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Financial centre bias in sub-sovereign credit ratings

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ABSTRACT

We investigate whether credit rating agencies are biased towards areas with strong financial centre characteristics, using data for 259 areas from 39 countries for 2004–17. We employ a range of measurements of financial centre characteristics, including a financial centre index, the share of financial and business services in an area's total employment, and revenues from investment banking. For all financial centre proxies, our results confirm the existence of a 'financial centre bias' that is statistically and economically significant. For example, cities present in the global financial centre index have a rating about a category higher than would be justified by fundamentals.

1. Introduction

Credit ratings agencies (CRAs) form an intrinsic component of contemporary financial markets. Their ratings influence the cost of borrowing of corporate and public bond issuers, as well as their norms of governance. Despite a plethora of rating agencies around the world, there are only three truly global agencies: Moody's, S&P and Fitch. Together, these three agencies control about 95% of the credit rating market, including Moody's share of about 33% (SEC, 2018). All three CRAs are owned by US conglomerates and headquartered in New York City (Fitch is the only agency with dual headquarters in New York and London). Given the role of the CRAs in the subprime mortgage crisis and the associated critique, their influence could have eroded as a result. Recent literature, however, shows that their power has endured (e.g. Binici et al., 2018; Mennillo and Sinclair, 2019). This makes it even more important to investigate how these agencies interact with and affect municipal and regional governments around the world that want to access the international bond market.

While sub-sovereign bond borrowing has a long history in the United States, its rise elsewhere is relatively recent.[1] A series of World Bank reports explains this surge as fuelled by fiscal decentralisation, including the enhanced taxation powers of local governments and their capacity to issue their own bonds; unprecedented pace of urbanisation, particularly in developing countries; and a shift away from bank borrowing (see Liu and Waibel, 2008; Canuto and Liu, 2010). According to the evidence

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[1] As used here the word sub-sovereign refers to all layers of public governance below the central government.

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presented in Canuto and Liu (2010), the annual issuance of sub-sovereign bonds outside the US increased from less than 50 billion USD in 2000 to more than 300 billion in 2009.

Fig. 1 extends the data of Canuto and Liu (2010) up to 2017. As it shows, the annual issuance of sub-sovereign debt remained higher than 300 billion USD for several years after the outbreak of the crisis and is still much higher than in the early 2000 s. To corroborate this trend, the figure also displays the increase in the number of sub-sovereign governments rated by Moody's outside the US, from 129 in 2000 to 443 in 2017. The combination of good creditworthiness of sub-sovereign bonds, coupled with higher yields vis-à-vis sovereign bonds, partially explains this trend (Vetter and Zipfel, 2014).

Our paper contributes to studies exploring biases in credit ratings. Our aim is to explore whether CRAs display a bias towards cities and regions with strong financial centre characteristics. Particularly at the sovereign level, several papers have pointed out the existence of cultural biases in credit ratings. Fuchs and Gehring (2017), for example, find that CRAs tend to give ratings about a notch higher to countries they are culturally familiar with, particularly in terms of language. To the best of our knowledge, however, no one has addressed the question of credit rating bias at the sub-sovereign scale. In addition, we are aware of no article examining the hypothesis that CRAs might be positively predisposed towards financial centres. This is a major research gap which we aim to address.

The lack of interest in financial centres is particularly surprising, given their centrality in the global economy. Financial centres have the capacity to provide households and firms with access to deep, liquid and sophisticated financial markets, and serve as information-intensive hubs for financial and advanced business services firms. These firms serve as protagonists in large financial transactions, such as new issues of equity and bond securities, syndicated loans or mergers and acquisitions. The combination of prior research demonstrating the significance of cultural familiarity for sovereign ratings and the fact that CRAs are important tenants of financial centres is in itself a good reason to ask, whether CRAs are biased towards sub-sovereign issuers that host financial centres.

Our analysis covers a sample of 259 localities from 39 countries, based on Moody's ratings. For our purposes, we utilise a random-effects panel ordered probit model. We employ a variety of proxies for measuring the importance of finance in a city or region. First, as with other empirical studies on financial centres (e.g. Degl'Innocenti et al., 2018a, 2018b), we consider the Z/Yen Global Financial Centres Index (GFCI). In addition to this, we utilise the local share of employment in finance and business services, and the position of a city as a hub for investment banking. Summarised briefly, our results indicate that regardless of measurement, Moody's ratings are indeed favourably biased towards areas which have strong financial centre characteristics. They also confirm the overarching influence of the country's sovereign credit rating as a determinant of sub-sovereign ratings. Additionally, they corroborate previous findings on rating biases, linked with cultural familiarity and geopolitical ties with the US (Fuchs and Gehring, 2017; Yalta and Yalta, 2018).

The rest of the paper is organised as follows. In Section 2 we review the literature on sub-sovereign ratings, focusing on their quantitative and qualitative determinants. We also examine the existing works on credit rating biases, and the literature on financial centres. In Section 3 we discuss our methodological approach, outlining in detail our selection of data and our econometric approach. In Section 4 we present our results together with a set of robustness checks. We also reflect on some of the most important implications of the detected 'financial centre bias'. In the concluding section of the paper we summarise our key findings and discuss implications for theory and policy.

