation and recent developments of sovereign yields in Italy and France presents various phases and a offers a variety of instructive points of study. Also, the variety and amount of the instruments traded with a direct reference to Italian and French sovereign credit risk is huge and provide reliable data for our analysis.
Finally, the primary point of view I want to present is the one of an European bond

investor, and it will be the occasion to analyze the investing in the Eurozone and what are the main differences that lead apparently similar claims as Euro denominated sovereign bonds to have so big price spreads.

2

Term Premium

In normal times, an investor who lends its money for any investment purpose, even the safest one, will require some sort of compensation, just for the fact of renouncing to the right of using its savings at will in the near future. This is not completely true anymore in modern financial markets. Large sum of money cannot be freely kept and stored without any charge, and therefore they must be parked somewhere, usually in bank accounts or money market instruments. In such a case, lenders do not have anymore the possibility of freely reducing their "money offer", since they have to lend their money anyway if they want to keep them to the next time period. Thus, the equilibrium time premium for lending money, not accounting for any credit risk, will be the result of a purely market dynamic between lenders and borrowers, and could theoretically assume any value. This is the reason why nowadays we see negative risk-free interest rates in most of developed markets.
However, two different types of lower bounds floor the term premium level. Lenders still maintain the option of converting their holdings in a physical liquid asset, cash notes or gold for instance, and to safely storage it until when they will want to use it. The negative premium cannot therefore be higher than the total amount that should have to be paid to complete this operation. In second place, if the term premium offered in the market is too low, the lender still keeps the right to use its money now for consumption or for non-money market investment opportunities (creating this effect to stimulate investments in the real economy is exactly the aim of Central Banks expansive monetary measures). That represents a second floor to the equilibrium term premium.

Since by definition the term premium does not entail any credit risk component, we should expect the time term premium structure to uniquely reflect expectations of future equilibrium of the money market. That is the Pure Expectation Hypothesis: today's long-term interest rate is an average of future short-term interest rates. However, this does not consider the fact that future short-term interest rates are uncertain. The uncertainty will lead investors with a short-term horizon to require a risk-premium for long-term bonds in order to compensate the possibility of having to unfold their investment in the near future at a different price than the one expected. There is empirical evidence that bond investors actually prefer short-term maturities and that they require a positive risk premium, called Liquidity Premium, to invest in long term bonds. On top of that, short-term and long-term bond market instruments are not completely fungible, and different market players play different

part of the curve (for instance, corporates invest on the short-term part and pension/insurance funds on the long-term). That lead to the creation of multiple market equilibria and the curve shape is mainly determined by different supply-demand balances.

Since it is a market equilibrium variable, estimating fair value models of term premia from economic variables is not easy. Some attempts have been proposed for very long-term risk-free rate, namely linking it to nominal GDP growth and inflation rate, but they have little explanatory power in the short term. The most used solution among practitioners and in literature is to directly use market data, once selected the relevant risk-free rate. I will present three possible benchmarks: Libor rates, US treasury rates and Germany treasury rates.
The Libor (London Interbank Offered Rate) indicates the average rate at which banks can obtain unsecured funding in the London interbank market for a given period, in a given currency. It is quoted for five currencies, with seven maturities, ranging from overnight to 12 months and use an Act/360 basis. It is probably the most widely used benchmark rate in Finance, with approximately 350 trillion of derivatives tied to it. However, the Libor is not completely free of credit risk. Indeed, it is the interested rate charged when the counterparty is a bank: in stress periods, the counterparty credit risk can account for a significant part of the spread. Even in normal times, there is normally a positive spread between Libor and benchmark sovereign rates (TED spread for US dollar), of the magnitude of 10-20 basis points.
The US yield curve of treasury rates is probably the closest approximation of a risk-free rate in finance. 62% of the world currency reserves are in US dollars. This translates in an "exorbitant privilege" for US Department of the Treasury, using the words of Valéry Giscard d'Estaing, French ministry of Finance in the '60s: US act as a benchmark for the world financial system, and therefore can do expansive monetary policies with few effects on its exchange rate. Therefore, a default on US treasury bills is deemed as impossible. In case of distress, the US Treasury could always print brand-new dollars, without triggering a big negative reaction on financial markets. However, since it is expressed in dollar term, to use the US yield curve of treasury rates as a benchmark for non-dollar investments, it has to be converted in the local currency by using swaps rates.
What the US is for the world, it is Germany for Europe, at least nowadays. Under the leadership of Schauble, the well-known German Minister of Finance, Germany has used Euro and EU to build a solid fiscal position from where it dictates austerity rules to less fiscal conscious members of the Union. This has made German Bunds, rated AAA since the starting of the currency union, the safe haven of Euro investments. The German interest rate has become so popular as a benchmark zero-risk measure, that a major indicator of sovereign distress in the Eurozone is now the spread between the local sovereign yield and the German one for the same maturity.

3

Redenomination Premium

The debate about the stability of the Eurozone and the difference between the various members sovereign credit claims can be traced back at before than the currency union itself. The fact that there is a unique currency among the different EU members, without an equivalent fiscal coordination, makes more complicated for investors to assess the effective risk incorporated in the distinct sovereign claims.
If the currency union is considered stable and well economically integrated, we should see a large convergence of yields among different Treasuries, since in such situation a credit event in one State has to affect in a comparable way also the other members states. However, the historical data for credit spreads in the Eurozone show as the yields are far from converging steadily across the union.
A factor that lead the yields' spread to increase is the possibility of a future breakdown of the currency union itself, with a reintroduction of a local currency by one or more current members. This option exposes holders of outstanding sovereign bonds to a currency redenomination effect. Effect is a more precise term than risk, since the redenomination does not automatically entail a loss for the creditor: if the new local currency appreciates with respect to the common one, the creditors will have a benefit, while, if we have a depreciation, they will experience a loss. However, we will keep using the term currency redenomination risk, since empirically in most of the case investors expect a depreciation of the new local currency and therefore require a higher yield to bear this risk.
Moreover, redenomination risk has an impact of the asset allocation of the investors, and widely explain the "home bias" we see in institution holdings. Indeed, the redenomination in local currency of the outstanding notional has a very different impact on the creditor balance sheet if the same happens to its liabilities than if that is not the case. For example, in case of a redenomination of the Italian debt in Liras, an Italian corporate that invested in BTPs and has a debt toward a local bank would offset the loss due to the Lira devaluation by the same process happening to its debt toward the bank on its liability side. Instead, a foreign company would have to convert its investment in Euros in order to repay its debt, and a large Lira devaluation could easily make it bankrupt.

Many attempts have already been made to isolate the redenomination risk component of the sovereign bond yield. De Santis (2015) uses quanto CDS, namely the difference between the CDS quotes in US dollar and euros, of EU member countries and compares them to quanto CDS of a "benchmark" country (Germany in the spe-

cific). An even clearer and more precise approach in my opinion is the one followed by Kremens (2018): by a "difference-in-difference" method, he manages to isolate the redenomination premium component of the spread between the CR14 and the CR regulation based CDS, one entailing redenomination as a credit event and the other not.

In this chapter, I would try to explain and interpret Kremens methodology for the study of CDS on Italy and France and derive the main implications for the Eurozone dynamics. Most of the content of such section are therefore directly inspired by Kremens (2018).
In 2003, the International Swaps and Derivatives Association (ISDA) updated the standardized definition underpinning the credit derivatives contract. In the Article IV it defines the credit events, and in the section 4.7 the restructuring events in particular. Subsection (a)(v) defines as restructuring event triggering CDS clause *"any change in the currency or composition of any payment of interest or principal to any currency which is not permitted currency", where permitted currency "means the legal tender of any Group of 7 country [...] or the legal tender of any country which [...] is member of the OECD and has a local currency long-term debt rating of either AAA or higher [...]".*
This means that under the 2003 ISDA provision, Germany, France and Italy could leave the Eurozone without triggering the CDS payouts, regardless of how this move would impact the bondholders.
To correct for such discrepancy and address other problems highlighted by the Eurozone sovereign crisis on both sovereign and corporate entities, the ISDA modified the Credit Derivatives Definitions in 2014. This time, in the Section 4.7 (a)(v), the redenomination event is relevant if it entails *"any change in the currency of any payment of interest, principal or premium to any currency other than the lawful currency of Canada, Japan, Switzerland, the United Kingdom and the United States of America and the euro and any successor currency to any of the aforementioned currencies (which, in the case of the euro, shall mean the currency which succeeds to and replaces the euro in whole)".* With the 2014 definition, an exit of Germany, France or Italy from the Eurozone triggers the CDS payout.
Therefore, the difference between the two contracts, quoted separately in financial markets under the denomination "CR" and "CR14" respectively, is a direct measure of the redenomination risk for Germany, France and Italy. In particular, the advantage of a "CR14" contract is that it will pay the protection buyer even when the debt will be redenominated in a new currency without triggering any other default clause. More precisely, by the spread we measure the protection cost against the conjoint event of both a currency redenomination and an absence of other credit events. This is a lower bound of the cost of insurance against redenomination risk as a whole.
However, since the CR14 amendment changes also other clauses (f.e. the Asset Package Delivery clause, in response to the 2012 Greek Bail-out), plus the liquidity between the two contracts could differ, leading to a liquidity premium on the most liquid claim, Kremens uses a "difference-in-difference" methodology to clean the redenomination component of these accessory effects. Under the assumption that all other differences between the two contracts' standards are expressed by a fixed spread, subtracting from the CR-CR14 spread of Germany, Italy or France

the CR-CR14 spread of a not-G7 comparable country, such as Spain for example, allows to isolate the redenomination risk component. More specifically, Kremens construct a synthetic CR CDS spread for Germany, Italy and Germany without their G7-membership. It does it by regressing four variables - namely the CR14 CDS spread, its bid-ask spread, the 5Y sovereign bond yield and its bid-ask spread - and optimizing the weights on a control group.
For other Eurozone members where do not have similar directly observable measures that separate credit risk from redenomination risk, Kremens estimates the sign of their redenomination risk by analyzing the co-movement of their credit spread with the French redenomination risk, that he believes to have more systemic features. From this analysis, we observe positive redenomination risk for countries such as Spain and Portugal, while negative redenomination risk is associated with Germany, Austria and Netherland.

