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Bank funding and the recent political development in Italy: What about redenomination risk?

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\textbf{A B S T R A C T}

The political situation in Italy had and still has implications for sovereign credit and redenomination risk. The current political environment is discussed from an economic and legal perspective focusing strongly on the funding situation of Italian banks. Some empirical evidence is reported. The findings depicted here are compatible with the point of view that the political development in Rome has affected the relationship between bank funding costs in Germany and Italy. In fact, there is clear evidence for the relevance of nonlinearities. Given the time period examined, changes to redenomination risk due to fears about Italy leaving the Euro could be one crucial explanation for the findings reported here.

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1. Introduction

The European government debt crisis has shown that sovereign credit risk is also of some relevance in developed countries (see, for example, Gruppe and Lange, 2014 and Ludwig, 2014). Moreover, there have also been fears that redenomination risk could emerge (see, for example, Basse, 2014 and Sibbertsen et al., 2014). This is a special type of exchange rate risk that will be discussed in more detail later. The European sovereign debt crisis seems to have ended tendencies towards interest rate convergence in the common currency union – at least for a while. Obviously, the introduction of the Euro has eliminated exchange rate risk within the currency union. This simple fact, of course, was also of high relevance for bond investors and should have been a cause for increasing financial integration among those countries that introduced the Euro and for interest rate convergence in the member states of the monetary union (see, amongst others, Holder et al., 2001 and Baharumshah et al., 2005). Then the European government debt crisis triggered fears about sovereign credit risk in some fiscally less solvent member states of the monetary union (and also about a possible breakdown of the currency union). Therefore, there are at least two relevant regimes – which could be called pre-crisis and post-crisis phase.

Gruppe et al. (2017) surveyed the relevant literature with regard to this topic. Then the European Central Bank tried to assure investors that it would do whatever it takes to rescue the Euro. In fact, Afonso et al. (2018) have argued convincingly that the monetary policy of 2012 helped to eliminate fears about financial stability (see also Bayer et al., 2018). Consequently, they argue that there are three different regimes.

Moreover, Arghyrou and Kontonikas (2012) even have suggested that there was an early and a late crisis phase. Thus, there could even be four regimes. The current political situation in Italy might be the cause of an additional regime shift. In this new potential crisis of the European Monetary Union redenomination risk could play a crucial role. This is the focus of our study.

Moreover, there is also quite a lot of empirical evidence indicating that the financial stability of major European economies - which, in this context means governments - is closely related to the stability of the banking systems of these countries (see, for example, Ejsing and Lemke, 2011 and Ludwig and Sobański, 2014). On the
one hand, banks that are in trouble could profit from government rescue programs. Therefore, the financial sector can cause fiscal problems for sovereigns. On the other hand, banks do hold government bonds – and tend to have a home bias. Consequently, fears about sovereign debt defaults are also harmful to these financial institutions. Therefore, we will also focus on how the political situation in Rome affects the Italian banking system. Given that there already is empirical evidence examining Italian government bond yields (see, for example, Basse et al., 2012 and Gómez-Puig and Sosvilla-Rivero, 2014) this approach could be quite interesting.

The organization of this paper is as follows; in the next section, the political and economic situation in Italy during our observation period is briefly analyzed. This discussion focuses on economic implications and also explains possible consequences for bond markets. Section 3 then examines the relevance of redenomination risk from a legal and economic perspective. Afterwards, section 4 discusses potential implications for the Italian banking system. The next section presents some empirical evidence focusing on bank refinancing costs in Germany and Italy, employing approaches from time series econometrics. Section 6 concludes.

2. Political and economic situation in Italy

Italy is a parliamentary republic formally headed by the president. A prime minister and a cabinet of his choice lead the executive branch. All of them are appointed by the president. The legislative power is divided into two houses – the chamber of deputies and the senate of the republic. They have to approve the cabinet (see Koeppl, 2007). Italy is the 4th largest economy in the European Union (see Eurostat, 2020a) and its government debt-to-GDP ratio is in the EU only surpassed by Greece (see Eurostat, 2020b).