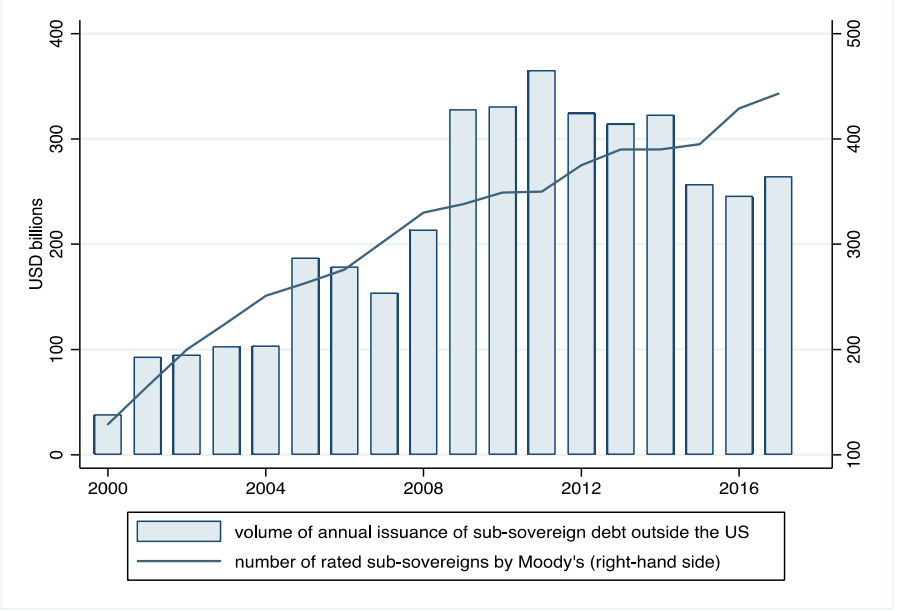

Fig. 1. Sub-sovereign debt and ratings outside the US. *Source:* Dealogic and Moody's (2019a).

2. Credit ratings, behavioural biases and financial centres

2.1. Determinants of sub-sovereign ratings

According to Moody's most recent methodology report (Moody's, 2018), there are two sets of factors that determine sub-sovereign ratings: the idiosyncratic factors of a given locality; and the broader macroeconomic environment, including the willingness and capacity of a central government to support lower levels of government.

Moody's considers idiosyncratic factors of sub-sovereign governments by using a scorecard with four groups of variables: economic fundamentals, fiscal and financial performance, institutional framework, and quality of governance. Typical measures of economic fundamentals and fiscal performance include local GDP per capita, unemployment, fiscal deficit and debt to GDP. The institutional framework covers regulations associated with local governments' discretion over spending and their revenue-raising powers.

The overarching macroeconomic environment is primarily captured by the country's sovereign rating. Some of the most important factors reflected in it are the fiscal and monetary policy of the central government, country-level economic fundamentals, as well as variables associated with financial stability (for Moody's sovereign rating methodology see Moody's (2019b); for supporting macroeconomic literature also see Cantor and Packer, 1996 or Afonso et al., 2011). Besides the ability of a central government to support lower tiers of government (reflected particularly in its own fiscal imbalance and debt to GDP ratio), Moody's also considers the government's legal constraints in aiding regions and municipalities in financial distress, along with its history and reputation of doing so.

Moody's (2019a) provides up-to-date evidence on the critical role of sovereign ratings in the determination of sub-sovereign ratings. As documented in their report, in the vast majority of cases sovereign ratings provide a solid upper-limit to sub-sovereign ratings (2019a: 10). The few existing exceptions to this rule tend to relate to countries in which regions enjoy a high degree of political and fiscal autonomy, for example the Basque Country in Spain. Moody's also documents that all non-US sub-sovereign defaults since 1983 have coincided with sovereign defaults (e.g. Russia, 1998; Argentina from 2001 to 2014; Ukraine, 2015).

Albeit few in number, econometric studies have contributed to identifying the key determinants of sub-sovereign ratings. Cheung (1996) investigates S&P's ratings of Canadian provinces. According to her analysis, provincial debt to GDP, employment rate, the size of provinces, federal transfers and unemployment benefits are all significant in determining provincial credit ratings. Sabourin (1999) also investigates the credit ratings of Canadian provinces and discovers non-linearities in the impact of local debt. More recently, Gaillard (2009) studies Moody's ratings for a large group of non-US regions and cities and uncovers that sovereign rating scores, GDP per capita and net direct debt are statistically significant predictors of sub-sovereign credit ratings. Jannone-Bellot et al. (2017) investigate sub-sovereign credit ratings in Europe and identify local population growth, unemployment rate, regional public spending, capital expenditures, as well as the relative size of an area (measured in terms of its population share) as additional determinants. Furthermore, Liu and Sun (2016) highlight the positive role of a country's economic and financial openness.

2.1.1. The significance of qualitative judgement

Moody's (2018) acknowledges that its credit ratings are also informed by qualitative considerations. This holds for all types of ratings of private and public sector issuers, and is common across the rating industry, including the big-three CRAs (see for instance S&P, 2020). Nonetheless, public finance, and particularly the sub-sovereign domain, has been documented as one in which qualitative judgement is most prominent. Omstedt (2020) shows this for sub-sovereign governments in the US using semi-structured interviews with rating analysts. As one of his interviewees puts it, the corporate world "is easier because it has fewer issuers and more harmonized financial reporting practices [...] Munis [aka municipal bonds] don't have this uniformity and you need a lot more manpower and less computer analysis" (Omstedt, 2020: 8–9). In a similar vein, another interviewee notes that CRAs cannot just plug in the numbers, since every state is governed by different laws and practices (Omstedt, 2020: 9).

It only takes one step of logical extrapolation, to argue that in an international context this challenge of comparability, and consequently the reliance on qualitative judgement must become even more pronounced. The significance of qualitative judgement and hence discrepancies between what would be justified by quantitative variables and actual credit ratings invites the investigation of behavioural biases in the process of credit rating.

2.2. Behavioural biases in sovereign ratings

One of the first behavioural biases to be identified at the sovereign level was that of procyclicality (Ferri, Liu and Stiglitz, 1999; Vernazza and Nielsen, 2015; Ioannou, 2017). Writing in the aftermath of the East Asian crisis, Ferri et al. (1999) suggest that Moody's, S&P and Fitch assigned overly optimistic credit ratings to countries in East Asia in the run-up to the crisis. Subsequently, the three CRAs turned excessively conservative and downgraded crisis-hit countries like Malaysia and South Korea more than what was justified by their economic fundamentals. Vernazza and Nielsen (2015) and Ioannou (2017) provide similar evidence in the context of the European crisis of 2010.