A limit to the so-estimated redenomination premium is that in CDS data we find only the positive part of it, so the one associated with a new currency depreciation. That is a limit, especially for Germany, were it is rational to expect a strong appreciation of the local currency in case of a monetary union break-down.
In any case, Kremens' redenomination premium measure seems sufficiently significant: regressing it along with swap rates (representing term-premium) and CR CDS spread (representing credit-risk) on the sovereign yields gives very significant coefficient and an R squared greater than 0.85 for both France and Italy. The lower result for Germany is due to the lack of negative redenomination risk measure.

The dynamic showed in the data (Kremens pag.26 onwards, analysis partially replicated in the empirical part of my thesis) by the estimated redenomination spread seems consistent with what we expect, with France premium spiking on the eve of 2017 presidential election, and Italian redenomination risk considerably increasing in parallel to the formation of the Lega Nord – 5 Star Movement government.
In addition, Kremens runs more regressions on the data to interpret the features of Italian and French redenomination risks. He concludes that redenomination spread in Italy does not bear contagious characteristics and it is associated with a flight-to-quality in the Eurozone, since it is correlated with lower yields on the rest of the Eurozone and bears no significant impact on the Euro exchange rate. Instead, French redenomination spread presents more systemic features, being correlated with an increase in both corporate credit spread and a polarization of yields in the Eurozone between weaker and stronger economies, plus an Euro depreciation.
The data support the hypothesis that French redenomination risk is correlated with the fear of a break-up of the currency union and therefore associated with capital flowing from weak currency countries to strong ones. On the other side, Italy redenomination risk appears more isolated to the local economy, leading investors to move their investment allocation homogenously among other Eurozone countries, without a clear break-up fear.

4

Credit Premium

Credit risk is deemed to capture all the credit and default risk not related to redenomination. It normally accounts for the largest part of the sovereign yield, since is the one that exposes the investor to the biggest risk: losing the money that he lent. A direct market measure of pure credit risk, that we will use widely in the future, are Credit Default Swaps contracts. A Credit Default Swap is a contract where the protection buyer makes periodic payments to the protection seller, in exchange for an insurance in case of credit event on the contract underlying entity. In fact, in case a credit event is recognized by the ISDA, the protection seller will have to pay the protection buyer its loss, defined as the nominal of the contract times one minus the recovery rate after the credit event.
Unfortunately, for non-G7 countries we do not have a direct measure of Credit Risk separated from Redenomination risk, since redenomination is an eligible credit event under the ISDA definition. As argued above, we retain more precise to treat currency and redenomination effects separately from standard credit risk. However, we can use quanto CDS in USD on the reference entity in order to get a measure of the credit risk independent from fluctuations in the local currency.
Because of its generality and its importance, studying credit risk requires a variety of approaches and techniques. In the following subsection, we will proceed to a presentation of the most important components to break-down the analysis and the most relevant factors to look for. The list is not exhaustive and many other tailored approached should be taken to do a good analysis on a specific basis.

4.1 The risk premium and expected loss components

The first important step in analyzing credit risk is to get an estimation of the expected losses and of the risk-premium component. Rationally, we know that a risk-premium component must be present, since expected losses estimation is by force very arbitrary and volatile. Indeed, sovereign default are very rare events, where historical rates are not significant, and they can depend on virtually any macroeconomic variable based on factor weights that change significantly depending on economic, political and social dynamics. Thus, a rational investor will want to be compensated for bearing such an uncertainty. Moreover, the default events present a sudden discontinuity, the so-called jump-to-default, that cannot be easily hedged in

a portfolio, and tend to happen all in bad times, which makes impossible to diversify them away. All these factors ensure us that we must have a risk premium component. However, the problem is to try to determine its magnitude from available data.
From market prices of corporate or sovereign bonds alone, we can only extract information on the risk-neutral intensity . The volatility and jump-at-default premia cannot be inferred without additional assumptions. Luckily, there are many ways to try to estimate these factors, and we will present the main ones experimented in the literature.

4.1.1 Credit Ratings

Remolona, Scatigna, and Wu (2008) provide estimates of the jump-at-event premiums for sovereign issuers representing the default event as a Poisson process. They approximate the credit spread CDSt(M) t(1R) to extract the risk-neutral default intensity and use information about credit ratings to extract the true probability default intensity P. However, as they emphasize, this methodology is very unprecise since ratings are often stale measures of credit risk for sovereign issuers and predicting the timing of a credit event for a country is a very different exercise than predicting the default of a corporation.

4.1.2 Historical Default Rates

Another way to estimate the risk-premium would be to compare the default intensity under the risk-neutral measure to the one implied by historical default rates. This approach is followed by Longstaff et al. (2010). Their model recalls the one of Pan and Singleton (2008): the default is represented as a Poisson process that follows a log-normal mean reverting process, and risk-neutral intensities are calculated from market data. Then, they model a parallel process that relies on true probability measure, which is linked to the previous one by a "market price of risk". Eventually, by a maximum likelihood optimization they get the relevant parameters and fit the observed term structure of CDS. In such a way, they separate the distress risk-premium associated with the unpredictability of the default intensity, by the expected loss. Following this methodology, they esteem that risk-premium is on average one third of the credit spread.
However, it is very difficult to calibrate these models on historical data. As said above, default are so rare events and so dependent on changing conditions that historical rates cannot act as more than general indicators. Surprising results about risk-premium were detected in Longstaff data: the resulting risk-premium component results less explained by global macro-variables than the default-risk component. The main explanatory variable is the SP500 returns, while just 8 out of 15 countries studied have a significant dependence of their risk premium on the volatility premium, and 7 out of 15 on the Equity Risk Premium.
As said, we should use these types of findings just an indicator among many others in the investing decision process, since the confidence interval underlying the historical default rate method is very large.

4.1.3 Individual preference models

Another approach is to derive the risk premium by assumption on individual preference models and solve for the equilibrium value. This kind of analysis is typical of economists, and it is followed, for instance, in Augustin (2012). Here, a recursive preference-based model is built based on risk averse agents. The sole risk premium analyzed here is the one related to the uncertainty of the default process. The jump-to-default effect is neglected. The results show an upward sloping term structure of risk premia, due to investors' risk aversion preferences. The curve results steeper for low risk country. This is consistent with the fact that default intensity and distress influence the short-term expected loss, while we do not expect a long-term risk-premium to depend on the default rate, being idiosyncratic risk diversifiable away.
The size of risk spread with respect to the total credit spread hovers around 3% for short maturities to approximately 10% for 5-year spreads and to 18% at the 10-year maturity. The magnitude of the results is very sensitive to the model assumptions: as said above, in Longstaff et al. (2010) model we have a 30% average risk-premium for 5-year spreads. This difference in size is partially explained by the autoregressive model used by Augustin, that by smoothing the volatility realization process entails lower volatility premia, but is significative of a very important key point to keep in mind for investors: the prediction obtained by using simplified models that relies on arbitrary assumptions are a fundamental tool to guide investing decisions, but must be considered more for the generic intuition that they convey than for the specific magnitudes. It is never too much to repeat that in such cases, confidence interval (seen in a subjective-Bayesian way) are very large and only the investor practical experience and the intuition will help him take more punctual decisions.
On one conclusion, however, we find an unambiguous convergence in literature. In Augustin (2012), the dependence of risk-premium on common global factors is persistent among the analyzed sample and leads to significant correlation in spread of CDS on very different sovereign entities, as highlighted also in Pan and Singleton (2008) and Longstaff et al. (2010).

4.2 Global versus Local components

The second important layer of an investment analysis on sovereign bonds credit risk is to determine which typologies of economic factors are relevant in driving its return. Many academical literature has focused on inquiring if the CDS premium was mainly due to local factors, global factors, or a combination of both. As expected, the results point toward an importance of both global and local factors, with the mix composure depending on country specific characteristics and global economic cycle.
Before digging more in-depth into the determination of these components, I will present the main potential global and local explanatory factors

4.2.1 Global factors explaining risk premium

I will start from the main global factor that are identified as possible explanation of the risk premium.

