Inflation &
Term premium :
Post COVID analysis
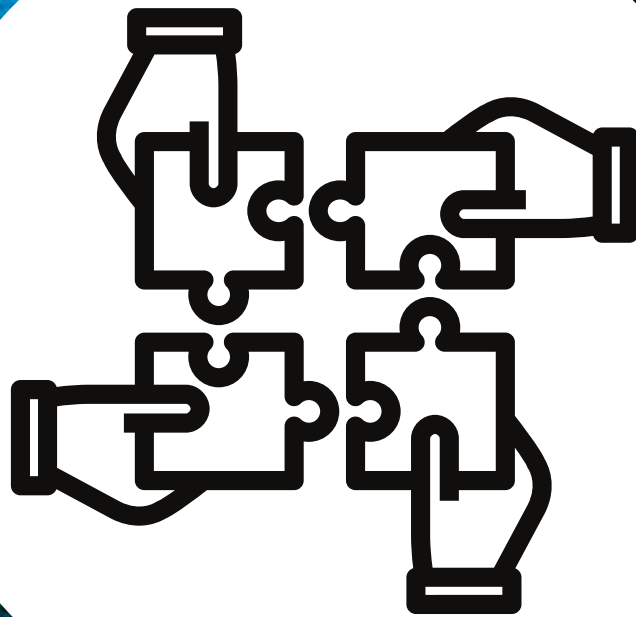
SUMMARY

INTRODUCTION

"The quest for certainty blocks the search for meaning. Uncertainty is the very condition to impel man to unfold his powers." – Erich Fromm

It is common knowledge that the financial market experienced some severe complications over the last decades. From the Global Financial Crisis (GFC) of 2008 to the Greek government-debt crisis and the recent pandemic shock, measures had to be taken to reduce the effects, like the historically noticeable low interest rates, even at the long end of the yield curve.

Understanding the source and the economic effects of the government bond yields decline was a subject brought to the limelight by many academics.

In fact, these events almost jeopardized the stability of the euro, thus making the challenge of strengthening the EU even greater. Investors grew in fear of what could be upcoming next, which made them seek more safety. As a result, long term yields drowned in low record levels. Among the measures adopted to stabilize the financial market and stimulate economic growth, The ECB set up an unconventional monetary policy through negative rates and quantitative easing. Recently, The ECB decided to also modify some key parameters of the third series of targeted longer-term refinancing operations (TLTRO III).

02. INFLATION OVERVIEW

A significant jump in 2021

The International Monetary Fund (IMF) define the inflation as the rate of increase in prices over a given period of time. Inflation is typically a broad measure, such as the overall increase in prices or the increase in the cost of living in a country.

The purpose of all monetary policies is genuinely to support the continued access of firms and households to bank credit, despite the disruptions and temporary funding shortages induced by the **coronavirus epidemic**. Moreover, the decline in hourly labor productivity in companies, the sharp rise in unit production costs due to the epidemic could lead to some serious changes in the inflation. In fact, some sectors are experiencing a decline in labor productivity, which alerts of an inflation of 3 to 4% per year if the new health standards are maintained.

It is therefore very likely that in 2021, or at least in the first half of 2021, inflation in the eurozone will rise above the ECB's target inflation of 2%, the statistics of Eurostat, the statistical office of the European Union are confirming that :

The euro area annual inflation rate was 1.3% in March 2021, up from 0.9% in February. A year earlier, the rate was 0.7%. European Union annual inflation was 1.7% in March 2021, up from 1.3% in February. A year earlier, the rate was 1.2%. The lowest annual rates were registered in Greece (-2.0%), Portugal, Malta, Ireland and Slovenia (all 0.1%).
The highest annual rates were recorded in Poland (4.4%), Hungary (3.9%), Romania and Luxembourg (both 2.5%). Compared with February, annual inflation fell in three Member States, remained stable in three and rose in twenty-one.
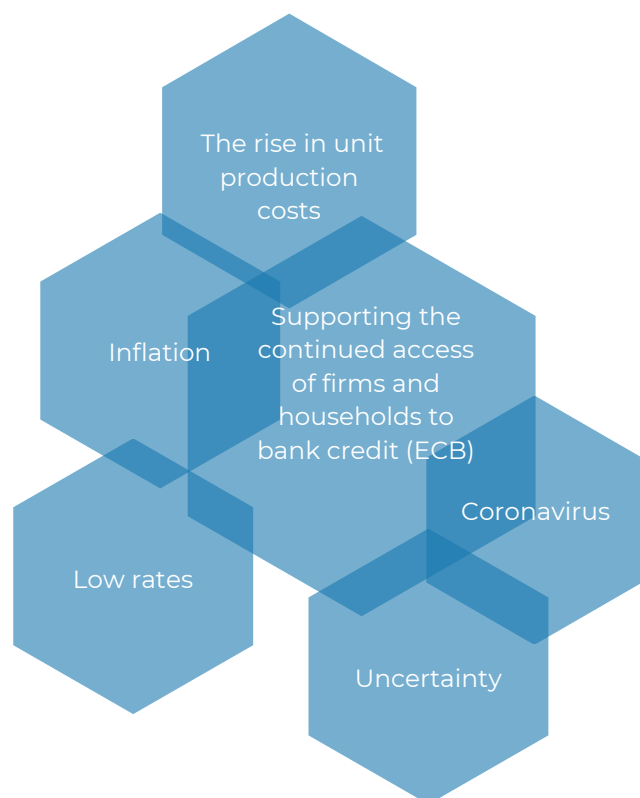
02. INFLATION OVERVIEW