In recent years, a growing body of literature has identified additional biases in sovereign ratings. One of the most cited papers of this stream is Fuchs and Gehring (2017). Based on a sample of 143 countries, and covering nine CRAs in their analysis (including the big-three agencies), they uncover what they refer to as 'home bias', with CRAs assigning higher ratings to their home countries (i.e. the countries of their headquarters) and, to a smaller extent, to other countries that are culturally close to their home countries. The term bias is used as these differences in ratings cannot be justified by economic and political fundamentals of the countries concerned. The bias is economically significant as the home country is on average assigned a rating that is one rating category higher than that justified by fundamentals. In Fuchs and Gehring's assessment, cultural proximity (with linguistic similarity used as a key proxy variable) is the main channel of the 'home bias' since it implies an easier, more favourable and optimistic interpretation of information, and enhances the level of trust that a sovereign government will repay its debts. Additionally, CRAs tend to assign higher ratings to countries in which home-country banks hold large risk exposures. This might indicate a role of economic and political proximity in addition to cultural proximity.

Further evidence on home bias is provided in Yalta and Yalta (2018). According to their findings, the three big CRAs do indeed provide inflated ratings to their home country, the US. They also seem to provide higher ratings to countries with considerable trade and military relationships with the United States. On the other hand, Yalta and Yalta's (2018) evidence shows that apart from the US-bias, no particular group of countries is discriminated against by CRAs. Altdörfer et al. (2019) add further nuance on 'home bias' by investigating the ratings of Fitch. Given the French co-ownership of the agency by a risk management company called FIMALAC at the time of the European crisis, and the fact that Fitch has dual headquarters in New York City and London, the authors treat it as relatively more European CRA, compared to S&P and Moody's. Consistent with the 'home bias' hypothesis, Altdörfer et al. (2019) find that Fitch issued more favourable sovereign ratings than the other two agencies for Eurozone economies during the crisis.

2.3. Financial centres and sub-sovereign ratings

When we combine evidence on 'home bias' in sovereign ratings with the observation that in sub-sovereign ratings qualitative judgment plays an equally, if not more important role than it does in sovereign ratings, we ought to consider the potential for behavioural biases in sub-sovereign ratings. In this paper, we propose and test the existence of a 'financial centre bias' in sub-sovereign ratings. In short, we expect that cities and sub-national regions that have strong financial centre characteristics, are assigned higher ratings than would be justified by their economic and political fundamentals. To contextualise this proposition, we start with some key observations on financial centres, and features that give a city or region a financial centre character.

Financial centres have been defined as spatial concentrations of financial and business services (FABS) firms, including law, accounting, marketing and management consulting (Coe et al., 2014; Sassen, 2001). The inclusion of business services other than finance, insurance and real estate is crucial for the definition. If we think about major financial transactions such as an initial public offering or a corporate merger/acquisition, such deals involve lawyers, accountants and management consultants in addition to bankers, all working in close collaboration with customers and each other. As such, financial centres represent large pools of mostly highly-skilled and highly-paid labour. FABS have been one of the fastest growing economic sectors for several decades, recently recording fastest growth in emerging economies (Cassis and Wójcik, 2018).

The existence of financial centres can be explained by an interplay of centripetal and centrifugal forces (Grote, 2008; Engelen and Grote, 2009; Degl'Innocenti et al., 2017). Centripetal forces can be divided into localisation and agglomeration economies (McCann, 2001). Localisation economies involve benefits that accrue to FABS firms that locate close to each other, as co-location allows them to share a large and deep labour market, infrastructure, and crucially, information, which in turn facilitates innovation, collaboration and competition. Agglomeration economies concern benefits of locating in large cities, in proximity to large pools of corporate clients, government agencies, specialised suppliers from beyond the FABS sector (e.g. IT firms), big-city infrastructure (such as international airports), and amenities improving the quality of life (like theatres and museums). As information is the primary input for finance and FABS more generally, financial centres operate as information hubs, reducing information asymmetries, while allowing firms and individuals to combine local with global information and interpret it. Local information can relate to a particular locally-headquartered company or a locally-based asset. Global information involves the ability to understand global political and economic trends and patterns. The intensity of information and knowledge exchange through competition, collaboration and innovation in financial centres helps build tacit knowledge and trust, which cannot be easily created or transferred across distance (Amin and Thrift, 1992).

Corporate and particularly retail customers of FABS are found in multiple locations scattered across the economic landscape, and hence the need for being close to them, is a major centrifugal force explaining the multiplicity of financial centres (Clark and O'Connor, 1997). Another significant centrifugal force involves diseconomies of agglomeration, with high labour and office costs, and congestion pressures on infrastructure in the lead (Taylor et al., 2003). Decentralised political structures, present particularly in federal countries, tend to protect local and regional FABS firms and their interests, thus acting as another centrifugal force (Verdier, 2002). Technology is a double-edged sword for financial centres. On the one hand it allows leading financial centres to have a larger spatial reach, by facilitating the collection of information from a larger area. On the other hand, it enables the unbundling of the value chains in FABS, whereby back-office, mid-office and various types of front-office activities can be located in different places (Haberly et al., 2019).

Financial centres form networks and hierarchies. Their networked character reflects the underlying flows of information, professionals and capital through financial centres (Taylor and Derudder, 2015). These flows describe the high degree of complementarity between financial centres. Faulconbridge (2004), for example, describes how the launch of the Euro produced an increased connectivity between Frankfurt with London. In a similar fashion, Karreman and van der Knaap (2009) note that the rise of Shanghai in the 1990s and the 2000s gave rise to a complementary relationship with Hong Kong, with a distinct sectoral specialisation and geographical scope of each centre; whereas Shanghai obtained a more prominent role in dealing with domestic companies from traditional industries, such as mining and utilities, Hong Kong remained the main centre for large Chinese companies with an international reach, particularly from information-intensive industries, such as financials and telecommunications.

At the same time, financial centres remain deeply hierarchical, with dominance of cities such as New York and London, or else what Cassis describes as *capitals of capital*, at the very top (Cassis, 2006). A number of scholars point out that prior to the crisis of 2007/08, the dominance of New York and London was consolidated even more, despite changes in the rankings of second- and third-tier centres (Poon, 2003; Engelen, 2007; Engelen and Grote, 2009; Engelen et al., 2010). Engelen and Grote (2009), for example, describe how the internationalisation of finance, and the introduction of virtual trading, led to the partial decline in the importance of Amsterdam in the 2000s, and correspondingly to the further strengthening of London, which stood to attract a significant part of Dutch financial activity. Following the crisis, New York and London have maintained their positions at top of the hierarchy, despite their protagonist role in causing the crisis at the first place (Wójcik, 2013). Both cities have occupied the top two positions in the Z/Yen Global Financial Centres Index since the institute's first report in 2007 (source: Z/Yen Institute's website). In investment banking- a core area of financial activity- New York and London have remained the two leading hubs for over a century, despite the recent growth of financial centres in Asia (Wójcik et al., 2019).