This high ratio partly originated from political and institutional changes and instability, especially in the 1980ies (see Cozzolino, 2020). The European integration enjoyed widespread support in Italy for a long time since it was seen as an external constraint enforcing governmental stability, economic modernization, and control over government finances. The EU also served as a reason for reforms (see Cozzolino, 2020). This was especially true before the Euro crisis during which Italy was one of the countries most affected, resulting in an increase of the debt-to-GDP ratio as depicted in Fig. 1.

As depicted in Fig. 2 since 2008 GDP growth rates (blue bars) were low, and especially during the Euro crisis negative, augmenting the debt-to-GDP ratio. Even though the government (except for 2009) provided primary surpluses (red bars) the total resulted in ongoing deficits (orange bars), which were reduced over time but still led to increasing total Government debt (blue line). The economic situation fueled social inequalities and pressure within the country (see Cozzolino, 2020).

The decline in the spread and interest rate around 2011 and 2012 shown in Figs. 3 and 4 falls parallel to the “Whatever it takes”-comment by Mario Draghi, the asset purchase programs by the ECB as well as the resignation of a Silvio Berlusconi government being directly succeeded by a cabinet considered as “technical” led by Mario Monti (see Balduzzi et al., 2020, and Cozzolino, 2020). In 2018, it became evident that the backing for the European idea faded in Italy and capital markets again focused on its sovereign credit risk. This was primarily due to political changes and the parliamentary elections on March 4, 2018. In May, the populist and rather eurosceptic Lega (League) and Movimento Cinque Stelle (M5S – Five Star Movement) formed a government (see Balduzzi et al., 2020 and Cozzolino, 2020).

The perceived political uncertainty can be seen, for example, in the spread - and thus the risk premium - of Italian vs German government bonds of the same maturity. While the spreads between German and Spanish respectively French government debt remained rather stable, the spread to Italian government debt increased (as shown in Fig. 2), and the ratings went down (see World Government Bonds, 2019). The spread rose from around 150 basis points at the beginning of 2018 to over 250 basis points in May 2018, with corresponding effects on the correlation between the two government bond markets (see ECB, 2020a, b; Blanchard et al., 2018 and SVR, 2018). Nonetheless, the peaks remained well below the crisis level at the beginning of that decade.

The yield on Italian government bonds with a remaining maturity of 10 years behaved similarly. At its peak, they yielded just above 7.00 % at the end of 2011. As can be seen in Fig. 4, after a steady decline and a longer stable period including large parts
of 2017, the interest rate and the risk assessment rose parallel to the political uncertainty in the first half of 2018 and went up to just under 3.70 % in October 2018 (see ECB, 2020b). Yield increases could also be observed for other maturities, even though most pronounced for 4 to 10-year maturities (see Blanchard et al., 2018). All this happened during an ongoing expansive policy by the European Central Bank, which softened the effects (see Balduzzi et al., 2020).

The recognizable skepticism in the financial market was caused by a budget proposal which would have led to a 2.4 % deficit. This would have violated European fiscal rules and initiated a controversy between the EU and the Italian government (see Andersen et al., 2019 and Balduzzi et al., 2020).

In the middle of 2019, another proposal sparked a discussion. The Italian government planned to introduce so-called mini-bots (bot stands for “Buono ordinario del Tesoro”), which are basically government-issued debt titles with no maturity and no interest rate in small denominations (for example between 5–500 EUR) emitted by the ministry of finance. Mini-bots can be used to pay within Italy and should also be accepted for tax payments. Therefore, mini-bots can be seen as a parallel currency to the Euro, which is also reflected in their design resembling classic banknotes (see Menendez et al., 2019; Meyer, 2019 and Meyer, 2020). Consequently, the then president of the European Central Bank (ECB), Mario Draghi, asserted that mini-bots are either a currency, which can only be emitted by the ECB and not by a country in the Eurozone, or new debt, which would increase the existing amount outstanding and therefore violate the European fiscal rules (see Menendez et al., 2019). Fears are that their introduction would facilitate a fast abolishment of the Euro. Proponents of the idea of a parallel currency state that this could improve economic activity within the country (see Andresen, 2019). Because of their characteristics, these mini-bots have a theoretical value of zero but receive value through their presumed scarcity and their acceptance as means of payment, for example for taxes. A parallel currency with an exchange rate to the Euro would be generated. The construct could lead to Italy leaving the Eurozone, which will require some preliminary measures by the other Euro-countries (see Andresen, 2019, Meyer, 2019 and Meyer, 2020).