The equity risk premium is a traditional tool used for valuation in the equity markets. It represents the return over the risk-free rate demanded by investors to hold the market portfolio. It is reasonable to think that it is strictly relatable to an equivalent premium in the fixed income market, since the market portfolio should be optimized on all the tradable securities available, bonds included. Numerous ways have been used to estimate the equity risk-premium, and it is difficult to find two papers or deal pitches that adopt the same value for it.
We can define two main approaches. The historical one takes as a risk premium the average overperformance of equity over risk-free bonds on a predetermined time horizon for a given geography. Whereas, the fair-value model approach decomposes the ERP in different components and looks to explain them through economic variables. The historical approach main problem is that by definition is not forward looking, and that suffers from dataset biases, as hidden one-off events and survivorship biases. The fair-value model instead relies quite strongly on assumptions and is not easy to calibrate, therefore offering very noisy predictions. Augustin (2012) uses as simple proxy for ERP the changes in the earnings-price ratio of the SP index. Of course, this approach is simplistic, but it is a good approximation, if we assume a stable outlook for dividend and internal company growth across the economy, and has the main advantage of being model-free.
The main metric to measure risk is without doubts volatility. Thus, it makes sense to believe that there is a correlation between the expected volatility in the market and the risk premium that the investors ask for bearing uncertainty. A market measure of both expected volatility and the price of hedging it is the implied volatility of traded options. In particular, if the difference between the implied market volatility and the realized volatility increases, it can be interpreted as a signal that investors are becoming more risk adverse and are ready to pay more to protect from downside events. For the US market, the main available option volatility indicator is the VIX, that averages the implied volatilities for SP500 options around 30 days of maturity. Even if there are numerous empirical findings that shocks in the US financial markets drives trend in the global market, when we will have to deal with European investors, I will prefer to be more precise and use the European correspondent of the VIX, the VSTOXX. The methodology to build the index is the same, but it uses options on the EuroStoxx50 instead.
The sign of the correlation with the VIX level has often been explained in literature as the effect on the CDS of a "flight-to-quality" rush. For countries that are considered as safe heaven, the sign should be negative, while it is expected to be positive for countries perceived as risky by investors.
There is another indicator that can be used to determine the "flight-to-liquidity" or "flight-to-quality" phenomenon, and this is the spread between the Bund yield and the KfW, the bonds of a government-owned German development bank. Being both guaranteed by the German state, they are completely risk-free. However, the Bund market is much more liquid, and therefore their spread indicates how much investor are willing to pay to access this liquidity.
To conclude, there exist uncertainty and sentiment indicators built through surveys and other non-market means, such as the European Economic Policy Uncertainty Index. Of course, not being market variable their frequency is often not significant enough to get good estimations on their relevance.

4.2.2 Local factors explaining risk premium

A part of the risk premium explanation could also derive from local contingencies. In presence of not perfectly integrated financial markets, it is natural to expect that risk appetite will vary depending on the local economy conditions. I will therefore propose some local factors that could help us explain a country risk premium.
First, the current local financial market cycle, as represented for instance by the local stock market return, or equity risk premium, denominated in local currency. We expect that in a bearish market, the investors will become more risk averse and the uncertainty over future default rates will be priced more expensively, so the risk premium should be inversely correlated with local stock index movements.
A second main indicator, in my opinion more significant than other proposed in literature (for example, exchange rates changes or local yields, that are indeed widely correlated with the other variables we already considered), is the net new flows into local mutual funds investing in debt-like or equity securities (proposed in Longstaff et all. (2010)). It represents a proxy to the risk sharing and investment diversification around the local economy. An inflow into local funds mean that more investors are confident in investing into the local economy, and therefore should cause the risk premium to decrease, while an outflow should mean the opposite.

4.2.3 Global Factors explaining expected loss

To capture the fact that the ability to repay the debt of a country is strongly interconnected with the state of the global economy, the main indicators used in literature are the US financial market return, the US treasuries swap rate and the US corporate yield spread.
In particular, the return on the SP500 index is the most widely used indicator for the shape of the world equity market, being the US market the financial center of the western world. The US treasuries constant maturity swap is useful since it conveys information more specifically about fixed income as an asset class, especially if combined with the US corporate yield spread. An alternative when working on European underlying could be to use Euro-based data (for instance, replacing the SP500 with the Eurostoxx50) but the positive effect is at least dubious since the new benchmark will be much more dependent on other local factors impacting the security.
In addition, it is possible to use sentiment indicators to have forward looking variables which reflects expectations regarding the global economy. An example is the European Commission's Economic Sentiment Indicator, used in Dewachter et al. (2014).

4.2.4 Local Factors explaining expected loss

The foremost factors determining a sovereign country bond expected loss are local determinants. These determinants can be represented by market and fiscal variables. Market variables include the local stock market returns, the change in the local currency exchange rate (usually against the dollar), and the change in the sovereign holding of foreign reserves (proposed in Longstaff et all. 2010). In addition, the change in the amount of outstanding debt on GDP (or of foreign debt on GDP) is an important indicator of modifications in the riskiness of the sovereign claims.

As important, at least in theory, are fiscal factors: deficit/tax indicates the capacity of the sovereign government to finance its deficit by its tax income. The higher the value, the riskier is to invest in sovereign holdings, since a large deficit with respect to the tax base leads to new debt issuance (therefore inflation) or in the worst case to default. The importance of the fiscal space will be remarked more in detail when we will talk about contagion risk, using the work of Aizenman et al. (2012).

To orient ourselves among these cluster of different possible explanatory factors, we have to find some good rule of thumb to guess from the main country economic variables which determinants to look at.
Dewachter et al. (2014) tries to decompose the yield spreads of a set of Euro countries into a fundamental and a non-fundamental component by using macro variables and other indicators. His study confirms that economic fundamentals are the dominant driver behind bond yield spreads, but non-fundamental risk increases in significance following crisis periods, with the two principal components that become an important factor explaining the bond yields variance.
However, the most interesting results of the link between curve shape, economic conditions and relevant economic factors is the one presented in Augustin (2012).
The underpinning idea is that the shape of the term structure conveys significant information about the relative importance of global and domestic risk through the following mechanism: if the term structure of sovereign CDS is upward sloping, the short-term loss risk is lower than the long-term risk aversion, therefore the idiosyncratic risk component is low and CDS spread is influenced mostly by the general shape of the world economy. Instead, a downward sloping term structure signals a distressed country, where investors fear a sudden default and are more concerned by the local dynamics.
To show it Augustin builds a consumption-based asset pricing framework to explain both the term structure of CDS spreads and their determinant factors. In its recursive preference-based model, with an uncertain autoregressive underlying default process, global macroeconomic factors impact all the countries through varying coefficient. Instead, country specific idiosyncratic shocks impact the local expected default rate, but they are absolutely uncorrelated across countries. In the model, calibrated over 44 countries historical data, systematic shocks in the default process are priced in the CDS risk premium, while country-specific shocks are unpriced.
The author shows that the term structure of expected losses in normal times is flat or slightly decreasing. It appears that, in periods of stability, investors estimate such losses as an exceptional event following a global economic crisis. This is consistent with what has been presented in Longstaff et al. (2010) analysis: global variables seem to explain the expected loss component better than local variable, with CDS premia normally increasing with time.
Thus, we can link a negative sloping term structure to high local risk priced. In fact, local shocks lead to an increased expectation about future default rates, making expected loss peak around short term maturities, while, despite the uncertainty, long term risk premia remain stable due to diversification. Instead, if the local risk is low, the curve shape is given by the long-term uncertainty aversion, and so is upward sloping. Data analysis confirm that during sovereign crisis, correlation drops for countries in distress, while increases for country in normal condition, strengthening Augustin conclusions. On top, repeating Longstaff et al. (2010) regression of CDS

spreads on both local and global risk factors, the results emphasize that for fiscally distressed countries such as Greece, Turkey and Spain, local variables are more statistically significant than global variables.
Such is empirically a very important result for investors in sovereign bonds or CDS. As rationally expected, both global and country specific risk factors are relevant in the sovereign credit risk explanation. However, they tend to matter in different periods, and therefore we should adjust our analysis and tools in order to account for it. Inverted term structure should thus be seen as an indicator of the prevalence of local factors over global factors in the CDS price breakdown.
On the other side, global shocks are the main determinants when the curve slope is positive. In such periods, investors should pay special attention to indicators about global appetite for credit-exposure, such as VIX and US corporate credit spreads. In addition, correlation between different entities will be more accentuated, and differentiation more difficult.

5

Sources of Commonalities

Another step in our investment analysis is to analyze the source of commonalities between different sovereign yield spreads and its evolution through time. Co-movement sources are very important both to understand the dynamics governing the single bond yield determinants and to construct a well risk-weighted portfolio. For example, if credit risk entails a high correlation among different union members, an investor holding many different sovereign claims should not account for too much diversification.

The first and simplest investigation about common movements in the sovereign spreads is a Principal Component Analysis. In Longstaff et all. is presented a PCA for 26 countries between 2000 and 2010. The first factor explains around 64% of the total sample variance, while the first three go above 80%. In essence, the first component appears as a parallel shift in the CDS spread, highly negatively correlated with the US stock market returns. The second component has positive weights on developing countries, while negative one on EU/US economies, and could be explained by a developed markets versus emerging markets factor. Finally, the third PC poses significant weight to country in high distress, highlighting the importance of local variables in such situations.
The analysis of these commonalities is an important tool to improve our "factor regression" on the single sovereign yields. The co-movements can either be explained by a correlation among the underlying macro-factors, so a common "systemic component", or by a feedback mechanism among different country-specific risks, that we will define as a contagion.

5.1 Systemic component

Regarding the question whether the shift component identified in the PCA is mostly due to correlation in the macro factors determining the single country-specific sovereign spreads, or represent a true common global factor impacting similarly all economies, an interesting analysis is done in Ang and Longstaff (2013).
Their results discard the hypothesis that commonality in systemic risk among sovereigns derives mostly from common macro-economic fundamentals, at least in Europe. Systemic risk in the Eurozone seems more correlated with financial market variables and related to the influence of global financial markets. In particular, the authors

found that Eurozone members default-risk dynamics under risk neutral probabilities are explained by Germany sovereign risk evolution much better than the risk intensity in single US States are explained by the US central government one.

5.2 Contagion/Spillover effect

A longer and different handling is required by the contagion effect. I will dedicate some pages to it, both for its relevance in nowadays financial markets and for its importance in political decision at the regulator level. Moreover, we will investigate the so-called bank-sovereign nexus, the doom loop between finance sector bailouts, worse credit worthiness of sovereign debt and further bail-out expectations.
In an increasingly interconnected financial world, a shock on a particular financial claim or institution could impact apparently very distinct financial products, which value however directly or indirectly depends on the other asset price. A clear example was the fast spillover of the 2007 US mortgage backed securities value drop, that in few months led to the collapse of the shadow banking system first and of the global industrial output afterwards.
Without understanding of contagion dynamics, an investor could overlook important risk factors hidden in its investment. In studying spillover risk for sovereign entities, we will focus on both the impact of changes in sovereign risk for the rest of the economy and the effect of external economic shocks on sovereign claims. The first analysis will tell us how much systemic/contagious a country debt is, while the second one will provide an analysis of external factor that have an indirect impact on the State's borrowers.