Financial centres' hierarchy is related closely to their connectivity and types of financial and related services they offer to their customers. Financial centres can to some extent specialise in different types of FABS services and in different parts of the value chain. Smaller financial centres typically focus on basic financial services for retail customers and small and medium sized businesses and have only local or regional market scope. The largest financial centres, such as New York and London, are diversified, have large and deep FABS labour pools, and serve global markets. As many of the largest financial transactions for corporate customers and governments, such as IPOs, debt issuance and syndication, and M&As are the realm of investment banking, the leading financial centres are typically the largest centres of investment banking industry (Wójcik et al., 2019). The latter hosts many of the best paid professionals in the whole FABS sector.

Financial centre characteristics discussed above are important, as they help us prepare the ground for explaining why we expect a financial centre bias in sub-sovereign credit ratings, which is conceptually related to the 'home bias' documented for sovereign ratings. Just as Fuchs and Gehring (2017) build their argument on the 'home bias' in sovereign ratings on the literature on 'home-biases' in investment decisions, bank lending behaviour and trade, we draw from research on 'financial centre biases' in economics, regional science and economic geography. In primary capital markets, Wójcik (2009) shows that companies from leading financial centres are more likely to go public than companies from other areas of their respective countries, while Wójcik and Burger (2010) demonstrate that firms from leading financial centres are more likely to cross-list their shares on foreign exchanges. As for secondary capital markets, there is a rich literature documenting a 'local bias' in investment decisions (Ivković and Weisbrenner, 2005; Loughran and Schultz, 2004). Coval and Mosckowitz (1999), for example, show that approximately one in ten companies in a fund manager's portfolio is chosen because it is located in the same city as the manager. Since financial centres are concentrations of fund management industry, the 'local bias' thus translates into a 'financial centre bias'.

Research on 'local bias' in capital markets is part and parcel of literature on the uneven access to finance across space. As Klagge and Martin (2005: 394) argue, within a financial system of a country it is common to find ''over-accumulation of credit (i.e. debt) and investment in one period, sector of the economy, or geographical location, and under-accumulation in others". Small firms in economically lagging regions in particular often struggle to access funding due to their distance from leading financial centres (Ioannou and Wójcik, 2020). Distance can aggravate information asymmetries between borrowers and lenders, leading to higher transaction and monitoring costs, and introduce biases in the way the latter perceive the former and their creditworthiness (Martin and Pollard, 2017). In addition, there is research showing the tendency of savings in peripheral regions to bypass local banks and flow towards leading financial centres, which offer more attractive investment opportunities in terms of rate of return and risk (Verdier, 2002). One could also anticipate periods of crisis to amplify these inequalities. Degl'Innocenti et al. (2018b), for example, describe how over the period of the global financial crisis, European regions hosting financial centres converged in their competitiveness with one another, while at the same time diverging further from other regions in their countries.

Building on the literature on biases that exist in financial markets at sub-national level, we expect the main channel of 'financial centre bias' in sub-sovereign ratings to be cultural proximity. Financial centres are the 'home' and 'natural habitat' of rating agencies, with which these agencies and their professionals are more familiar than with other cities and regions. An indicative example of CRAs' locational preferences, is the fact that 27 of the 30 international offices of Moody's are located in cities included in the Z/Yen Global Financial Centres Index (source: Moody's website; Yeandle and Wardle, 2019).[2]

[2] The three exceptions are Moody's offices in Limassol, Cyprus, and in Bangalore and Gurgaon in India.

We expect cultural familiarity to breed optimism and trust. As rating agencies operate out of and through financial centres, and their professionals are an integral part of the FABS labour force and social environment, they may be more optimistic about the economic prospects of financial centres compared to what economic fundamentals would suggest about these prospects. Additionally, they may presume that public administrations in financial centres have a better understanding of the complex financial instruments they use, as compared to other cities, due to their immersion in a financial centre. As a result, they may believe that these administrations have the knowledge and expertise required for achieving and/or maintaining sustainable debt profiles. Put counterfactually, Dodd (2010) indicates that it was precisely this lack of expertise that caused financial distress to numerous municipalities in the US and in Europe throughout the 2007/08 financial crisis. According to his testimony, "complex derivatives transactions on both sides of the Atlantic have resulted in crippling financial losses for local governments [...] these deals usually involved unsophisticated local governments [...] [which once intro trouble] became susceptible to greater dangers as they traded more complex or exotic- and riskier- derivatives to recoup their losses" (Dodd, 2010: 33). In summary, just as familiarity breeds optimism, trust and investment in financial markets (Huberman, 2001), and as it leads to 'home bias' in sovereign ratings, we expect familiarity to lead to higher sub-sovereign ratings assigned to cities and regions with strong financial centre characteristics.

3. Data and methodology

Our sample covers a total of 259 localities, across 39 countries, and runs from 2004 to 2017 (all localities listed in the appendix). About half of our sample consists of urban areas. All countries but Ukraine are classified as either upper middle income or high income by the World Bank. Moreover, 14 countries have a federal system of governance. Mexico is the largest country in terms of coverage (71 locations), and Europe is the continent with the largest number of countries in the sample (25).

Our main source of data is Moody's statistical handbook on regional and municipal governments outside the US (Moody's, 2005).[3] This is, to the best of our knowledge, the richest source of standardised cross-county economic data for sub-sovereign governments. The handbook contains all the local demographic, economic, and financial variables Moody's considers in its production of sub-sovereign ratings. The richness of data is also why we concentrate on Moody's ratings rather than those of Standard and Poor's or Fitch.

Moody's coverage shapes the temporal and geographic dimensions of our panel.[4] Despite the unique richness of the Moody's dataset, it is natural to expect a bias of representation in our sample, given that the only localities included are those rated by Moody's. A stylised fact stated by Moody's itself is that most of the rated sub-sovereigns are located in investment-grade countries (2019a: 2).