A significant jump in 2021

Eurozone annual inflation jumped to **0.9%** in January 2021 after spending several months in negative territory. Therefore, investors are expecting inflation at the turning point. This would mean a rise in nominal rates (which is already the case for long rates). Investors are then facing a first scenario of low rates and a second scenario of rates that rise under the effect of a great inflation (which will push the ECB to rise short rates). This mixture could give a hefty shove to the financial system, thus making it vulnerable.

The unpredictable lurking rates scenario occurs undoubtedly as a relevant matter. Hence, this justifies the wide concern of central bankers and investors as it comes to understanding the forces triggering the movements in interest rates. That is why the yield curve happens to be crucial for the transmission of monetary policy, as it has a significant influence on asset valuations and remains the main driver of the investment and saving decisions of households and firms.

So basically, the longer you lend money to someone (or a government) for, the more time there is for things to go wrong. Some claim that the **term premium** reflects the buffer that investors need to account for two key risks. One is changes in demand for or the supply of bonds, which can affect prices. The other is inflation, which would reduce the real value of future bond payments. When investors feel more uncertain on either point, they demand a higher premium.

The rise in unit production costs

Inflation

Supporting the continued access of firms and households to bank credit (ECB)

Low rates

Coronavirus

Uncertainty

03. TERM PREMIUM BACKGROUND

The long-term yields have been divided into two components using dynamic term structure models. The mere aim of this decomposition is to help bring out an explanation to the observed decline in long-term yields. Therefore, the yields are composed of a **policy rate expectations component** and a **term premium component**. The expectations component reflects the average of current and future expected short-term policy rates over the maturity of the bond.

The yields

The policy rate expectations component

The term premium component.
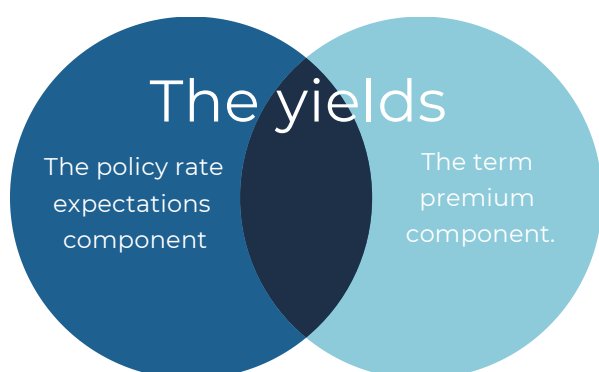
The assumption that only the pure expectations' hypothesis of the term structure would explain the movements in long-term rates was doomed to fail in practice. Moreover, a time-varying premium that investors require to hold a long-term bond instead of just rolling over a series of short-term bonds had to be taken into consideration.

So, if the monetary policy transmission relies on both the expectation component and the term premium component as they tend to influence the level and shape the yield curve, which is - as stated previously - an asset to the central bank.

How could we gauge these components, especially the term premium? Even more, what if shedding the light on the term premium is the missing piece to a brighter picture of a more controlled monetary policy?

03. TERM PREMIUM BACKGROUND

The gap between long-term interest rates and the average of expected short-term rates, often called the "term premium"