5.2.1 Contagion and fragile beliefs

To explain dynamics between default probabilities and risk premium, Benzoni et al. (2015) propose an equilibrium model for defaultable bonds that are subject to contagion risk. In particular, agents are uncertain both about the default intensities of the single countries, and about a fundamental hidden economic state, common to all euro-zone countries. They have "fragile beliefs", i.e. they weight more less favorable models' outcome, and they form their best estimate (their reference model) of the underlying state based on all available information (credit events and news signal) using Bayesian updating. Such combination leads to equilibrium credit spreads that are significantly higher, more volatile, and more correlated than in a model where there would be no uncertainty about the state. This express rational contagious-like behavior in sovereign credit spreads and positive jump-to-default risk premia.
The information filtration is given by a set of fundamental shocks, that modify the agents' estimation of posterior probabilities of both the country's specific risk and of the hidden economic state. Fluctuations in the state vector drive variation in the state-conditional default intensities, which in turn affect the prices of sovereign bonds. Second, shocks to the macroeconomic signals and default events trigger changes in the posterior probability of the hidden state, that impact sovereign spreads. The macro indicators used are inflation, reserves/GDP, real GDP growth, government surplus and debt/GDP, plus logarithmic VIX changes.
The model coefficients are estimated by quasi-maximum likelihood in combination with unscented Kalman filter. Two sources of nonlinearity are allowed in the system:

the CDS pricing formula is a nonlinear function of the state vector, and the hidden state probabilities have nonlinear dynamics.
Breaking down empirically the CDS spreads into risk-premium and expectation components, the last one account for around 20-50% of the total, soaring from an average below 30% pre-sovereign debt crisis, to nearly 45% in 2009-10. The ratio of the risk neutral default intensities probabilities to the true ones ranges from 1 (f.i. for very safe heaven such as Germany), to 2.5, so there is evidence that default events are not conditionally diversifiable, and that any shift in the probability of the bad states can be magnified when it comes to pricing.
The default risk premia tend to decrease as uncertainty is reduced, and "fragile belief" aversion toward the model uncertainty accounts for the largest component of CDS risk-premium. However, the authors admit that this is conditional to the specific agents' preferences assumptions, and that "separating model uncertainty from-time varying risk aversion remains an open and challenging problem".
We believe that this approach is a very interesting way of dealing with inter-correlation and contagion like behavior, since the model, differently from standard regressions, allows for non-linear relationships: compared to a linear benchmark, the model RMSE is 10 to 80% smaller, with a 40-90% reduction of the mean absolute error.

5.2.2 Liquidity risk

The impact of liquidity risk, in parallel with credit risk, in the sovereign bond market as a source of contagion has been analyzed by Bai et al. (2012). The hypothesis is that liquidity may dry up when a country is facing fundamental problems, since liquidity traders withdraw their investments due to worsening fundamentals. In their model, the interaction between informed traders and noise traders give rise to an excess correlation above the one explained by common fundamentals, that is defined as liquidity contagion. Sovereign bond yields are regressed on CDS spread and on the excess bid-ask spread with respect to the average. Structure breaks are allowed to let the relationship change over time. The optimal number of breaks chosen in the one that minimizes the Bayesian Information Criterion (BIC).
The spillover effect is identified by a structural vector autoregression (S-VAR) approach. Five types of shocks are considered: foreign credit risk shocks (measured as the average CDS spread excluding the underlying country), domestic credit risk shocks (measured as the CDS spread of the underlying country), foreign liquidity risk (measured as the average bid-ask spread of bond prices, excluding the ones issued by the underlying country), domestic liquidity risk (measured as the bid-ask spread of the bond prices of the underlying country) and net order flow shocks (measure as the percentage of buy minus sell orders to the total outstanding of domestic government bonds). To identify liquidity shocks, a "long run neutrality" is imposed: transitory liquidity shocks should have no effect on the credit spreads, nor on portfolio rebalancing, in the infinite future.
The results show that the liquidity risk becomes a primary source in determining sovereign bond yields in deep crisis periods (such as after Lehman Brothers' bankruptcy), while in other period is credit risk that drives yield changes. In particular, there is a significant flight-to-quality phenomenon associated with international liquidity shocks. However, there are no evidence of feedback effect from liquidity

shocks to fundamental credit shocks in the structural VAR analysis. The European sovereign crisis mainly propagates through the fundamental credit risk channel.

5.2.3 Fiscal contagion

A specific focus on fiscal space determinants can be observed in Aizenman et al. (2012). Making the distinction between South-West Eurozone Periphery countries (Greece, Ireland, Italy, Portugal and Spain) and other euro country, the paper looks to determine whether the spike in sovereign default risk market perception can be explained by changes in fiscal and macro fundamentals.
To do this, they develop a pricing model for around 50 countries, from Europe and outside Europe, analyzed in a period ranging from 2006 and 2010. Variables include both fiscal and economic fundamentals: the first ones are debt/tax and fiscal deficit/tax ratio, the second ones are trade openness, inflation and external debt. The results confirm the significance of the fiscal variables, while of the economic variables only inflation is highly significant.
More interesting the pattern detected about CDS evolution: for the period preceding 2008, European CDS seems undervalued with respect to their controlling variables prediction, while default risk price was soaring in extra-European countries. From 2009-10 the situation is inverted, with sovereign CDS differentials steepening in SWEAP and Euro countries in general, while risk assessments were falling in the rest of the world.
Particularly striking is the fact that the ability of the fiscal based model to explain CDS spreads drops during the 2008-10 crisis, padding from 70-80% to 45-50%. The prediction error ratio in the 2008-10 period is very high, around 4 for Spain, 2.5 for Italy, and 3 for the not-SWEAP Euro countries. No evidence appears in the data about the hypothesis that debt and deficits in the SWEAP countries led to high prediction errors during the crisis.
One of the possible explanations furnished by the authors about the incredible surge in CDS Eurozone spreads after a period of "great moderation" is that investors and speculators are trading on expectation of future further fiscal deterioration, more than on current fiscal data, and that explain why the regression has so little explanatory power. Another possibility is during the crisis the market moved from a previous over-optimistic equilibrium that were underpricing intra-euro risk, to a new pessimistic expectational equilibrium. Here, persistent pessimism, manifested in high risk premia, induced further deteriorations of the balance sheet of a country, leading a self-fulfilling prophecy crisis.
Evidence for these interpretations derive also from the matching of the SWEAP countries with 5 extra-European middle-income countries comparable in term of debt/tax ratio. From the comparison, it results that in 2010 the CDS of the SWEAP countries skyrocket without any similar behavior in the comparable group, even allowing for differentials in the fiscal space and other fundamentals. In summary, there is strong evidence that high market default risk assessments in the SWEAP are partly attributable to deteriorating fundamentals, but that a large component is unpredicted.

5.2.4 Bank-Sovereign nexus

Four transmission channels have been identified by the BIS (2011b) between sovereign and bank specific risk. The Asset Holding channel is the most direct one: banks' balance sheet are filled with plenty of sovereign bond holdings, therefore an eventual increase in sovereign yields will immediately lead to a mark-to-market loss for banks. The second transmission channel is defined as collateral channel. Sovereign spread can hinder a bank capacity to fund its short-term liabilities in the interbank market by lowering the value of collateral that banks hold in sovereign debt. Related to this, a rating channel may imply that a downgrade in sovereign claims credit quality affect negatively a bank funding cost. Finally, a government with a weakened fiscal position is more unlikely to save a large bank, making harder for investors to rely on public aid in in case of distress, the so-called guarantee channel.

The simplest approach to study the bank-sovereign contagion is by estimating the excess correlation.
Bruyckere et al. (2012) run a regression for sovereign and banks CDS spread on macro and market factors, and the correlation among the residuals, defined as excess correlation. They label this increase in the correlation between the CDS spread unexplained changes as contagion. Then, they attempt to identify the main factors that drives this contagion. By Fisher transformation of excess correlation coefficients, the authors also test whether changes in excess correlation are statistically significant.
Controlling for European Market performance, market volatility, credit spread and term premium, the results give an average excess correlation of 17% in the years following the financial crisis. Using Fisher transformation to test the significance of the excess correlation coefficients, there are findings of significant contagion with their home country for 86% of the banks in 2009 and 64% in 2010.
The authors provide then evidence of substantial home bias in bond holdings, confirming the Asset Holding channel as one of the main determinants of the stronger contagion between banks and their home country. Also, data show that the higher correlations is more pronounced with respect to countries that present a higher level of credit risk, as measured by the CDS spread and by fiscal fundamentals. Therefore, it is important to keep these fiscal factors into consideration when analyzing the opportunity to invest in sovereign claims not only for their direct impact on Government finances, but also for their indirect spillovers to the financial sectors that could start an unavoidable doom loop.