Other city-level data resources used in our paper are the Oxford Economics Global Cities 2030 database and Dealogic. Oxford Economics offers city-level macroeconomic, sectoral and demographic data (Oxford Economics, 2014).[5] Dealogic provides a rich source of granular data on investment banking transactions, including underwriting of equity and debt securities (corporate and government bonds), syndicated loans, and advisory services on mergers and acquisitions (M&As).

Credit rating is a discrete alphanumerical variable reflecting a rating agency's expectation of default of a given entity. Given its discrete nature, the typical linear panel data approach is not applicable (Fry et al., 1993; Wooldridge, 2001). We therefore opt for a random-effects panel ordered probit model, a choice also in accordance with the well-established econometric tradition in credit rating modelling (e.g. Gaillard, 2009; Afonso et al., 2011; Jannone-Bellot et al., 2017). Effectively, this is a generalisation of the simple probit model, where instead of two we have n possible outcomes, corresponding to the 21 different credit rating scores. The framework involves the following linear latent model:

$$y^*_{it} = \beta X_{it-1} + \gamma D_i + \delta w_i + u_i + \varepsilon_{it} \tag{1}$$

where y^*_{it} is an unobserved latent variable; X_{it} is the vector of time-varying control variables; D_i is the vector of time-invariant measurements; w_i is our proxy for financial centre characteristics in a given area (also in a time-invariant form); β, γ, δ are the corresponding sets of parameter values; $u_i \sim N(0, \sigma^2_u)$ is the location-specific effect; and $\varepsilon_{it} \sim N(0,1)$ is the model's standard error. To match the values of y^*_{it} with discrete rating scores, we utilise 20 cutting points (i.e. $n-1$) as follows:

$$y_{it} = \begin{cases} Aaa & if \;\; y^*_{it} > \kappa_{20} \\ Aa1 & if \;\; \kappa_{19} < y^*_{it} \leq \kappa_{20} \\ & \vdots \\ Ca & if \;\; \kappa_1 < y^*_{it} \leq \kappa_2 \\ C & if \;\; y^*_{it} \leq \kappa_1 \end{cases} \tag{2}$$

[3] Other rating agencies, such as Standard and Poor's provide snapshots of their analyses but not detailed spreadsheets, as in the case of Moody's. Moody's dataset is proprietary and in principle available upon payment, but free access can be granted on request for using the data for academic purposes.

[4] This is also why the US is not included in our sample. As categorised by Moody's, US sub-sovereign bonds are treated as a separate asset category, with a different methodology and availability of data (source: Moody's website).

[5] One limitation in our analysis is that Oxford Economics and Moody's do not define urban areas in identical ways. Specifically, Moody's defines areas on the basis of legal jurisdictions of rated governments, whereas Oxford Economics also considers the broader metropolitan areas of a city. Although not ideal, we expect the correspondence between the two to be strong enough for the purpose of our paper, given that banks and other business services are usually found in central areas.

where y_{it} represents the actual credit rating. According to this model, the probability of the rating being equal to Aa1, for example, is stated as follows:

$$\Pr(\kappa_{19} < \beta X_{it-1} + \gamma D_i + \delta w_i + u_i + \varepsilon_{it} \leq \kappa_{20}) = \Phi(\kappa_{20} - \beta X_{it-1} - \gamma D_i - \delta w_i - u_i) - \Phi(\kappa_{19} - \beta X_{it-1} - \gamma D_i - \delta w_i - u_i) \quad (3)$$

where $\Phi(\cdot)$ denotes the standard normal cumulative distribution function (for further elaboration see Wooldridge, 2001, chapter 15). The model is estimated using the maximum likelihood method. To protect the model against simultaneous endogeneity, all time-varying regressors are lagged by one year.

To enable our econometric analysis, we convert Moody's ratings into a numerical format. In our conversion every alphanumerical category is matched with one number. The higher the number, the higher the rating, e.g. $Aaa = 21$, $Aa1 = 20$ and so on (for full listing see the lower part of table 1). An alternative numerical conversion, with bottom ratings pooled together into one category, is saved as a robustness check (see discussion below). For deciding which control variables to include in the time-varying vector X_{it} we follow the recent most cited papers on the determinants of sub-sovereign ratings (Gaillard, 2009; Jannone-Bellot et al., 2017), as well as Moody's own methodology reports (Moody's, 2005; 2018). First and foremost, we take into account the overarching sovereign rating of every locality. This is consistently reported as highly significant and positive in econometric literature and is emphatically highlighted as a crucial factor by Moody's itself. To this we add local GDP per capita (+), net debt (−), unemployment rate (−), gross operating balance (current revenues minus current expenditures and interest payments; +) and capital spending (+). (In brackets we show the expected sign for coefficients related to each of these variables.)

We also tried some alternative specifications offered by Moody's, given the availability of the data. Specifically, we tried to run our model with net instead of gross operating balance, wherein principal payments are also included in expenditures; and with total debt instead of net debt. In all cases results are highly consistent with what reported in the econometric Tables 3 And 4 below. One of the reasons for choosing which specifications to include were Moody's own remarks. Moody's (2005: 7), for example, calls for caution in the use of net operating balance, given the potential irregularity in debt maturity profiles. Similarly, Moody's (2005: 4) points out that net debt is a more appropriate descriptor of creditworthiness than total debt, as it relates more closely to the taxpayer-supported part of local government debt (precise definition can be found in Table 1). Other variables in the Moody's dataset turned out to be insignificant (e.g. discretionary own source revenue; and share of short-term debt).