Before diving any deeper, let us explain some facts. The expectations' hypothesis is an assumption that investors value bonds as if they were risk neutral. In other words, they do not worry about the level of uncertainty in a long-term investment. This means that long-term bond interest rates are determined by current and future expected short-term interest rates, in a way that the return on the investment in a long-term bond is the same as the expected return attained from rolling a short-term interest rate over the lifetime of the same bond. This assumption merely presumes that the various maturities are perfect substitutes and implies that the expectations of future short-term interest rates is the only factor needed to construct a complete term structure, determining its shape at each point in time.
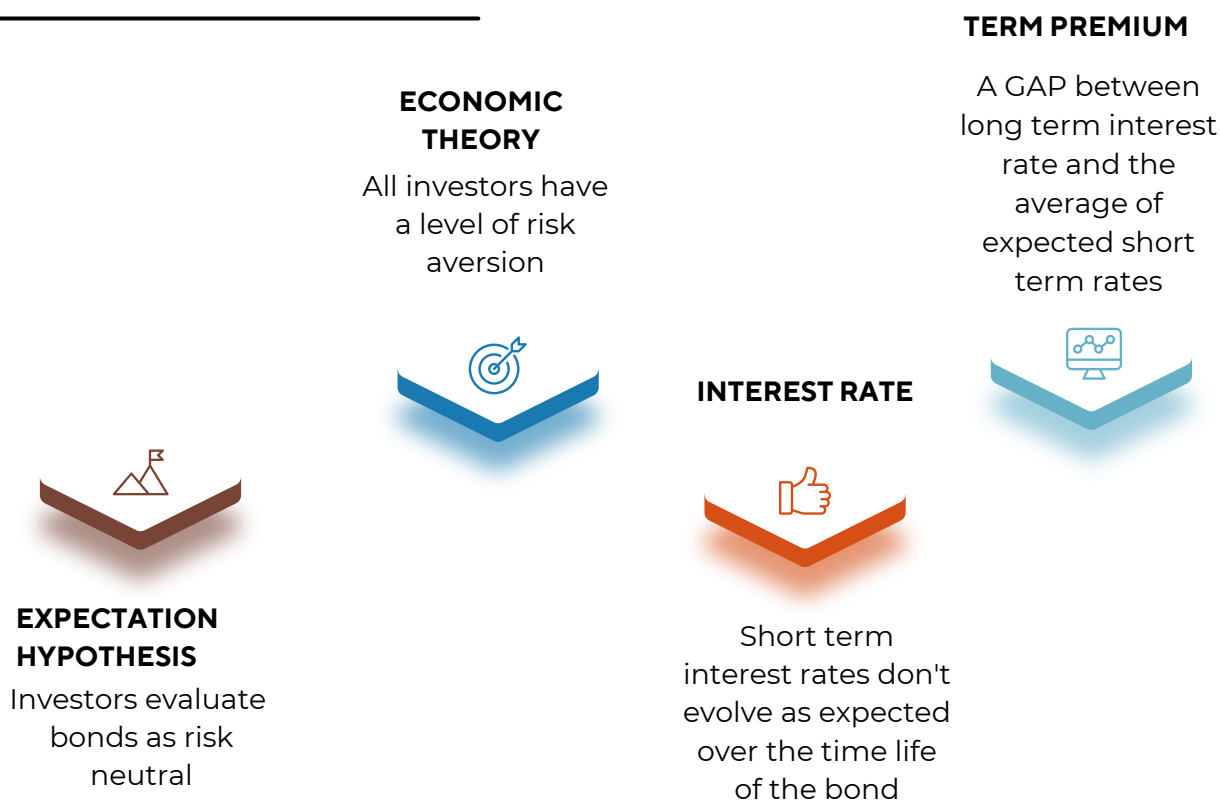
Nonetheless, economic theory expects that investors have some level of risk-aversion and are typically worried about the risk that short-term interest rates do not evolve as expected over the lifetime of the bond. This implies that there is a gap between long-term interest rates and the average of expected short-term rates. This gap is often called the "term premium".

Term premium operates as a measure of the compensation that investors demand for buying and holding a long-term zero-coupon bond until maturity rather than rolling over a short-term interest rate. Empirically, the expectations' hypothesis has failed to fully explain the behavior of interest rates. Several seminal studies, have exposed evidence of non-zero and time-varying risk premium in bond markets, consequently violating the expectations' hypothesis.

03. TERM PREMIUM BACKGROUND

The gap between long-term interest rates and the average of expected short-term rates, often called the "term premium"

ECONOMIC THEORY

All investors have a level of risk aversion

TERM PREMIUM

A GAP between long term interest rate and the average of expected short term rates

INTEREST RATE

EXPECTATION HYPOTHESIS

Investors evaluate bonds as risk neutral

Short term interest rates don't evolve as expected over the time life of the bond

Term premium operates as a measure of the compensation that investors demand for buying and holding a long-term zero-coupon bond until maturity rather than rolling over a short-term interest rate. Empirically, the expectations' hypothesis has failed to fully explain the behavior of interest rates. Several seminal studies, have exposed evidence of non-zero and time-varying risk premium in bond markets, consequently violating the expectations' hypothesis.

04. WHAT IS THE TERM PREMIUM, AND WHAT DO WE KNOW ABOUT IT ?

We must say that the term premium has been used in several different ways depending on the context, but three commonly definitions stand out:

Return premium : The expected return on holding a multi-period zero coupon bond for one period minus the one-period yield (short rate).

The forward premium : The forward rate minus the expected future spot rate.

The yield premium : The yield on a zero-coupon bond minus the average of expected short rates from the present to the maturity of the bond.

Our eventual interest being the prediction of yield curve movements, we retain the last definition.

1. The **"term spread"** Often referred to as the "slope" of the yield curve by practitioners, this is the difference between long-end and short-end yields.

2. The **"term return premium"** refers to the ex-post (based on actual results rather than forecast) return difference between holding a longer-dated bond to maturity versus rolling a series of shorter-dated bonds at regular intervals over the same period.

3. The **"term premium"** is the ex-ante (based on forecasts rather than actual results) version of the term "return premium"the excess return that market participants require for holding longer-dated bonds as opposed to rolling shorter-dated bonds.