One of the most comprehensive handling of the bank-sovereign nexus is in Acharya et al. (2013). The authors provide a simple three period model of interaction between the central government, the financial sector, and the non-financial sector. They find that if the debt-overhang problem in the banking system is relevant enough, as it is in crisis times, the government will be willing to sacrifice part of its creditworthiness by bailing-out the private banks debt. As a consequence, this will not only distort future financial sector incentives, increasing moral hazard, but more directly it will weaken the current holdings of the bank sovereign claims. The doom-loop is the stronger the greater the home-bias in the banking sector's bond holding is and can generate needs for further government intervention.
In particular, the authors found that during the bailout period (second half of 2008),

it is present an evident transfer of risk from the private sector to the public sector, with sovereign and bank CDS significantly negatively correlated. Then, after the 2008 public bailouts, *'there emerges a strong, positive relationship between public debt-to-GDP ratios and sovereign CDS'*, absent in the previous data. This created a robust relationship between the level of sovereign risk and bank credit risk, as measured by the respective CDS. A 100 basis-points soar of sovereign CDS is associated with a comparable 10 basis points increase in the average level of banks CDS. More than that, the country's pre-bailout level of financial sector distress results a good predictor for the subsequent sovereign credit-risk increase.
The results were robust after accounting for both foreign credit risk exposure and other macro variables. Moreover, a lower but significant correlation was documented also with respect to foreign sovereign credit risk. A further control, included banks' own equity returns, was included in order to eliminate any possibility of a co-movement between sovereign and bank CDS due to country-level common shocks.
A further inquiry on the bailout effects on the sovereign-banks dynamics in the Eurozone has been made by Alter and Schuler (2012). They highlighted the heterogeneity of responses to different bailouts programs.
CDS of countries that provided a larger public help to banks, Ireland and France for example, were more impacted, with an inversion of the mechanism of risk transmission that pass from banks toward government to the opposite direction. Government CDS spread have increased relevance in the price discovery mechanism of the banks' CDS series, while the effect of banks shocks on itself almost disappear, signaling a successful transfer of the fat-tail risk to the government balance sheet.
Instead, countries that provided lower public aid levels – an example is Italy, which had already a relevant debt burden that did not allow for bigger recapitalization programs – shows a less pronounced change in dynamics, with banks that still maintain the tail risk that was transferred to the government balance sheet in other countries. The two-way link between banks and government credit risk becomes more pronounced, as financial sector distress could require further public intervention and deteriorate the public finance health on one side, and a decrease of the government borrowing possibilities would lower both the holding bonds value and the implicit guarantees to the financial sector.

To better investigate and understand the implication of such relationship, it is important to understand qualitatively which kind of distress could cause an excessive debt-to-GDP ratio in response to a public bail-out. In Acharya et al. (2013), the model assumes a fixed "default loss", that proxy any type of distress risk, from inflation in case of excessive debt issuance, to reputational costs, to cost linked to eventual austerity politics. However, in an actual empirical setting, I believe that each of this event would have a fairly different impact on bonds yield, and therefore they should be analyzed separately.
First of all, there exists a various and changing regulation landscape. In the last-years, regulator in Europe focused on cutting such malicious nexus, by the launch of the Single Supervisory Mechanism in 2012. Based on the SSM, the ECB is responsible for the 120 most significant banks of the Euro area (85% of banking assets), thus lowering any eventual national bias. Moreover, new debt issuance in absence of supranational constraints has very different inflation effects based on market structure and investors' expectations. Japan combines a 200% debt-to-GDP

ratio with a long-standing deflation problem and 0% long-term yields on sovereign bonds, whereas Brazil and Argentina, despite a debt-to-GDP ratio between 50% and 80%, have an average inflation of respectively more than 5% and more than 30%, with significant default risk implication. Even in a stable Eurozone framework, we have seen how breaches of the stability and growth pact constraints have received very different responses, depending on the country and on the time conjuncture. A careful investor should be aware of the local specificities of the political process, therefore assessing in a more tailored-way the supra-mentioned bail-out contagion risks from the private sector to the public one. Periodical empirical analysis on the correlation between sovereign based and corporate based indicators should be run in order to identify in time signals of an eventual changes in the common landscape.

6

The CDS-Bond basis

The CDS-Bond basis is the difference between the CDS spread and the equivalent credit spread implied in the Bond price. To be comparable, the bond spread considered must represent the spread, over the term-premium, implied by the risk-free curve for a floating rate note on the same entity. In absence of these tradable claims, there are methods to estimate this spread given a basket of standard bonds and a risk-free benchmark curve. In standard market condition, the basis should be zero by no-arbitrage argument.
Adler and Song (2010) stress the importance of this process of readjustment of the observed bond credit spread to obtain a comparable of the CDS spread, in absence of par-trading floating rate notes. If we do not do it, it will be natural for bonds below par to observe a negative basis, and for bonds above par to have a positive basis. The authors use the term structure of traded CDS to estimate the risk-neutral default intensities and create a corrected "implied bond yield spread".

A positive basis means that the CDS spread is greater than the implied credit spread by the bond price. Therefore, the bond is overpriced with respect to the CDS market, and an arbitrageur could short the bond and sell protection on the CDS for the same nominal, and with the CDS spread repay the short bond coupons. Conversely, a negative basis implies a bond under-priced with respect to the CDS market, and an investor could take profit of this situation by buying both the bond and the protection.
Therefore, it is clear that a basis different from zero represents a concern for both theoretician and practitioners, since, if we assume an arbitrage-free market, it implies that there are some hidden risk factors or limits to arbitrage that allows the CDS and Bond spread to differ.
That the persistence of basis different from zero is a factor to address is confirmed by the inconsistence of explanations to the basis that does not consider limits to arbitrage. The idea, expressed by Hull, Predescu, White (2004), that the CDS-Bond basis reflects the risk-free funding cost available to any investor, since they assume that the average true basis should be zero, is dismissed by the evidence that the cross-sectional variation in the basis is very large and disperse. It is important, as stressed by Bai and Collin-Dufresne (2018), to focus more on the cross-sectional distribution than on the average level, since the risk-free rate is uncertain and therefore the average level could be impacted by "flight-to-quality" occurrences. In general, the authors showed for corporate bonds that there can be important idiosyncratic

factors driving some reference basis, and this could also happen for sovereign entities.

6.1 Leading discovery

CDS premia and bond spreads present, at least partially, different drivers, more notably on crisis periods. While both are strongly influenced by global risk factors and appetite, CDS premia are much more driven by country specific variables, such as Equity returns or internal economic confidence level, than bond yield spreads. Therefore, in periods of stress, the CDS market is more reactive and a better measure of country specific risk than the bond market, where, given the huge size and liquidity of the positions, the players reason more in term of opportunity cost and are less flexible in their responses, tending to either keep their investment or liquidate it completely to switch to a safer profile (flight-to-liquidity).
In normal times, it is the sovereign bond market that leads the discovery of the credit risk, while the CDS market follows. A number of studies confirm this theory. However, in crisis times the CDS market, for its liquidity and the easiness of taking both long and short positions, augments its importance in information discovery. A harsh political debate had place on whether shocks in the CDS market could manipulate the required bond yield, and numerous politician accused speculators of increasing sovereign borrower costs. Even if in some case it appears to be the case, Duffie (2010) rejects the hypothesis that the CDS market could significantly impact the required yield on sovereign bonds, increasing the borrowing costs. He arguments that it would be too difficult to manipulate the CDS market price and that its size is so small compared to the debt outstanding (between 5% and 1% in average) that it is difficult to imagine that CDS rates can drive consistently the bond market.

6.2 Positive Basis

Bai and Collin-Dufresne (2018) found that the basis tends to be very close to zero, or slightly positive, in normal times, to turn negative during financial crisis.
An explanation to the positive basis could be tracked in the difficulty to short bonds, or in cheapest-to-deliver option in the CDS, that increases the protection cost. In fact, if in case of credit event it is possible to deliver the cheapest bond of a basket to the protection seller in exchange of its nominal, a portfolio entailing both the CDS and the bond would not be perfectly hedged, since in some cases the loss for the CDS protection seller could be greater than the one occurred on the specific bond. In Adler and Song (2010) we find other evidence that for Brazil and Argentina, in parallel to a great stress on the credit market, a unexplained positive basis persisted for a long period, sustained by the fact that very high repo costs made impossible a large scale short-sale of bonds to profit of the arbitrage opportunity.
Fontana and Scheicher (2015) analysis on the 2007 to 2012 CDS and bonds for Eurozone countries confirmed that a persistent positive basis deviation is explained by short-selling frictions and flight-to-liquidity phenomenon. The relevance of short-selling friction is measured by the "Active Utilisation" variable. Active Utilisation is the percentage of securities in lending programs which are currently out on loan. When its value is high, we can expect to be difficult finding available bonds to short sell. To this effect, it adds the flight-to-liquidity that leads investors toward safe

heaven European bonds such as German or Dutch ones. This explain the greater positive basis that we tend to see in such countries in normal periods, and, by adding pressure on the buy-side of these bond markets, it increases also the effect due to short-selling frictions.
Finally, the authors document the impact of the ECB intervention though the Securities Markets Programme (SMP). Reducing the illiquidity premium required by investors and pushing up the bond price, the program is naturally a factor for a widening of the positive basis. In addition, since the SMP's holding does not participate in the Repo market, it drains liquidity from the potential short-sellers. From the data, there is significance both that the purchase program decreased CDS and bonds yield for the peripherical Euro countries and that the average CDS-Bond basis increased in value.