In August 2019 the government by the Five Star Movement and the League under the independent Prime Minister Giuseppe Conte was ended by the League trying to initiate new elections (see Balduzzi et al., 2020 and Cozzolino, 2020). While the positions of the consecutive government are not yet apparent, spreads are declining (see Andersen et al., 2020). In the first month of 2020 Europe and especially northern Italy were severely affected by Sars-CoV-2 / Covid 19 with over 230,000 confirmed cases and over 30,000 deaths in Italy alone (see Johns Hopkins University and Medicine, 2020). The resulting economic effects will be severe, but their magnitude remains unclear at this point in time.

While the discussion on high public debt usually focuses on its impact on the government’s ability to invest, this article aims at scrutinizing the side effects of a sovereign's debt burden on the banks’ funding capacity. In a first step, we analyze the legal aspects of leaving the European Monetary Union.

3. Some legal thoughts about redenomination risk in the Eurozone

Redenomination risk has to be classified as a special type of exchange rate risk. It is caused by the danger of a member state of a monetary union deciding to leave this currency union. In this case, the country will introduce a new and most probably devaluing currency (see Bayer et al., 2018; Klose and Weigert, 2014 and Basse, 2014). Rose (2007) proved that leaving a common currency area does not necessarily lead to financial turmoil. Whether an economy suffers from currency devaluation after leaving a currency area rather depends on the reason for the exit (see Eichengreen, 2010). Nevertheless, it should be taken into account that economies that have left a currency area in the past, did not play a significant role in terms of size. Hence, conclusions that are drawn for the Eurozone from previous currency exit experiences should be treated with caution as the Euro is a big player in global financial markets (see De Santis, 2015).

Due to the principle of currency sovereignty (Lex Monetae) a country that introduces a new currency is likely to convert government bonds issued under national law to the new unit of account. This would be a problem for most foreign investors because the new currency will probably devalue against most other currencies. In fact, there are hopes that this exchange rate movement could help to solve some macroeconomic issues (competitiveness) in the country leaving the monetary union.

While the member states of the EMU experienced a convergence of sovereign bond yields since the introduction of the Eurozone until the financial crisis, the opposite was the case from then on. Di Cesare et al. (2012) proved that the until then biggest economic crisis of the new millennium revealed latent macroeconomic problems in the periphery of the euro zone (such as high debt-to-GDP ratio, increasing government budget deficit and low GDP growth),
which were reflected in rising spreads. On the other hand, the deterioration of the macroeconomic figures was not sufficient to fully explain the sharp rise in spreads in the peripheral economies (see De Grauwe and Ji, 2012). One of the reasons why the worsening of the figures named above heavily weigh on some member states is due to an essential asymmetry in the Eurozone’s structure: having a common monetary policy, while the fiscal policies remain conducted by the member states (see Scott, 1998). Second, peripheral economies were forced to fix their currencies to the Euro at an exchange rate that turned out to be a burden (see Bootle, 2012).

As the risk premia cannot be attributed entirely to quantifiable macroeconomic factors, the gap could correspond to the systemic risk that market investors fear a breakup of the EMU. This is true even though there is a lack of a legal basis for this particular case (see Siekmann, 2015). Although article 50 of the Lisbon Treaty explicitly provides a legal framework for the process of leaving the European Union (see Lazowski, 2012), it is open to question how a Eurozone exit could be carried out – neither voluntarily, nor by force (see Athanassiou, 2009).