Out of time-invariant controls, we utilise the share of an area in the total population of a country, the country's legal origins as well as the US military presence in the country. The share of population is used as a proxy for the size of a city or region, based on the hypothesis that size might positively influence credit ratings, e.g. due to the higher capacity of an area to diversify its economic activity and achieve economies of scale (Jannone-Bellot et al., 2017). The consideration of a country's legal framework is based on the legal indicators database of La Porta et al. (1998) and is in line with research showing that credit ratings are biased in favour of countries culturally and institutionally similar to the home country of the CRA (Fuchs and Gehring, 2017; Yalta and Yalta, 2018). As constructed here, this variable takes the value of one for countries with a legal system of English origin, and zero otherwise. Naturally, we would expect it to exhibit a positive sign. The consideration of US military presence follows the evidence presented in Yalta and Yalta (2018), and the observation that a US-based CRA (Moody's in our case) might tend to favour countries with strong geopolitical ties with the US.[6] Other variables we experimented with were the English-speaking part of a country's population (based on Wikipedia data); and the share of a country in US's total exports (based on data from the US Census Bureau). While meaningful economically, both variables exhibit a correlation of about 80% with legal origins. Additionally, the 'share in US exports' variable turned out to be insignificant when included in the model in place of legal origins.

To capture the financial centre characteristics of a city or region, we design five different variables. First, as with other empirical studies on financial centres (e.g. Degl'Innocenti et al., 2018a, 2018b), we consider Z/Yen Global Financial Centres Index (GFCI). This is an index published bi-annually, which evaluates the competitiveness of cities as global financial centres, and ranks them on the basis of a five-dimensional scorecard: quality of business environment, human capital, infrastructure, financial sector development, and reputation (Yeandle and Wardle, 2019). It includes 134 instrumental factors based on secondary data, combined with more than three thousand questionnaires, completed by financial services professionals around the world. Examples of instrumental factors include tax and cost competitiveness, quality of life and cultural diversity. We construct two alternative variables based on the GFCI. In the first we apply the GFCI identifier in a strict sense, flagging only cities that have a global financial centres index (1 if a city has an index; 0 otherwise). In the second, we include the first set of cities plus the broader regions that include such cities (e.g. Bavaria; Ile-de-France). All locations matched with the GFCI are shown in italics in the appendix. Those considered in the first specification are also underlined.

As a second variable capturing financial centre characteristics, we use the share of employment in financial and business services (FABS) in the total employment of a metropolitan area, based on the Global Cities 2030 database of Oxford

[6] In Yalta and Yalta (2018) geopolitical ties are captured by a dummy which takes the value of 1 for countries with active US military personnel deployed (2018: 686). Although we use the same database as these authors (Defense Manpower Data Center, 2019), we found it difficult to draw a distinction between countries with active US military forces and countries without, for the reason that all countries register some US military presence (12 people are for instance recorded in Russia). We therefore separate between countries on the basis of the actual number of US military personnel, taken in natural logarithmic form.

Table 1
Summary statistics, description of variables and numerical credit rating scale.

Variable	Description	Source	Obs	Mean	Std. Dev.	Min	Max
sub-sovereign ratings	1–21 scale	Moody's	2715	13.85	4.84	1	21
sovereign ratings	1–21 scale	Moody's	3599	15.83	4	1	21
GDP per capita (ln.)	In USD; natural logarithm	Moody's	2979	9.77	0.98	7.41	15.9
Net Debt to Op. Revenue	Net debt equals total direct and guaranteed debt minus debt covered by dedicated financial assets (e.g. sinking fund assets) and debt related to state-owned enterprises deemed by Moody's to be financially self-supporting; divided by operating revenues	Moody's	3059	69.28	75.14	0	567.9
Unemployment rate	Percentage rate	Moody's	3019	7.52	5.51	0	36.6
Gross Operating Balance	Operating (current) revenues minus operating expenditures and interest payments; divided by operating revenue	Moody's	3070	7.63	11.69	−44	81.2
Capital Spending	Ratio of total expenditure	Moody's	3056	18.01	11.38	0.5	74.5
Share of population	Percentage share out of country total	Moody's	3626	5.21	8.22	0.06	57.51
Legal_English	1 if legal origins of the country are English; 0 otherwise	La Porta et al. (1998)	3626	0.19	0.39	0	1
US military (ln.)	No. of military personnel (includes army, navy, marine corps, air force and coastal guard); natural logarithm	Defense Manpower Data Center (2019)	3626	5.19	2.65	1.10	10.92
GFC1	1 if city is included in the global financial centre index; 0 otherwise	Yeandle and Wardle (2019)	3626	0.08	0.28	0	1
GFC2	Equals to GFC1, plus broader areas that include cities with a global financial centre index	Yeandle and Wardle (2019)	3626	0.15	0.36	0	1
FABS employment share	The percentage share of employment in FABS in total employment; as defined by Oxford Economics, FABS includes financial and insurance activities, real estate activities, professional, scientific & technical activities and administrative & support service sectors.	Oxford Economics	966	13.74	4.97	5.75	25
IB1	Investment banking fees income by city (USD, 2010); in natural logarithm. Added up based on the location of the fee earning institution. Zero values for areas for which Dealogic does not report any data.	Dealogic	3626	0.45	1.31	−0.77	8.31
IB2	Equals to IB1, but also takes into account broader areas that include cities that record investment banking fees. Sum of cities if more than one in a given area.	Dealogic	3626	0.91	1.88	−1.3	8.31

RATING SCALE & NUMERICAL CONVERSION

Alpha-numerical ratings	Numerical conversion	Alpha-numerical ratings	Numerical conversion	Alpha-numerical ratings	Numerical conversion	Alpha-numerical ratings	Numerical conversion
Aaa	21	A3	15	Ba3	9	Caa3	3
Aa1	20	Baa1	14	B1	8	Ca	2
Aa2	19	Baa2	13	B2	7	C	1
Aa3	18	Baa3	12	B3	6		
A1	17	Ba1	11	Caa1	5		
A2	16	Ba2	10	Caa2	4		

Economics (OE). The focus on FABS, rather than finance alone, is compatible with our earlier discussion on financial centres and the observation that business services tend to co-locate and work together with big banks and other financial institutions.[7] The variable is taken in a time-invariant form, given our purpose to use it as a spatial descriptor. One constraint of the exercise is the partial overlap between our main database and the coverage offered by OE. Specifically, OE provides data

[7] It is also due to data availability, as FABS is the closest sector to finance that is covered by OE.

Table 2
Correlation matrix.