Holding the long-dated bond exposes the investor to the risk that interest rates may increase unexpectedly during the holding period. An unexpected increase in interest rates causes a market loss on the investment position in fixed-rate securities. The term premium compensates investors for taking on such interest rate (or duration risk).

The term premium refers to such compensation and any other sources of deviation from the expectation's hypothesis.

# 04. WHAT IS THE TERM PREMIUM, AND WHAT DO WE KNOW ABOUT IT ?

This definition genuinely assumes that the term premium reflects uncertainty about the future path of short-term interest rates. Mostly, this uncertainty may arise from inflation risk and/or concerns related to future economic growth, depending on the specific type of instrument being traded.

Indeed, pure market interest rate risk or even other factors such as the lack of liquidity of some traded bonds, credit risk (in the case of Greek government bonds), and/or flight-to-quality effects could be influencing the term premium. The "flight to quality" effect in some major (credit risk-free) government securities markets at times of economic instability. For instance, news on important geopolitical events, might provoke a particularly strong demand for relatively safe assets, momentarily pushing down bond yields and thus impacting the term premium component.

To conclude this section, we can say that measuring the term premium is the key to a more precise prediction of the yield curve. However, this task has always been challenging because the term premium cannot be clearly observed as it is driven by uncertainty about unexpected shocks. So, the fateful question that pops up is "**How could we gauge the term premium?**".

The following section is a literature review combining the techniques used so far to quantify the term premium.

HOW COULD WE GAUGE THE TERM PREMIUM
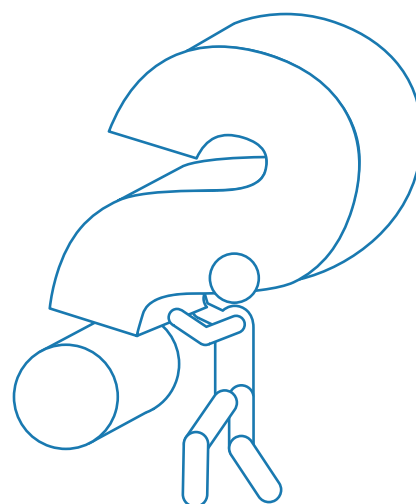
05. METHODS TO GAUGE TERM PREMIUM

Intuitively, a practitioner would attempt to calculate the term premium by decomposing the current yield curve into its component types of compensation, and to link each component back to macro or technical drivers.

Doing so requires the separation of current yield from the yield implied by the expected future path of short-term interest rates. However, finding a good proxy for short rate projections far into the future remains a difficult task. Sources such as the Survey of Professional Forecasters administered every quarter by the Federal Reserve, or implied rates derived from the Fed Funds or Eurodollar futures markets, and inflation markets simply do not go out far enough. Moreover, the infrequency of survey updates renders them useless to investment practitioners attempting to build a more thorough term-premium model. As a result, yield spreads at the longer end of the curve, such as the 5–10 year or 10 –30 year spread, are often taken as weak proxies for the term premium.
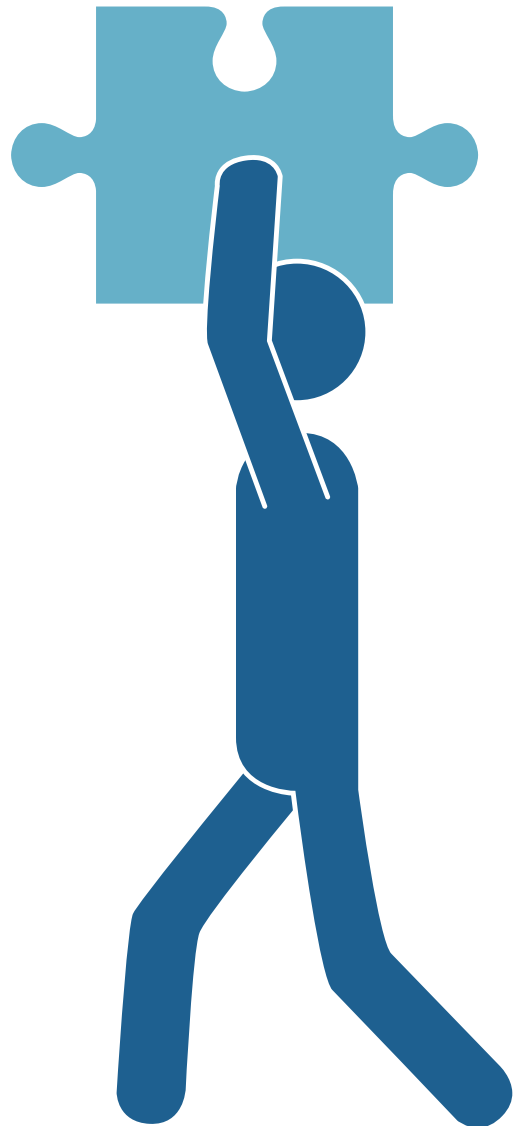
Term structure models are important tools that central banks use to describe and better understand the behavior of interest rates. Here we have a glance of the term structure estimation aka Yield curve fitting.