In this context, one should bear in mind that the member states of the Eurozone have lost a popular monetary policy instrument to combat recession: currency devaluation. Also, the respective central bank cannot resort to the mechanism used in the USA in the middle of the last century, namely devaluing public debt through inflation. To restore competitiveness, which has been lost in many countries of the periphery, the protracted adjustment process of wage restraint and painful fiscal cures is needed instead (see Hofmann, 2012). Nevertheless, instruments to establish payment methods independent from the Euro with the idea to strengthen economic development have been brought into the discussion (see the paragraph on mini-bonds in chapter 2).

Aiming at providing financial support in case of a high debt burden, the European Financial Stabilisation Mechanism (EFSM), the European Financial Stability Facility (EFSF) and later the European Stability Mechanism (ESM) were introduced. To prevent moral hazard, severe austerity conditions were imposed on countries that applied for financial aid (see Ryvkin, 2013). In order to avoid these harsh procedures, politicians could be tempted to pursue an exit of the monetary union and then introduce a national currency. In case of a suffering economy, it would be directly subject to a sharp devaluation (see Di Cesare et al., 2012). The intended short-term side effect would be a sudden increase in competitiveness. The fact that the possibility of a sharp rise in interest spreads was even on the horizon, plunged the entire monetary union into a crisis of confidence, which manifested itself in investors fleeing into safe haven assets. ECB President Mario Draghi stated the risk of a member state leaving the Eurozone as re-denomination risk. If its institutional framework including an unlimited membership of the participating countries were credible, the re-denomination risk would be zero (see Klose and Weigert, 2014). Despite the prevalent discussion for the need for a legal basis for leaving the Eurozone, there is still a lack of a Euro exit clause while Art. 50, TEU provides a legal basis for leaving the European Union (see Fuest, 2018).

4. Political uncertainty, economic problems, a possible exit from the Euro: Implications for Italian banks

Aiming at scrutinizing the impact of deteriorating sovereign risk on financial institutions, the first option to look at is Italy. This is due to the fact that the worsening of the creditworthiness commenced in the public sector which negatively impacted the ratings in the banking sector and not vice versa like in Ireland or Spain (see Panetta et al., 2011). Moreover, Italy has a long history of high debt levels. The debt-to-GDP ratio between 1993 and 2011 on average amounted to 107 % corresponding to the debt level that already prevailed from 1876 to the end of the 19th century. After the end of the post-second-world-war-boom, Italy’s debt-to-GDP level rose from 34 % in the mid-1970s to 119 % in the mid-1990s when the then-government commenced conducting a contractionary fiscal policy accompanied by privatization of state-owned companies. Supported by decreasing interest rates, the Treasury managed to push down the debt-to-GDP level to 86 % in 2007 when debt levels began to rise again (see Bartoletto et al., 2015).

Italy’s sovereign bonds are principally held by domestic financial intermediaries of which the most significant share falls upon domestic banks. Including loans, the Italian banks’ exposure to domestic government debt amounts to about EUR 690 billion, making Italian banks the biggest creditor of the government in Rome (see Gros, 2019). Having these numbers in mind is important, as the risk of a default decreases with a rising share of domestic debt holders (see Bruttì and Sauré, 2013; Broner et al., 2014 and Brunnermeier et al., 2016).

In the past, like in the mid-1940s, Italy reduced its high debt burden through inflation provoking a currency depreciation (see Bartoletto et al., 2015). Since being a member of the EMU, this instrument has disappeared (see Lanotte et al., 2016). Even if the ECB tried to increase competitiveness through value depreciation by following a loose monetary policy, most member states would not benefit as they mostly trade within the Eurozone (see Hofmann, 2012). Hopes that the lack of this instrument of monetary policy would discipline the Italian government’s fiscal policy were dashed. On the contrary, Italian politicians were tempted to conduct a loose fiscal policy by converging sovereign yields compared to the time of issuing Lira bonds (see, for example, Zoli, 2013). The expansive fiscal policy only began to negatively impact investors’ demand for risk premia since the beginning of the financial crisis when distrust started to spread in the financial markets (see Klose and Weigert, 2014 and Fig. 1). In times of crises, members of a currency union that are highly indebted can be exposed to re-denomination risks. When investors fear that countries are supposed to leave the currency union, in order to regain control of their monetary policy which might help decrease the debt burden by increasing the inflation rates, re-denomination risks rise. Anticipating these risks makes investors demand higher risk premia which could provoke a vicious circle (see Krivoluzky et al., 2019). This is what happened to Italian and Spanish bonds that were exposed to higher sovereign credit spreads due to increasing re-denomination fears (see De Santis, 2019).