6.3 Negative basis

For negative basis, more considerations are needed to show that it does not allow a free-lunch arbitrage. Not considering the differences in duration between the CDS and the bond contract, unavoidable in absence of floating rate notes but negligible, the PL from a long bond and long protection position is equal to D*Basis – D*BidAskSpread – Bondask*(h*(libor+f)+(1-h)*Repo))-M*(libor+f), where D is the duration, h is the haircut required to Repo the bond, f is the spread payed by the investor to borrow money and M is the CDS margin.
Thus, an investor that would like to take advantage of a negative basis would be exposed to:

- A further decrease in the basis
- An increase in trading costs, represented by a widening the bid-ask spread, that would impact the mark-to-market of the position
- A worsening of its creditor position, measure by the spread f that he needs to pay for his funding, or an increase in the Libor rate
- A decrease of the collateral quality, that would imply a higher haircut and a higher Repo rate
- A bigger margin requirement on the CDS position

Even more relevant is the counterparty risk relatively to the CDS contract. The biggest danger is that the counterparty default is correlated with the underlying entity default, a risk very relevant when we consider sovereign bonds which default could trigger unpredictable events on the financial world. In case the counterparty defaults at the exact moment when the bond entity does, the investor will lose its hedge at the exact moment when he needs it.
An arbitrager who faces funding constraints will invest only in the best factor-adjusted negative basis trades. Where the risk-factors expressed above are not directly available, we can proxy them. For instance, an investor can use credit rating for haircuts and repo rate measures. Bond liquidity risk can be expressed by the co-movement between bond illiquidity and market illiquidity. If a bond become illiquid during market downturns, that will increase our trading costs and make our

negative basis trade less attractive. For the funding liquidity risk, there are multiple proxies, among them the TED Spread and the Repo-TBill spread.
Negative basis determinants are identified by Fontana and Scheicher (2015) in the so-called "funding frictions". These limits-to-arbitrage affect the weaker public finance countries and regard the difficult for arbitrageurs to finance the purchase of the bond and set up a profitable "negative basis" trade. The theoretical link is strengthened by the evidence that negative basis is associated with the increase in the haircut of sovereign bonds. The interpretation is that an increase in the haircut trigger a financial deleveraging and therefore a large bond sale, making at the same time more costly for arbitrageurs to exploit an eventual negative basis. So, funding frictions, that are usually associated with crisis periods since haircuts and credit risk are positively correlated, can be a strong explanatory variable of the negative basis persistence for riskier sovereign countries. The results from Collin-Dufresne (2012) confirm that during normal period only credit rating is significant in explaining the basis, so collateral quality is the main concern for a basis arbitrage trade in absence of stress on the market.

6.4 The effect of liquidity

In Badaoui et al. (2013), the authors use data spanning from 2005 to 2010 for 9 emerging market countries in order to assess the importance of liquidity in both bond yield and CDS spread.
In general, liquidity risk has the effect of widening the bid-ask spread, making market participants less prone to trade and the premium to go up. Badaoui et al. (2013) focus in particular on the systematic component of such liquidity risk, namely the one given by commonality across different assets, sovereign countries in our case. They calibrate a model where to pure default and liquidity risk, which intensities are uncorrelated, they add a factor matrix representing CDS liquidity, bond liquidity, systematic liquidity and flight-to-liquidity intensities. The idea is that for instance sovereign risk increase could negatively affect the instrument specific liquidity, or there could be a negative spill-over between CDS and bond liquidity (the instruments are substitute) or a positive one (a liquid CDS market allows for an efficient hedge of bond exposition).
The result shows that both CDS and Bond liquidity decrease the credit risk premium intensity, since the liquidity risk is lower and the delivery option on the defaultable leg becomes insignificant. Also, a sustained bond liquidity tends to decrease the CDS market bid-ask spread, with a favourable contagion probably due to investors that hedge their bond positions in the CDS market. Finally, there are evidence that bonds and CDS on riskier sovereign entities tend to be more liquid for lower rated (BBB/BB) entities, but that for safe heaven the effect is the opposite, since investors are scared by a deterioration of the credit worthiness. This last result could suggest some sort of segmentation of the market. Coherent with this idea, is also the finding that liquidity risk premium is less important in percentage for lower rated entities, even if it is bigger in absolute size, reflecting a "flight-to-liquidity" concern. This segmentation is much less evident for CDS than for bond market. However, it is important to consider that extraordinary monetary measures, such as QE in Europe, could have an impact on these interaction factors, making the analysis not so valid. The results confirm the assumption that that flight-to-liquidity phenomenon tends

to push up liquid sovereign bonds during stress periods, contributing to add more weight to the defaultable leg of the CDS and thus decreasing the spread.
The study brings also evidence that liquidity has a stronger influence on CDS than on bond's price, and it explain a good share of the incredible surge in CDS premium that we have seen in crisis times. Using Badaoui et al. (2013) sample, 74% of the bond yield is explained by pure credit risk, versus 55% for sovereign CDS.

6.5 Regulation

Regulation has a significant impact both on sovereign bond yield and on CDS premium level. However, it can slightly differ between the two instruments, that by default entails different capital requirements and regulatory treatment. Therefore, the evolution regulatory landscape could lead to the creation and modification of a persistence CDS-Bond basis.
This topic is tackled by the work of Klinger and Lando (2018): they show that, as a consequence of Basel III credit value adjustment regulation, capital requirements are linked to the amount of CDS demand by derivatives dealers. In fact, sovereign counterparties do not post collateral when they enter in OTC transaction, such as interest rate swaps. As long as the CDS premium is nonzero, the regulator asks for an additional capital requirement to cover the counterparty credit deterioration mark-to-market risk. The CVA measures the potential loss arising from the counterparty risk, considering that the bank will make the whole payment in case of a negative mark-to-market of the derivatives contract, but that it will recover only a fraction of the value of the position if it has a positive value to the bank. This requirement is also called "expected exposure" (EE).
However, the regulator allows banks to avoid this additional capital requirement by "covering" their exposure with the purchase of CDS on the counterparty entity. This is a strong incentive for the dealers to move from their standard role as protection sellers, to become protection buyer, and that trend is consistent with what is shown in the data (derivatives dealers are net buyer since 2010-11). Capital relief is particularly important in a context where available capital is limited, and recurring to new equity issuance is costly, and that is the exact situation on financial markets nowadays.
The regulatory context creates a buying pressure on the CDS market, leading the spread to increase in a manner unrelated to the bond yield, and the basis to become positive. That is true especially for "safe heaven" issuers, where the default risk implied in the CDS should be close to zero, and therefore the market equilibrium tends to be determined by the balance of regulatory constraints, that pushes banks on the buy-side, and capital/leverage constraints, that limits available risky capital for investors on the sell-side. We expect that in equilibrium, since the demand for protection is driven by external regulation, that the CDS premium will entail a positive risk-adjusted expected return for the protection seller.
Klinger and Lando test empirically four predictions: for low credit risk countries, regulatory proxies explain large part of the observed CDS premium; the notional outstanding of CDS is linked with the open derivatives positions of the sovereign entity; an increased EE in the bank position increases the CDS premium; and the more the bank is capital-constrained, the more is willing to pay a premium for CDS protection.

Using data regarding 28 sovereign entities CDS and banks' exposures deriving from EBA stress tests, the authors were able to confirm most of the predictions. The fair value of the derivatives outstanding is a significant explanatory variable for the total amount of CDS outstanding at a 1% level, even after controlling for the overall sovereign debt outstanding. In addition, bond yield changes are almost to CDS movements for safe heaven countries (Germany, Japan, US). The insignificance persists when proxy variables are added to account for liquidity premia and CtD option. When we analyse Germany, a careful investor should consider also the fact that CDS does not account for the positive redenomination premium which is present in the bond yield. For riskier countries, such as Italy and Spain, the relation between CDS and bond yield is much more relevant, with a coefficient not significantly different from one. However, for Italy, that had the largest amount of interest rate swaps outstanding in the sample, regulatory proxies still help explaining the variation in its CDS premium.

7

Eurozone spreads and carry trade

One of the main questions of this work, whose purpose is to be an investor guide, is: would be profitable a carry trade type of strategy in the Eurozone? If the large spread observed are more due to an exaggerate risk-aversion and regulatory constraints of many financial institutions, betting on a long-term yield convergence. In the empirical section, we will try to give more data to answer this question. Before doing it, however, it is useful to look at which similar strategies have been used by financial institution in the last year, and what implication they had on the market.
A sovereign-Eurobonds carry trade strategy, short Germany and long peripheric countries, has been carried out also by European banks during the crisis period 2010-13, based on the findings of Acharya and Steffen (2014). This carry trade focuses in particular on Spain and Italy, the largest economies of the Southern Europe. The operation is motivated not only by profitability, with banks anticipating the survival of the Eurozone, even if, in period of negative central interest rates and having access to short-term funding in the wholesale market, the positive yield offered by potential some European central government bonds was surely very attractive.
The authors used both market data and public information from the EBA stress tests between March 2010 and June 2012. Not having any high-frequency data on sovereign bond position, the banks' exposure is estimated by a style-analysis, where the sensitivities of banks' stock return to sovereign bond returns, after having controlled for common factor, measure their exposure to sovereign debt. This approach has the advantage to be flexible, but its results must be used very carefully since it entails the important assumption that in the equity market is correctly priced the effective bank holding of sovereign debt, and that the correlation we spot in the data is not given by other unexpressed common factors.
With this methodology, the paper studied three additional causes that could help explaining banks' behaviour.
Since regulation assign zero-risk weight to investments in sovereign debt, Euro banks prefer to invest in peripheric (GIIPS area) bonds in order to get a higher expected return on equity. In addition, bankers can reasonably expect that in the case of a Eurozone crash or a sovereign failure, the financial distress would be so great that the government will bail them out anyway. Thus, they sort of place a bet on their own survival (risk shifting), increasing the expected profitability of their holdings.
These hypotheses are confirmed by the finding that, in average, banks weakly capitalized and with higher regulatory arbitrage incentives increase their exposure to

risky sovereign debt more than other banks.
A second channel to explain carry trade is the home bias, already largely documented in literature. That is confirmed both in the banks holding and in the fact that, while after the debt crisis and the regulator intervention in 2010-12 to foster banks' financial stability, we see that non-eurozone and non-peripheric banks decrease their investments in peripheric bonds' much more than GIIPS banks, which instead continue to load on risky home debt using ECB's LTRO capital.
Finally, a third factors is the pressure by domestic sovereigns on their banks to act as a last-resort buyer for their bonds. This moral suasion to maintain asset exposure to domestic economy is another aspect of the home bias and explains its increase over time that is documented in the data.
That the behaviour is due not only to risk-rewards considerations but also to some sort of financial distortion is confirmed by the fact that it is not present in US banks, that are neutral on peripherical sovereign bonds, or macro hedge funds, that instead seem long German bunds.