	Sub-sovereign ratings	Sovereign ratings	GDP per capita (ln.)	Net Debt to Op. Revenue	Unemployment rate	Gross Operating Balance	Capital Spending	Share of population	Legal English	US military (ln.)	GFC1	GFC2	FABS employment share	IB1	IB2
Sub-sovereign ratings	1.00														
Sovereign ratings	0.92	1.00													
GDP per capita (ln.)	0.65	0.54	1.00												
Net Debt to Op. Revenue	0.40	0.34	0.40	1.00											
Unemployment rate	−0.16	−0.17	0.02	0.18	1.00										
Gross Operating Balance	0.06	−0.11	−0.03	−0.17	−0.19	1.00									
Capital Spending	−0.02	−0.06	−0.19	−0.20	−0.09	0.62	1.00								
share of population	0.10	0.02	0.17	0.00	0.18	0.21	0.13	1.00							
Legal English	0.44	0.46	0.21	−0.05	0.03	0.09	0.14	−0.02	1.00						
US military (ln.)	0.39	0.33	0.29	0.72	0.15	−0.09	−0.12	−0.32	−0.08	1.00					
GFC1	0.17	0.02	0.28	−0.14	0.02	0.21	0.08	0.31	0.13	−0.14	1.00				
GFC2	0.17	0.02	0.28	−0.14	0.02	0.21	0.08	0.31	0.13	−0.14	1.00	1.00			
FABS employment share	0.39	0.22	0.41	0.09	0.10	0.15	0.02	0.32	0.44	−0.11	0.58	0.58	1.00		
IB1	0.34	0.22	0.35	−0.03	0.08	0.14	0.03	0.23	0.32	−0.04	0.74	0.74	0.71	1.00	
IB2	0.36	0.24	0.37	0.06	0.12	0.10	0.01	0.24	0.31	0.03	0.72	0.72	0.70	0.98	1.00

Table 3
Basic econometric models.

Dependent variable: Sub-sovereign credit rating	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sovereign credit rating	0.680***	0.657***	0.659***	0.659***	0.705***	0.658***	0.657***
	(12.506)	(12.228)	(12.273)	(12.298)	(8.032)	(12.282)	(12.258)
GDP per capita (ln.)	0.271*	0.195	0.178	0.181	0.202	0.184	0.187
	(1.904)	(1.509)	(1.358)	(1.388)	(0.835)	(1.399)	(1.435)
Net Debt to Op. Revenue	−0.007***	−0.008***	−0.008***	−0.008***	−0.002	−0.008***	−0.008***
	(-3.400)	(-4.076)	(-4.072)	(-4.040)	(-1.026)	(-4.112)	(-4.113)
Unemployment rate	−0.096***	−0.107***	−0.106***	−0.105***	−0.122***	−0.106***	−0.105***
	(-4.609)	(-5.704)	(-5.709)	(-5.616)	(-3.219)	(-5.715)	(-5.603)
Gross Operating Balance	0.023***	0.023***	0.023***	0.023***	0.023***	0.023***	0.023***
	(4.271)	(4.355)	(4.331)	(4.368)	(2.615)	(4.357)	(4.379)
Capital Spending	0.023***	0.024***	0.023***	0.024***	0.015*	0.023***	0.024***
	(4.464)	(4.720)	(4.610)	(4.628)	(1.783)	(4.592)	(4.691)
Share of population		0.122***	0.115***	0.099***	0.077**	0.114***	0.103***
		(5.482)	(5.611)	(4.557)	(2.523)	(5.499)	(4.977)
Legal_English		3.573***	3.551***	3.464***	1.201	3.494***	3.433***
		(6.751)	(6.811)	(6.818)	(1.279)	(6.740)	(6.542)
US military (ln.)		0.536***	0.545***	0.533***	0.432***	0.534***	0.513***
		(7.156)	(7.110)	(7.087)	(3.285)	(7.040)	(6.936)
GFC1			1.377***				
			(2.779)				
GFC2				1.256***			
				(2.746)			
FABS employment share					0.196***		
					(3.327)		
IB1						0.296**	
						(2.465)	
IB2							0.201**
							(2.326)
Observations	2466	2466	2466	2466	695	2466	2466
Number of locations	259	259	259	259	69	259	259

Notes: *, ** and *** denote significance at the 10%, 5% and 1% levels respectively; *t*-statistics in parentheses; heteroskedasticity robust errors and random effects used in all cases; xtoprobit routine in STATA; GFC1 and GFC2 are based on financial centre index of Yeandle and Wardle (2019); FABS employment share represents the share of employment in financial and business services out of total employment; IB variables describe fee revenues from investment banking. FABS and IB variables in full-time averages for each location. Source: Authors' calculations based on data from Moody's Statistics, Oxford Economics and Dealogic.

for 69 metropolitan areas out of the 259 locations in our sample. This limitation, however, also gives us the opportunity to test our results on a smaller size sample, and therefore serves as a robustness test too.[8]

Third, we use Dealogic's data on investment banking fees, aggregated at the city level, based on the location of the fee earning firm. The dataset has a global scope and covers more than 900,000 transactions, from 2000 to 2015. One of its limitations is that whereas the deal value is available for an absolute majority of deals, actual fees are reported for only approximately 20% of the transactions.[9] Moreover, fees as a percentage of deal value vary significantly, ranging from less than 0.5% for underwriting of debt securities to more than 7% for underwriting of initial public offerings of equity securities. To address this missing data problem, we follow the approach developed in Wójcik et al. (2019) and model percentage fees as a function of deal characteristics. We then use the predicted values of these models for filling in the gaps in our dataset. This allows us to meaningfully aggregate investment banking activity. In cases where the locations of the bank subsidiaries involved in a transaction are missing, we manually collect the addresses of their operational headquarters, based on Bureau van Dijk's Orbis, Nexis UK and Bloomberg.[10]

We construct two alternative specifications. First, we match our dataset of investment banking revenue only with the cities for which data is available (44 cities covered in total). Second, we construct a broader specification wherein regions that include cities under Dealogic's coverage are also taken into account. Given the comprehensive nature of Dealogic databases, we treat any cities or regions without any investment banking as true zeros, rather than missing data. As with FABS employment share, the two variables are considered in a time-invariant form.