As a consequence of the emerging sovereign debt crisis, more attention was once again paid to the state-bank nexus that had been slumbering for years. Among others, Barth et al. (2012) could prove that the worsening of sovereign creditworthiness also harmed its financial institutions. If the depreciation of the banks’ portfolios required government aid, the fiscal situation would continue to worsen and turn into a chain reaction (see, for example, Brunnermeier et al., 2016). The negative impact of a struggling fiscal situation on financial institutions is transmitted through several channels. As a fundamental insight in this context, it should be acknowledged that banks tend to hold substantial shares of sovereign bonds as they comply with liquidity requirements and regulatory rationales like the zero risk weighting for sovereign bonds (see Bolton and Jeanne, 2011). As there is a widespread home bias of banks buying mainly bonds of the home sovereign, a downgrade of one notch of the corresponding sovereign bonds weakens the bank’s balance sheet that is holding sovereign debt. In case that the bonds are accounted at market value, the impact is quite immediate. The same applies to loans granted to the domestic country that financial markets consider to get closer to default.

In this regard, claims against a country are not any different from the ones against private debtors apart from the fact that banks tend to have significant exposures to the domestic sovereign.
Angelini et al. (2014b) emphasize that the EU regulation based on directive 2006/48 does not foster a home bias rather than a preferable treatment of sovereign debt issued regardless by which EU member state. Ongena et al. (2019) could show that banks from the PIIGS countries (Portugal, Italy, Ireland, Greece, and Spain) were all suffering from increased sovereign debt yields during the sovereign debt crisis which led to the acronym PIIGS) tripled their holdings of domestic sovereign assets, while foreign banks started to lower their exposures to the respective sovereign bonds with the outbreak of the sovereign debt crisis in 2010. Acharya and Steffen (2015) claimed to explain this behaviour by moral hazard: Banks in a financially distressed situation increase their exposure to high-yielding sovereign debt that does not burden the banks’ risk weighting.

Another transmission channel is the deterioration of sovereign bonds as collateral. This is the case for repo-transactions as well as interbank loans and liquidity facilities offered by central banks that require highly liquid assets as collateral (see Bolton and Jeanne, 2011). As the sovereign security is decreasing in its value, the bank that aims to use this security as collateral for repo-transactions is limited in its capacity to demand funding due to the worsening of the underlying sovereign asset (see Cooper and Nikolov, 2018). Even here, the regulation does indicate preferable treatment for sovereign bonds but not necessarily for domestic sovereign bonds (see, Angelini et al., 2014b). Another transmission channel for the negative feedback loop of aggravating sovereign credibility is driven by the fact that it is supposed to correspond to lower output expectations through depressing investment which in turn pulls down output. This leads to lower tax income for the Treasury which implies a weakened debt-paying capacity with a negative impact on banks as credit providers for governments (see Bolton and Jeanne, 2011).

It may also happen that the sovereign asset is not regarded as being liquid at all times, which increases the liquidity risk. Moreover, in case of decreasing creditworthiness of a sovereign, its implicit guarantee for the national banks is weakened as well, which leads to rising funding costs. To prevent a shortfall of liquidity supply public debt issuers suffering financial problems are forced to apply the same instruments as their private counterparts – they have to elevate the yields in order to compensate the investors for the increased default risk. The increased wholesale refinancing costs depress the profit and loss account, which weighs on the bank’s capital figures. As rating agencies anticipate these transmission channels a worsening of one or more notches in a sovereign’s rating has a trickle-down-effect on the credit assessment of domestic banks (see, among others, Gertler and Kiyotaki, 2010). This also happens because the sovereign’s rating corresponds to an implicit ceiling for the rating of financial institutions registered in the same jurisdiction. The sovereign’s rating can also have a negative back-loop on being used as collateral. The worst-case would be losing investment-grade status because the investment regulations of institutional investors tend not to accept such underlying (see, Angelini et al., 2014b).