8

Empirical analysis: the Italian and French case

The most interesting data implementation, taking into account also data availability constraints, appears to me a breakdown of Italy and France redenomination risk from credit risk, followed by a regression factor analysis on both local and global variables. To do so, I will follow the methodology illustrated in the above-mentioned paper by Kremens (2018).

The period I chose to analyse is included between the 01/10/2014 and the 10/06/2019. In fact, in 2014 started to be traded the CDS based on the new ISDA regulation, which does not entail any exemption for G7 countries currency redenomination. The data were downloaded using Reuters Datastream.

8.1 The data

CDS and Bond Yield Series
Weekly time series of 5Y Sovereign CDS, Bond Yield and relative Bid-Ask Spread were retrieved for Italy, France, Spain, Ireland and Belgium. The last three acts as control group in the redenomination risk estimation process.
Global Factors
VIX index values are used as proxy for investor risk aversion. SP500 index represents global equity sentiment. The Bank of America High-Yield Spread Index is another proxy of global risk aversion and credit market momentum.
Local Factors
The local stock index, FTSE MIB for Italy and CAC40 for France, is used as local variable factor.

8.2 Methodology to break-down credit and redenomination risk

ISDA CR 2003 CDS contracts does not consider redenomination as a credit event for G7 countries. Therefore, CR CDS protection buyers for Italy and France are not covered against an eventual exit of the country from the Eurozone and a subsequent devaluation of the new national currency. Instead, with ISDA 2014 reform,

redenomination is a credit event for every country but US, Canada, Japan and UK. A buyer of France or Italian CDS under the 2014 regulation is therefore protected in case of break-down of the Eurozone, since the protection seller will have to pay him the loss due to the new local currency depreciation.
However, since CR03 and CR14 regulation entails additional changes, such as new provision regarding alternative redemptions, and the market liquidity can significantly differ, we need a further step to isolate the pure redenomination premium. This is why, following Kremens (2018), we propose a "difference-in-difference" approach. Proxies for the CR14 CDS and CR03 CDS of Italy and France without the "G7 membership" effect are estimated. Then, the redenomination premium is calculated with the following formula, respectively for Italy and France:

$$Redenomination\ \ Premium\ = \mathrm{CR}_{14}CDS - CR_{03}CDS - (ProxyCR_{14} - ProxyCR_{03})$$

The term within the parenthesis should allow us to control for the differences in CDS due to factors others than the different treatment of G7 countries redenomination event.

I calculated the two proxies with the following steps. Spain was selected as the not-G7 countries with characteristics more compatible with the ones of Italy and France.
Therefore, the 5Y CDS CR03 spread of Spain is regressed against the relative CR14 spread, the Spanish 5Y Sovereign Yield and the Spanish Yield Bid-Ask spread (to control for market liquidity). The weight so obtained are kept constant and used to proxy the CR03 CDS spread for Italy and France without their G7 membership. Synthetic dependent variables (CDS CR14, 5Y sovereign yield and sovereign yield bid-ask spread) for Italy and France are obtained from a combination of the same series for control group countries (Spain, Ireland and Belgium) that minimizes the square errors (OLS estimator).
In the following chart we plotted the resulting redenomination premium against the time. The outcome is very satisfying. The French line spikes around April 2017, when uncertainties about the French Presidential Elections were fuelling fears of a FrExit. Thus, the premium returns negligible when it becomes clear that it will be the Europeist Emmanuel Macron to become president.
Italian redenomination risk grows for the first time during the Euro-tension of the first half of 2017. Then it calms down until, after the March 2018 political election, in May it becomes likely the formation of a Eurosceptic 5 Star Movement – Lega Nord coalition government. Then, it stabilizes hovering around the 60-80 points level, highlighting how redenomination risk is an event very feared by many investors in Italian 5Y sovereign claims.

Table 1

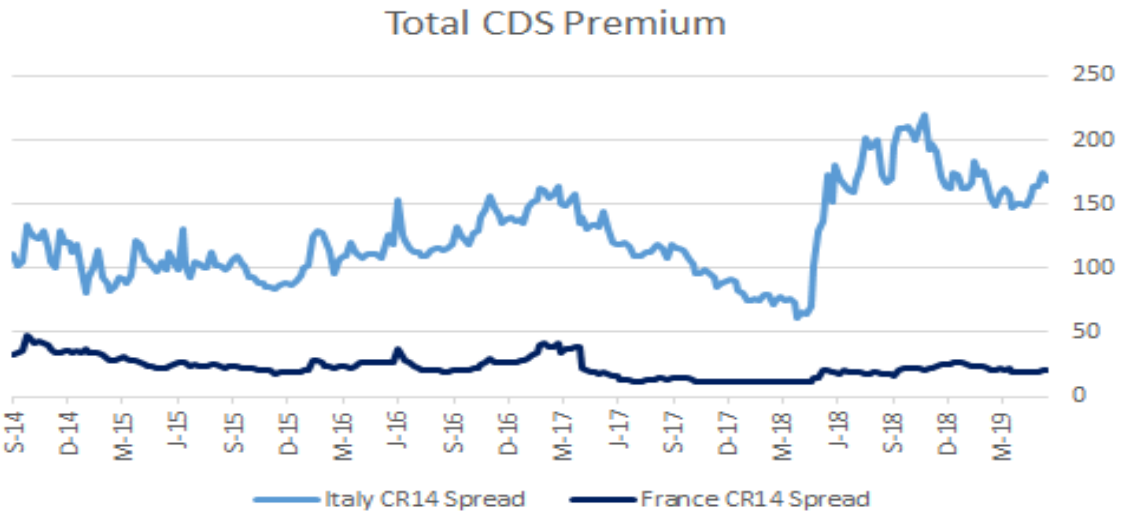


Table 2

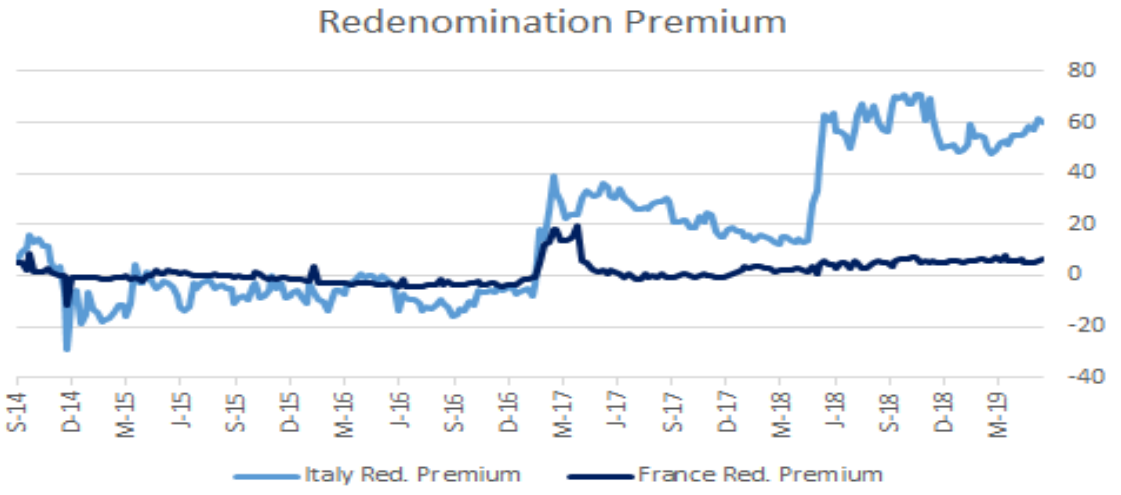
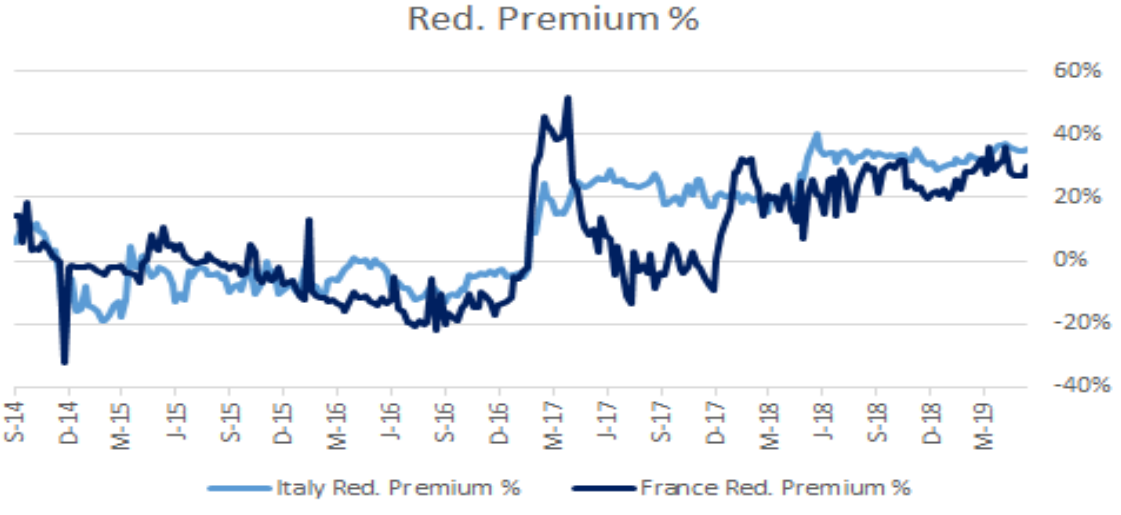


Table 3



8.3 Analysis of factors influencing credit and redenomination spreads

Once separated the currency redenomination premium from the credit premium, we can follow up by analysing some possible explaining factors. In the tables below, Italian and French total CDS spread, redenomination premium, and credit premium are regressed against different combinations of the VIX (representing the global risk-premium), the SP500 (representing global equity factor), the High-Yield Spread over Investment Grade bonds (that proxies investors risk aversion in debt investing) and the local stock market index (either FTSE MIB or CAC40, to represent the local economy factor).