05. METHODS TO GAUGE TERM PREMIUM

Classes of methods are used to gauge the term premium

1   Term structure-based models

2   Regression based models

3   Estimates based on survey Data

Term structure models are important tools that central banks use to describe and better understand the behavior of interest rates. Here we have a glance of the term structure estimation aka Yield curve fitting.

05. METHODS TO GAUGE TERM PREMIUM

|	Term structure estimation or Yield curve fitting	
Type of model	**Parametric Method**	**Non Parametric Method**
	• Nelson and Siegel model (1987) • Svensson model (1994)	• McCulloch method (1971, 1975) • Vasicek & Fong method (1982) • Fisher & al. method (1995)
Advantages	• Relative easiness to estimate, as some parameters are assumed to be fixed over time. • Functional form and more smoothness on the shapes of the estimated curves.	• More robustness to specification. • Greater flexibility by fitting all kinds of term structure curves with very small fitting errors.
Flaws	• No impose of the presumably desirable theoretical restriction of absence of arbitrage across maturities. • Complications in fitting more flexible curves and curves with long maturity ranges.	• Exhibition of a greater instability in fitting the shorter and longer-term maturities of the term structure. • The choice of the location and the number of interpolation points in the maturity space before estimation.
Example of use	A macroeconomist intrested in measuring monetary policy expectations through the forward curve or in understanding the fundamental determinants of yield curve would prefer a greater degree of smoothness.	A trader looking for small pricing anomalies may be very concerned with how a specific security is priced relative to those securities immediately around it probably, he'll choose the more flexible method to estimate the term structure curve.

Term structure estimation is a point of reference in the analysis of the interest rate behavior. Obtaining continuous, interpolates term structure estimation. Deciding what estimation method to up to how much flexibility to allow in the term structure estimation and the purpose that curves are intended to serve.

05. METHODS TO GAUGE TERM PREMIUM

I.

Term structure-based models (1/2)

Dynamic term structure models, aka "no-arbitrage models", has been increasingly used to extract short rate expectations and term premiums from the observed market yield curve. The no-arbitrage concept implies, among other things, that securities with the same risk characteristics (same payoff in all states of the world) should have the same price. This condition constrains the way bond yields of various maturities can move relative to one another, simplifying the formulation of the dynamics of the entire yield curve. The Gaussian affine term structure model (GATSM) is a pillar among the no-arbitrage models.

An affine term structure model is a financial model that relates zero-coupon bond prices (the yield curve) to a model for the short rate. It is particularly useful for deriving the zero-coupon yield curve from quoted bond prices. "Affine" means that the bond yields depend linearly on the risk factors. Although the assumption of linearity may appear simplistic at first, when the risk factors are defined as unobserved (statistical) variables, such a specification can accommodate a rich selection of possible term structure models (such as the Nelson Siegel family of yield curve models). "Gaussian" refers to the distributional assumption for the risk factors, which also helps to simplify the yield dynamics considerably. For instance, Krippner (2012) calibrates an arbitrage-free Nelson Siegel term structure model to US yield curve data and subsequently provides an analytical framework to extract the term premium component.
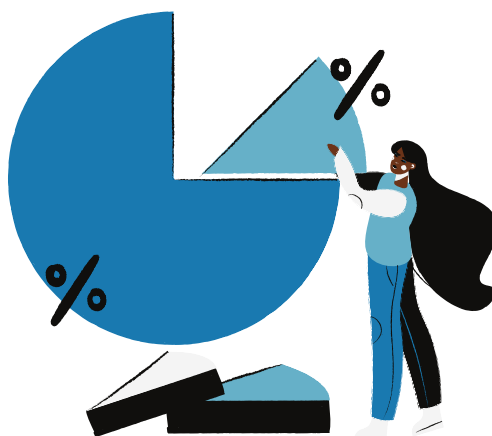
05. METHODS TO GAUGE TERM PREMIUM

I.
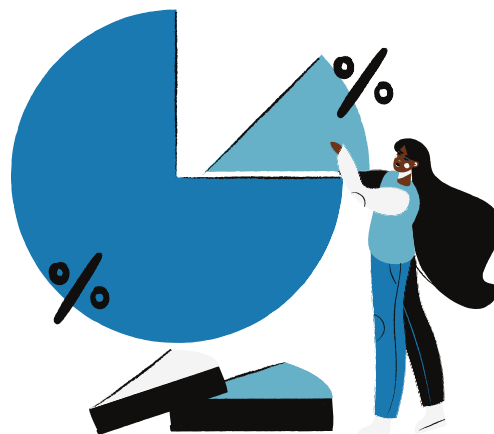
Term structure-based models (2/2)

Because term structure models tend to capture the high persistence of yields, reflecting their predisposition to be highly correlated over time, some researchers have embedded survey data and even macroeconomic factors in their term structure models. Other models incorporate macroeconomic variables into the term structure model. Normally, the choice of these macroeconomic variables reflects what investors usually consider when investing in bonds.