No matter which transmission channel triggered the sovereign’s rating downgrade, it deteriorates the banks’ funding which trickles down to companies and other borrowers of the same jurisdiction, which could finally lead to a negative feedback loop of worsening the sovereign’s as well as the banks’ solvency. The impact of the sovereign debt crisis on financial institutions could be perceived in the market for commercial papers which is a common instrument for short term bank funding. In the second half of 2010, the outstanding amounts of commercial papers issued by Italian banks have decreased sharply. As a consequence of their weakening creditworthiness, other PIIGS’ countries also had difficulties to place their debt securities during the public debt crisis. In contrast to what would be an intuitive reaction, banks and other financial intermediaries were supposed to foster their portfolio diversification to compensate the home bias and outweigh the deteriorating rating of its sovereign. Corresponding to the renationalization hypothesis, the financial institutions instead expanded their purchases in domestic sovereign papers, aiming to hedge the renomination risk (see Panetta et al., 2011). Bruttì and Sauré (2013) could show that the repatriation effect was only true for the PIIGS countries. Between 2006 and 2011, the share of sovereign debt held by domestic creditors of these economies increased from 80 % to 87 % in contrast to the core countries where this share remained unchanged. In economies with a worsening fiscal situation, the golden rule for banks of matching assets and liabilities in terms of maturities or currencies was transferred into a matching at the national level (see Battistini et al., 2014).

The carry trade hypothesis expressed a different motivation for the described flight to domestic sovereign debt. In the search for profitable investments with low risk adjustments, the increased risk spreads for sovereign bonds of the PIIGS states became a very attractive asset for banks. The investment became even more reasonable, taking into account the increasing volume of write-offs for corporate loans. Although the theory is called gambling for resurrection, figures do not prove that struggling financial institutions were deeper involved in these trades than more solid banks (see Acharya and Steffen, 2015).

A different hypothesis claimed that banks were forced to buy domestic sovereign debt through moral suasion as public issuers were faced with undersubscribed bonds in times of financial problems. If due to a lack of market demand, a sovereign bond auction was undersubscribed, it would harm the government’s credibility which would lead to higher sovereign spreads and thereby backfire on the banks’ funding costs (see Ongena et al., 2019).

Whether an increase in buying sovereign debt even led to a crowding out of corporate lending is still open to discussion. There is no doubt regarding the curtailment of corporate lending in Italy after the outbreak of the sovereign debt crisis due to increased risk spreads for new credits (see Albertazzi et al., 2014).

There is no clear evidence that the experienced credit crunch was mainly driven by banks’ priority for sovereign assets or their deteriorating financial situation that limited the ability to expand their credit portfolio. Figures indicate that the increased funding costs forced the banks to implement tighter lending conditions that especially smaller firms could not accomplish. Apart from that, the decline in credit lending was also driven by decreasing demand due to an unfavorable economic outlook. The strong interdependence between sovereign credit risk and the credit risk of Italian banks can be perceived by looking at the correlation of changes in Italian banks’ CDS spreads and changes in Italian sovereign spreads. The close ties between Italian sovereign credit risk and banks’ credit risk are also reflected in lending rates (see Zoli, 2013).