The regressions shown in table 1 and 2 present the total CR14 as dependent variable versus a different combination of explanatory factors. In particular, in the first column we use all the four regressor, while in the other columns we keep just one between the global and the local equity proxy. The R squared is very high, meaning that our factors explain most of the observed variance.
The most consistent explanatory element appears to be the High-Yield versus Investment Grade credit spread, that is positively correlated with an increase in the overall credit spread for both Italy and France under all scenarios. That is consistent with the theoretical hypothesis that an increase in the risk premium for bearing potentially distressed debt will increase the price paid by the CDS protection buyers. The VIX instead has a slightly negative correlation with the CDS of both Italy and France, significant at a 5% level. That is unexpected and could mean that higher expected volatility in the equity market push investors to safer assets as governments claims, therefore lowering the sovereign CDS spread.
However, the most striking result is the one of both local and global equity indexes. In fact, not only they often present a significant positive correlation with the CDS spread, which would mean that a positive outlook in the equity market increases the cost of insuring a sovereign debt claim, but the coefficients change greatly of size and sign depending on the presence of other controlling variables. In the univariate regression, the FTSE Mib and CAC40 has a significant negative impact, while the SP500 has a positive sign for Italy and negative for France. Therefore, we can conclude that local equity has more influence on credit risk that global equity. In addition, it is likely that there are more unexpressed underlying factors, linked to global equity, that should explain CDS movements. Further inquiry is thus needed to answer the raised questions.

Table 1					
					Single regressor
Dependent Variable	**Italy 5Y CR14 Spread**				
Independent Variable 1	**VIX**	-0,10723 **	-0,13067 **	-0,06859 **	0,00976
Independent Variable 2	**S&P500**	1,45695 ***	0,71466 ***		0,84468 ***
Independent Variable 3	**HY Spread**	0,61472 ***	0,40303 ***	0,59637 ***	0,12809
Independent Variable 4	**FTSEMIB**	-1,09080 ***		0,56821 ***	-0,91666 ***
Adjusted R Squared		0,962525	0,946565	0,914574	

Table 2					
					Single regressor
Dependent Variable	**France 5Y CR14 Spread**				
Independent Variable 1	**VIX**	-0,10999 **	-0,12958 **	-0,13402 **	0,08875 *
Independent Variable 2	**S&P500**	-0,49488 ***	0,05930		-0,73048 ***
Independent Variable 3	**HY Spread**	0,63347 ***	0,75762 ***	0,70503 ***	0,43000 ***
Independent Variable 4	**CAC40**	0,65479 ***		0,11046 **	-1,19396 ***
Adjusted R Squared		0,906611	0,900959	0,902514	

In table 3 and 4 we study the pure credit risk series, calculated as the total CR14 spread minus the redenomination risk estimated above. The situation resembles closely the one already descripted. HY Spread is positively significant across all regression, while an increase VIX appears to lower slightly credit spread. Nothing clear can be concluded on the equity indexes impact, since it is significant but very unstable. Particular is that the SP500 coefficient are positive for Italy and negative and France, but this can be explained by the different weights on the local index, where the situation is the opposite (negative for Italy and positive for France). In the univariate regression, both local and global equity increase make the CDS spread lower, consistently with what we expect from theory.

Table 3					
					Single regressor
Dependent Variable	**Italy 5Y Credit Spread**				
Independent Variable 1	**VIX**	-0,18261 ***	-0,19052 ***	-0,16667 ***	0,05601
Independent Variable 2	**S&P500**	0,60100 ***	0,35057 ***		-0,20957 ***
Independent Variable 3	**HY Spread**	0,87039 ***	0,79897 ***	0,86282 ***	0,39616 ***
Independent Variable 4	**FTSEMIB**	-0,36801 ***		0,31635 ***	-1,20125 ***
Adjusted R Squared		0,962574	0,960371	0,952209	

Table 4					
					Single regressor
Dependent Variable	**France 5Y Credit Spread**				
Independent Variable 1	**VIX**	-0,20879 ***	-0,24076 ***	-0,25709 ***	0,09750 *
Independent Variable 2	**S&P500**	-0,99446 ***	-0,09028 **		-1,31649 ***
Independent Variable 3	**HY Spread**	0,93547 ***	1,13802 ***	1,07927 ***	0,64576 ***
Independent Variable 4	**CAC40**	1,06833 ***		-0,02550	-2,07924 ***
Adjusted R Squared		0,911036	0,898518	0,896893	

Finally, we regressed the explanatory factors against the redenomination risk. The results are much less significant than in the previous case: if for Italy the variance explained is still ranging from 40% to 76%, for France the R squared are all lower than 0,3. The high-yield spread is still the most consistently significant risk fac-

tor, but this time has a negative sign. An increase in the overall riskiness of the non-investment grade debt claims seems to be associated with a reduction in redenomination risk. The interpretation we can give is that in concomitance with a larger HY spread, investors focus more on direct credit risk, while the concern on redenomination risk is largely dominant in otherwise calm periods. The VIX coefficient are positive but not very significant for Italy, and significantly positive for France. An increase in overall risk aversion in the global equity market translates in a bigger concern for potential redenomination risk, that as we said impacts the most international investors. SP500 is still strangely positively correlated with a bigger CDS spread, while the local index weights signs depend on the presence of additional regressors. In the univariate regression, both local and global indexes have significant positive coefficients.

Table 5

					Single regressor
Dependent Variable	**Italy 5Y Redenomination Spread**				
Independent Variable 1	**VIX**	1,15326 *	0,87008	1,57154 *	-1,17054
Independent Variable 2	**S&P500**	15,77118 ***	6,80332 ***		21,40215 ***
Independent Variable 3	**HY Spread**	-3,66080 ***	-6,21834 ***	-3,85943 ***	-5,88790 ***
Independent Variable 4	**FTSEMIB**	-13,17825 ***		4,78022 **	5,79393 **
Adjusted R Squared		0,761750	0,626017	0,435091	

Table 6

					Single regressor
Dependent Variable	**France 5Y Redenomination Spread**				
Independent Variable 1	**VIX**	0,47421 **	0,52780 **	0,59364 ***	0,03699
Independent Variable 2	**S&P500**	2,45911 ***	0,94375 ***		2,73447 ***
Independent Variable 3	**HY Spread**	-1,15218 ***	-1,49165 ***	-1,50777 ***	-0,84573 ***
Independent Variable 4	**CAC40**	-1,79045 ***		0,91438 ***	4,04058 ***
Adjusted R Squared		0,255916	0,232085	0,203717	

9

Conclusion

In this work I tried to present an overall *compendium* of the investment in sovereign debt claims. I assumed the point of view of an investor who is interested in building a portfolio exposed to sovereign risk and wants to understand both the financial instruments available and the risk factors to which they are exposed.
Because of space and data availability, the discussion has focused more on the theoretical aspect. I tried to gather and reinterpret on a common light the literature available. In the first chapters, I gave my personal interpretation of how to breakdown sovereign risk. First, I presented the term premium, then I differentiated between credit risk tied to expected loss and credit risk related to a risk premium component. The most interesting and original part, at least for a Euro country, is the analysis of the currency redenomination premium . The possibility of using quanto USD CDS was mentioned, but the methodology most widely presented was the one based on the price differential between ISDA 2003 and ISDA 2014 CDS for G7 countries. Its presentation follows Kremens (2018) job, that is the biggest contributor of my paper analysis.
Then, I entered in the never-ending dispute regarding whether are global or local factors to drive credit risk. I carried it out by presenting both points of view, explaining their main contributions, and finally proposing some risk-factor proxies easily available to empirical test these hypotheses.
In the following chapter, the contagion and spillover effects are delved in-depth, with the idea that an informed investor should consider them carefully, especially after the 2011-12 Eurozone sovereign debt crisis. What is peculiar about this phenomenon is that it can push the market price of risk to equilibria very far from current fundamentals. This represents a threat to many trading strategies, in particular if the investor may need liquidity at the same moment of the spreading of the contagion effect.
Then, the theoretical part is concluded by presenting the main sovereign debt market features and the most widely used investment strategies. A particular focus is given to the two most important financial instruments to take a position on sovereign debt: sovereign bonds and sovereign CDS. Even if they are driven by very similar market forces, investors must keep in mind that they are different financial claims, and their value can differ: that is the so-called Bond-CDS basis. The basis size and sign covariate with different determinants and a careful analysis of them will help in choosing the right financial instrument to use at the right time.
Finally, I have done an empirical study using the data obtained on the CDS and

bond yields of Italy and France, in addition to the one on a group of European control countries, to show we can break-down credit risk from redenomination risk. Thus, I have analysed the correlation with some potential determinant risk factors. The results obtained are double sided. On one hand, the redenomination risk trend is satisfying and match well relevant political events. However, when doing the regression, some factors, in particular the equity indexes, presents sometimes significant different correlation signs with respect to what we were expecting from literature. A univariate regression has been also executed to understand potential collinearity issues. Still, some hidden risk factors are probably missing, and better data series are needed to progress in the empirical analysis.

Personally, writing this thesis has been an amazing immersion in the world of investing. In doing so, I always tried to keep in mind the point of view and concerns of an investor, avoiding the most theoretical debates to focus more on what really determines the risk-reward trade off. I hope that, despite the limits of the discussion, I managed in my objective and I stimulated some meaningful investing ideas and raised interesting points. That would be enough to give me a tremendous satisfaction.

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