One example is the Hordahl and Tristani (2014) model, which incorporates data on nominal and real (index-linked) interest rates, the output gap (as a measure of economic slack) as well as survey data on both future short-term interest rates and future inflation rates. Another term structure-based model of the term premium embedding survey data is the one used by the Bank de France (BoF) based on Monfort & al (2017). The authors build a new class of affine term structure models which is able to accommodate a short-term rate that stays at the zero-lower bound (ZLB) for extended periods of time, while longer-term rates feature high volatilities.
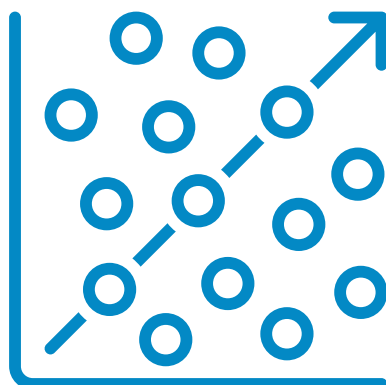
05. METHODS TO GAUGE TERM PREMIUM

II.

Regression based models

The second class of models used to produce measures of the term premium is the family of regression-based models. Under the joint assumption of the expectations hypothesis and rational expectations (expectations that are unbiased and incorporate all available information), the difference between the forward short rate and the ex-post realized short rate should not be forecastable with ex-ante variables (variables available when the expectations were formed). If, in fact, ex-ante variables help to predict this difference, it would imply the presence of a term premium or in other words a failure of the expectation's hypothesis.

In such a case, one may then use the predictable component of the rate difference resulting from the regression as a measure of the term premium. The regression of the forward rate minus the ex-post realized short-term rate on explanatory variables nests several well-known models, and the most popular within this category is the ACM term premium model of Adrian, Crump and Moench (2013).

Basically, their approach takes the risk factors to correspond to the first few principal components of the observed yield curve data, and then models the factor dynamics as a classical vector auto-regression model. ACM shows that the parameters of the term structure model are then obtained in three steps using standard OLS regressions. ACM find evidence in favor of a five-factor model, and subsequently use this as their baseline specification.

05. METHODS TO GAUGE TERM PREMIUM

III.

Estimates based on survey Data

A third alternative approach to the term structure and the regression-based estimates of the term premium is to use survey forecasts of financial market participants as a model-free proxy for "expected" future short rates. The forward premium in this case is then simply calculated as the market quoted forward short rate minus the expectation of the short rate implied by the survey.

However, there are several caveats to using this approach which include namely the risk that participants in the survey base their estimations on observable/quoted market forward rate data which already embeds a forward term premium component. Furthermore, there is also the issue of data quality or rather the lack of reliable survey data on future short policy rates for the euro area. Overall, the literature using forecast surveys to estimate term premium is scarce and more commonly survey data are usually incorporated into the model-based approaches to enhance the estimation procedures.

As a conclusion for this section, we can say that using Survey data on its own is not a great idea, yet it could be incorporated into the model-based approaches to enhance the estimation procedures.
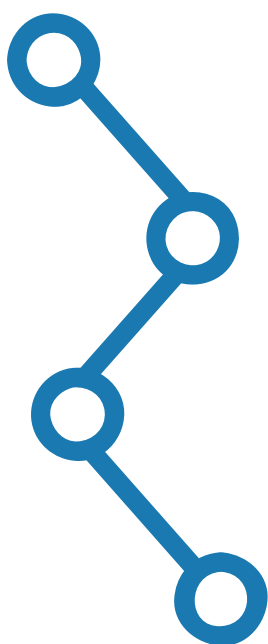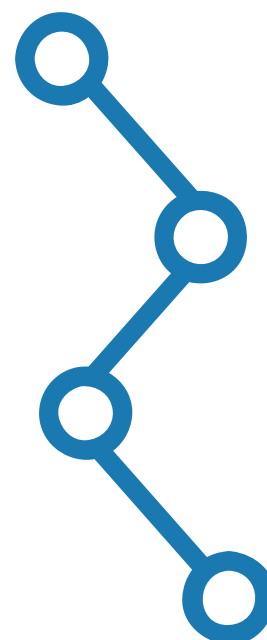
06. EUROPEAN TERM PREMIUM ESTIMATION

We tackle some questions about rising rates and its possibility to compromise the conduct of monetary policy and endanger financial stability. How is the ECB handling this matter?

We can say that the decomposition of yields cannot be inferred directly from market prices. Moreover, identifying the drivers of yield curve movements in real time is a challenging task. Even Though extensive theoretical and empirical work has been dedicated to this issue, yet there is neither a commonly accepted framework nor agreement on empirical regularities.

The European monetary authorities, as well as most central banks, are pursuing the objective of reducing the Quantitative Easing and normalize interest rates. A clear understanding of the forces underlying the movements in interest rates has thus become a timely and very relevant issue. A challenging task for policymakers is the estimation in real time of the unobservable term premium, which provides a measure of the investors' perceived risk of holding government bonds.