5. Bank funding costs in Germany and Italy: Some empirical evidence

At this point, it is of some importance to examine data in some detail. We analyze the funding costs of banks in Italy and Germany. To do so, we examine senior unsecured bond yields issued by banks in the two countries. We only consider fixed income securities that are denominated in Euro. All the time series are generic bond yields derived from a sample of different banks. The yields are calculated from bond prices at market close. The time series are taken from Bloomberg. It would, of course, also be possible to analyze credit default swap data for German and Italian banks. However, given the research question examined here (and the existence of the interesting Bloomberg data set analyzed here), we decided not to follow this approach. However, it would certainly be interesting to do so in

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future research. We use weekly data examining bond yields of fixed income securities with maturities of 2 and 5 years. Data availability is a problem (especially in Italy). Therefore, we start in early April 2012. This should be no major problem given the research question examined here (namely how the current political situation in Rome affects the funding costs of banks in Italy). It has to be noted that all Italian banks examined here are rated BBB+, BBB or BBB-. In Germany, the sample of banks used to calculate generic yield time series also includes financial institutes with a better rating. On the other hand, the status of senior unsecured bank bonds in Italy is more favorable for investors than, for example German ones in the case of a resolution of the financial institution that has issued the securities (see, for example, Bschor, 2015 and Stanghellini, 2016). In this context, it is of some importance to stress that the empirical evidence that has been reported by Crespi et al. (2018) clearly indicates that investors’ bail-in rules do matter for buyers of bank debt.

The four time series examined here all seem to be nonstationary and integrated of order one (no details are given in order to conserve space). Given the existence of a common currency, bank bonds in Italy should ceteris paribus be close substitutes to German bank bonds for investors that are searching for exposure in fixed income securities issued by financial companies and denominated in Euro. Therefore, the time series could be cointegrated. However, redenomination risk could be a problem for investors. In fact, local law bank bonds could be redenominated in the new (and most probably depreciating) Italian currency when Rome really would decide to leave the Euro. Moreover, given that governments can fund bank rescue programs, the fiscal stability of the two countries Germany and Italy, should also be of some relevance. Zaghini (2014) reported empirical evidence that the expectation of implicit sovereign support does matter for market prices of bank bonds. Consequently, both redenomination and sovereign credit risk could affect the equilibrium relationship among senior unsecured bonds issued by German and Italian banks. Therefore, we first test for cointegration among bond yields in Germany and Italy. More specifically, the Johansen procedure (see Johansen, 1988 and Johansen, 1991) is employed. This approach searches for cointegration using maximum likelihood techniques. Then, the Bierens and Martins (2010) test is applied to search for nonlinearities in the relationship between the interest rate time series. This approach examines the stability of the cointegration vectors. There may also be very abrupt structural changes. In this case, it could be a good idea to use empirical techniques that test for breakpoints in vector error correction models (see, for example, Hansen and Johansen, 1999) instead of the approach suggested by Bierens and Martin (2010). However, the graphical examination of the time series (see Figs. 5 and 6) seems to suggest that the technique proposed by Bierens and Martin (2010) is the more appropriate way to analyze the relationship between the funding costs of banks in the two countries. In fact, finding time-varying cointegration between German and Italian bank bond yields in the time period examined here could be interpreted as a sign for changes to risk premia that affect the equilibrium relationship among German and Italian senior unsecured bonds. Given the development in Rome, empirical evidence that indicates the relevance of time-variation in the cointegration relationship between the time series examined here, might be a consequence of fixed income markets repricing redenomination and sovereign credit risk in Italy.

There should be no difficulties with degrees of freedom because we examine weekly data. However, some challenges remain. Most importantly, assumptions with regard to the existence of
Table 1
Cointegration between 2-year bank bond yields in Germany and Italy.

| Trace Test: | Hypothesized | No. of CE(s) | Test Statistic | Critical Value | p-Value |
|-------------|--------------|--------------|----------------|----------------|---------|
| Max Eigenvalue Test: | Hypothesized: m = 4 | Test Statistic | 0.10 | Critical Value | 0.05 |
| m=3 | 24.3 | 13.3 | Critical Value | 15.2 |
| m=4 | 24.3 | 13.3 | Critical Value | 15.2 |
| None | 24.3 | 13.3 | Critical Value | 15.2 |

Table 2
Cointegration between 5-year bank bond yields in Germany and Italy.

| Trace Test: | Hypothesized | No. of CE(s) | Test Statistic | Critical Value | p-Value |
|-------------|--------------|--------------|----------------|----------------|---------|
| Max Eigenvalue Test: | Hypothesized: m = 4 | Test Statistic | 0.10 | Critical Value | 0.05 |
| m=3 | 24.3 | 13.3 | Critical Value | 15.2 |
| m=4 | 24.3 | 13.3 | Critical Value | 15.2 |
| None | 24.3 | 13.3 | Critical Value | 15.2 |

Table 3
Time-varying cointegration test: 2-year bond yields.

| Test Statistic | 0.10 | Critical Value | 0.05 | Critical Value |
|----------------|------|----------------|------|----------------|
| m = 1 | 8.52 | 4.61 | 5.99 |
| m=2 | 12.99 | 7.76 | 9.49 |
| m=3 | 25.82 | 10.64 | 12.59 |
| m=4 | 33.62 | 13.36 | 15.51 |
| m = 5 | 44.06 | 15.99 | 18.31 |

Table 4
Time-varying cointegration test: 5-year bond yields.

| Test Statistic | 0.10 | Critical Value | 0.05 | Critical Value |
|----------------|------|----------------|------|----------------|
| m = 1 | 39.34 | 4.61 | 5.99 |
| m=2 | 45.47 | 7.76 | 9.49 |
| m=3 | 56.05 | 10.64 | 12.59 |
| m=4 | 70.91 | 13.36 | 15.51 |
| m = 5 | 72.38 | 15.99 | 18.31 |

deterministic trends are a well-known problem when testing for cointegration. We assume that the time series analyzed in this paper are integrated of order one without drift. At least for the first part of the sample examined here, this seems to be an adequate trend assumption. The results for the Johansen tests for bonds with a maturity of 2 years are reported in Table 1. Table 2 then provides empirical evidence for 5-year senior unsecured bank bonds in Italy and Germany. In both cases, the critical values are taken from Johansen and Juselius (1990).

The assumption of no cointegration can be rejected examining 2- and 5-year yields (5% error level). This could be interpreted as empirical evidence for the existence of a strong equilibrium relationship between the markets for Italian and German senior unsecured bank bonds. However, the results of Bierens and Martins (2010) tests reported in Tables 3 and 4 show that nonlinearities do matter. In both tables, m is the number of Chebyshev time polynomials considered.

Independently from m, the null hypothesis that the cointegrating vector is time-invariant is always rejected. Therefore, nonlinearities are present, and the cointegrating vector is not stable over time. Consequently, there is no robust equilibrium situation in both cases. Given the sample examined here this – as already discussed above – should be a consequence of the political situation in Rome. Quite clearly, redenomination risk could be a potential explanation for our empirical findings reported in Tables 3 and 4.

6. Conclusion

This paper examines the current political and economic situation in Italy and discusses implications for sovereign credit and redenomination risk. The focus of our paper is the funding situation of Italian banks in relation to government debt. Then empirical evidence is reported examining generic bond yields of senior unsecured bank debt issued by German and Italian financial institutions (with maturities of 2 and 5 years). In both cases, there is clear empirical evidence for cointegration using the Johansen approach (see Johansen, 1988 and Johansen, 1991). This empirical finding seems to indicate a long-term equilibrium relationship between the funding costs of banks in Italy and Germany. However, nonlinearities do matter in this context. In fact, Bierens and Martins (2010) tests suggest that the cointegration vector between both 2- and 5-year generic bank bond yields in Italy and Germany is not stable over time. Without a doubt, changes to risk premia might help to explain this observation. Given the sample analyzed here, redenomination risk could indeed be of some relevance.

Credit authorship contribution statement

Johannes Tholl: Conceptualization, Supervision, Writing - original draft, Writing - review & editing. Christoph Schwarzbach: Writing - original draft, Writing - review & editing, Software, Data curation, Visualization. Sandro Pittalis: Conceptualization, Supervision, Writing - review & editing. Hans-Jörg von Mettenheim: Software, Empirical analysis, Data curation, Methodology.

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