The idea of the EUTERPE (European Term Premium Estimation) research project is to provide timely and reliable estimates of the term premium and its components for government bonds of the Euro Area (EA). In fact, EUTERPE not only produces an academic contribution but also aspires to produce a new analytical tool with various applications in the practice of European policymakers and the financial industry. Implementing this innovative system will help to fill an important gap in the existing literature by proposing an integrated procedure which relies on a novel multi-country term structure model with interrelation between yield curves, macro variables, volatility, and global factors. EUTERPE intends to supply the European policymakers with a new analytical tool for their monetary policy decisions. Furthermore, it has potentially numerous applications in the financial industry, thus representing a way to use knowledge in Europe effectively for business and policy purposes.

06. EUROPEAN TERM PREMIUM ESTIMATION

THE EUTERPE PROJECT

Start date : 01/04/2018

End date : 30/05/2021

Aim of the project

- Develop a new analytical tool with various applications for European policymakers and the financial industry
- Help derive estimates for all unobservable variables from market data
- Separate the two components of the rates

General Purpose

- Reduce the Quantitative Easing & normalizing interest rates
- Support decisions & monetary policy transmission
- Stimulating economic growth
- Providing a unique database for policymakers, long-term investors and researchers
- Become a reference point at European level

Results Obtained

- Long-term yields split into several components, each with a specific economic content.
- Tool calculating estimates for "unobservable" factors based on market data
- Development of a system of indicators calculating the exposure of EA government bonds to diverse risks.

Other Contributions

- Contribution to the new legislation for a Pan-European Personal Pension Product.
- Contribution to the development of a model for European asset allocation in the context of the European Commission's new Pan for a capital Markets Union
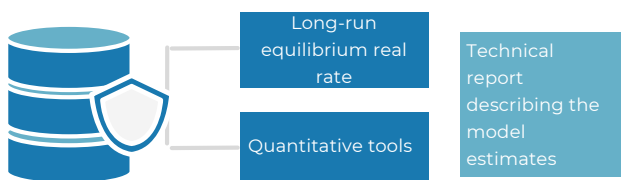
General information about the project
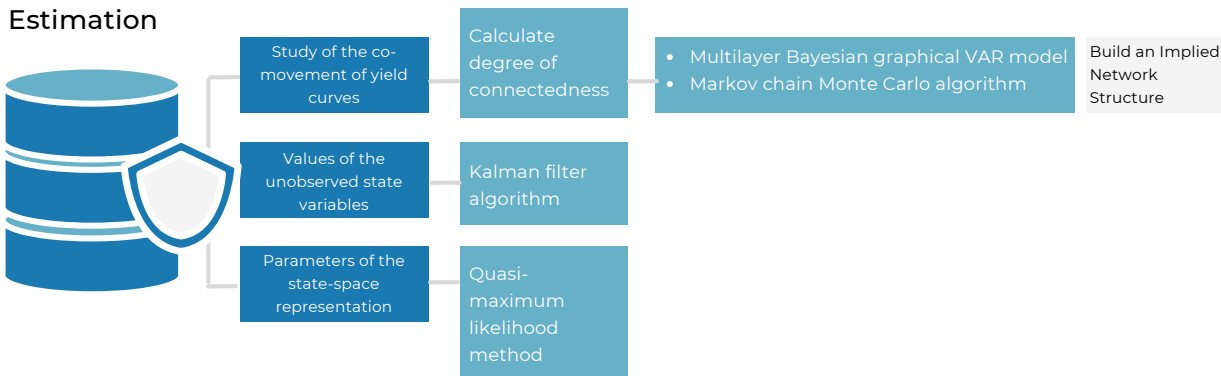
06. EUROPEAN TERM PREMIUM ESTIMATION
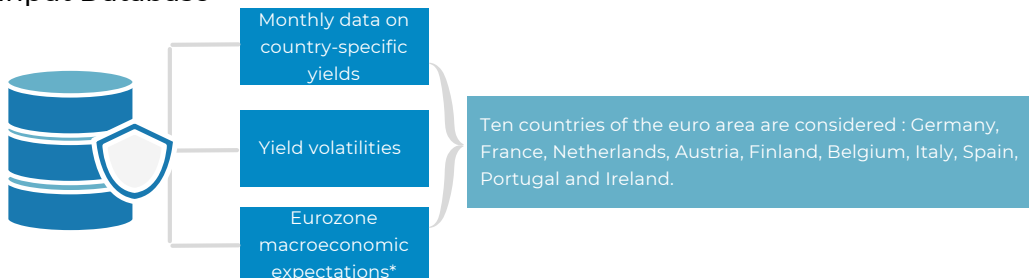
Potential Customers

Insurance companies, pension funds, investment banks and hedge funds.

The tools produced for the management of interest rate risk and inflation risk in global long-term bond portfolios could be exploited commercially*

The utilization of the results for commercial purposes will be evaluated with the supervisor

Output

Long-run equilibrium real rate

Quantitative tools

Technical report describing the model estimates

Estimation

Study of the co-movement of yield curves

Calculate degree of connectedness

- Multilayer Bayesian graphical VAR model
- Markov chain Monte Carlo algorithm

Build an Implied Network Structure

Values of the unobserved state variables

Kalman filter algorithm

Parameters of the state-space representation

Quasi-maximum likelihood method

Input Database

Monthly data on country-specific yields

Yield volatilities

Eurozone macroeconomic expectations*

Ten countries of the euro area are considered : Germany, France, Netherlands, Austria, Finland, Belgium, Italy, Spain, Portugal and Ireland.

*Starting in Jan 2000

General model of the project

06. EUROPEAN TERM PREMIUM ESTIMATION

Among the results of the Euterpe, we can notice an estimate of "the long run equilibrium real term rate". It is an expected short-term average real rate over 1 period of 5 years, beginning 5 years in advance. Also considered to be a proxy for the neutral (or "natural") interest rate, this "long run equilibrium real term rate" turns out to be interesting:

- For central bankers as, it is a reference for calibrating the position of monetary policy:

    a. If short-term real rate < equilibrium expansionary policy rate
    b. If short-term real rate > Restrictive policy equilibrium rate

- For investors as the natural rate is a reference point for forecasting future discount rates applied in the valuation of financial assets.

So far, the results expected from the empirical application of the model have been obtained. We note:

- Long-term time series for the term structure of term premium, inflation and real risk premium, real interest rates and inflation expectations for each EA country ;
- A timely update of the estimated term premium and its components for EA government bonds ;
- Measures of the sensitivity of the term premium and its components to shocks in macro, volatility, and global factors ;
- A series of indicators for the exposure of EA government bonds to macro risk, volatility risk, and global risk ;
- A timely update of the estimated term structure of real interest rates and inflation expectations ;
- A practical tool to analyze the co-movement of term premium, calculate their degree of connectedness and build the implied network structure.

According to the project coordinator of EUTERPE, the conclusions are published on the website's project. Its content is divided into three monthly updated sections that include a scientific section (technical notes, working papers and publications), a data section (downloadable estimates of the term premium and interest rate expectations for eurozone countries), and a popular science section.
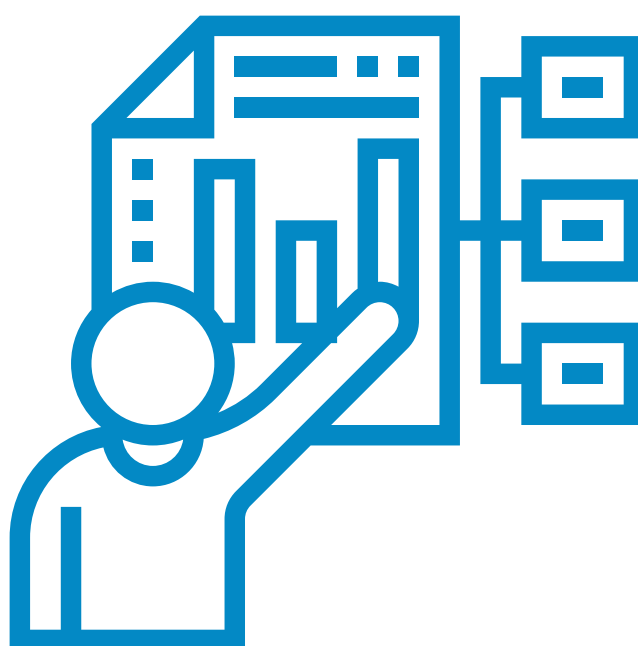
07. CONCLUSION & BIBLIOGRAPHY

The coronavirus crisis has been a big challenge for all the economic industry, in different ways, so we had and have to face it in several fields, as consequences the financial side also has known multiple downs and ups.

These challenges have developed regarding the investors and householders an uncertainty about the future of their money as long as they are acquiring bonds, this uncertainty is interpreted as an aversion of risk, which led specialists to have their own intervention into the subject by evaluation this aversion of risk in terms of gauging the term premium for bond yields what has reveled to the arrival of the European Term Premium Estimation with different models.

In conclusion, we remind that the term premium operates as a measure of the compensation that investors demand for buying and holding a long-term zero-coupon bond until maturity rather than rolling over a short-term interest rate.
To enhance the estimation of the term premium, it's preferable to incorporate Survey Data model into the model-based approach.

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We mobilize a diverse set of skills to meet the challenges of our clients with commitment and efficiency. We intervene in the fields of insurance in actuarial and risk management, project management, new technologies and regulatory monitoring.

+33 6 65 40 48 98
Contact@iconcilio.com

https://www.linkedin.com/company/
iconcilio-corporate

http://www.iconcilio.com/home

EL AIDOUNI
AMINE
ICONCILIO Founder

NADIM
AMINA
Consultante finance