Table 1 reports all summary statistics of the variables utilised in our paper and provides their detailed definitions. It also maps the correspondence between actual credit ratings and their numerical conversions. Table 2 contains the corresponding correlation matrix.

[8] Another limitation is that our data from Oxford Economics only goes up to 2015, and hence the full-time averaging omits the two most recent years of our sample.

[9] Deal value equals funds raised in primary issues of equity or debt securities, lent through syndicated loans or the price paid in an M&A.

[10] To make this task feasible, we selected the top 500 bank subsidiaries for each year/deal combination, yielding 7458 unique names. This sample covers more than 99% of the value of transactions for all year–deal combinations.

Table 4
Robustness tests.

	Robustness test 1: alternative numerical scale for credit ratings							Robustness test 2: regressions for the post crisis period (2010–2017)						
Dependent variable: Sub-sovereign credit rating	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sovereign rating	0.692***	0.666***	0.669***	0.669***	0.739***	0.668***	0.667***	0.658***	0.626***	0.629***	0.632***	0.737***	0.661***	0.628***
	(11.910)	(11.672)	(11.715)	(11.737)	(8.059)	(11.725)	(11.699)	(11.299)	(10.741)	(10.749)	(10.863)	(6.836)	(11.346)	(10.796)
GDP per capita (ln.)	0.248*	0.172	0.155	0.158	0.175	0.161	0.164	1.807***	1.321***	1.277***	1.254***	0.905**	1.758***	1.282***
	(1.759)	(1.323)	(1.171)	(1.200)	(0.742)	(1.214)	(1.250)	(7.866)	(5.779)	(5.570)	(5.505)	(2.143)	(7.722)	(5.668)
Net Debt to Op. Revenue	−0.006***	−0.007***	−0.007***	−0.007***	−0.002	−0.007***	−0.007***	0.000	−0.002	−0.002	−0.002	0.001	0.000	−0.002
	(-2.872)	(-3.553)	(-3.547)	(-3.516)	(-0.705)	(-3.582)	(-3.586)	(0.057)	(-1.176)	(-1.160)	(-1.057)	(0.314)	(0.056)	(-1.196)
Unemployment rate	−0.098***	−0.109***	−0.109***	−0.107***	−0.137***	−0.109***	−0.108***	0.023	−0.018	−0.018	−0.015	−0.017	0.023	−0.015
	(-4.770)	(-5.881)	(-5.876)	(-5.780)	(-4.068)	(-5.886)	(-5.771)	(0.980)	(-0.808)	(-0.826)	(-0.687)	(-0.342)	(0.952)	(-0.714)
Gross Operating Balance	0.023***	0.023***	0.023***	0.023***	0.021***	0.023***	0.023***	0.020***	0.018***	0.018***	0.018***	0.023*	0.019***	0.019***
	(4.329)	(4.399)	(4.375)	(4.414)	(2.580)	(4.402)	(4.423)	(2.966)	(2.745)	(2.712)	(2.740)	(1.801)	(2.934)	(2.772)
Capital Spending	0.023***	0.024***	0.023***	0.023***	0.015*	0.023***	0.023***	0.021***	0.023***	0.023***	0.022***	0.010	0.021***	0.023***
	(4.348)	(4.636)	(4.525)	(4.543)	(1.870)	(4.509)	(4.609)	(3.827)	(4.094)	(4.017)	(3.988)	(0.894)	(3.706)	(4.063)
Share of population		0.122***	0.115***	0.099***	0.078**	0.114***	0.102***		0.099***	0.095***	0.076***	0.071*		0.079***
		(5.486)	(5.609)	(4.544)	(2.570)	(5.501)	(4.995)		(4.770)	(4.779)	(3.794)	(1.937)		(4.383)
Legal_English		3.561***	3.538***	3.451***	1.164	3.482***	3.423***		4.015***	4.026***	3.945***	2.827**		3.903***
		(6.722)	(6.783)	(6.786)	(1.205)	(6.712)	(6.520)		(7.214)	(7.244)	(7.257)	(2.124)		(7.052)
US military (ln.)		0.529***	0.538***	0.526***	0.419***	0.527***	0.507***		0.319***	0.330***	0.321***	0.330*		0.300***
		(7.034)	(6.992)	(6.965)	(3.204)	(6.919)	(6.817)		(4.113)	(4.198)	(4.161)	(1.952)		(3.995)
GFC1			1.383***							0.860				
			(2.809)							(1.487)				
GFC2				1.263***							1.294**			
				(2.767)							(2.423)			
FABS employment share					0.201***							0.221***		
					(3.489)							(2.863)		
IB1						0.296**							0.350***	
						(2.475)							(2.655)	
IB2							0.199**							0.206**
							(2.311)							(2.169)
Observations	2466	2466	2466	2466	695	2466	2466	1678	1678	1678	1678	474	1678	1678
Number of locations	259	259	259	259	69	259	259	256	256	256	256	67	256	256

Notes: *, ** and *** denote significance at the 10%, 5% and 1% levels respectively; *t*-statistics in parentheses; heteroskedasticity robust errors and random effects used in all cases; xtoprobit routine in STATA; GFC1 and GFC2 are based on financial centre index of Yeandle and Wardle (2019); FABS employment share represents the share of employment in financial and business services out of total employment; IB variables describe fee revenues from investment banking. FABS and IB variables in full-time averages for each location; in robustness test 1 the rating scale is [1–17] is used for both sub-sovereign and sovereign ratings (17 for Aaa). Source: Authors' calculations based on data from Moody's Statistics, Oxford Economics and Dealogic.

4. Results

We begin with the correlation plots presented in Fig. 2, which display a visualisation of the positive association between sub-sovereign ratings, FABS employment and investment banking revenue. In the upper part we plot the relationship between ratings and FABS share of employment; in the lower that between ratings and revenues from investment banking. As seen in the figure, a positive association is discernible in both cases, despite some difference in degree.

Table 3 displays our baseline econometric results. We present seven models, based on the econometric setup described in the previous section. The first two columns consider the most basic configuration, with and without time-invariant measurements. This is for contrasting purposes, and for establishing a consistent basis on which we can build adding proxies for financial centre characteristics. We introduce these proxies one at a time, in columns 3–7.

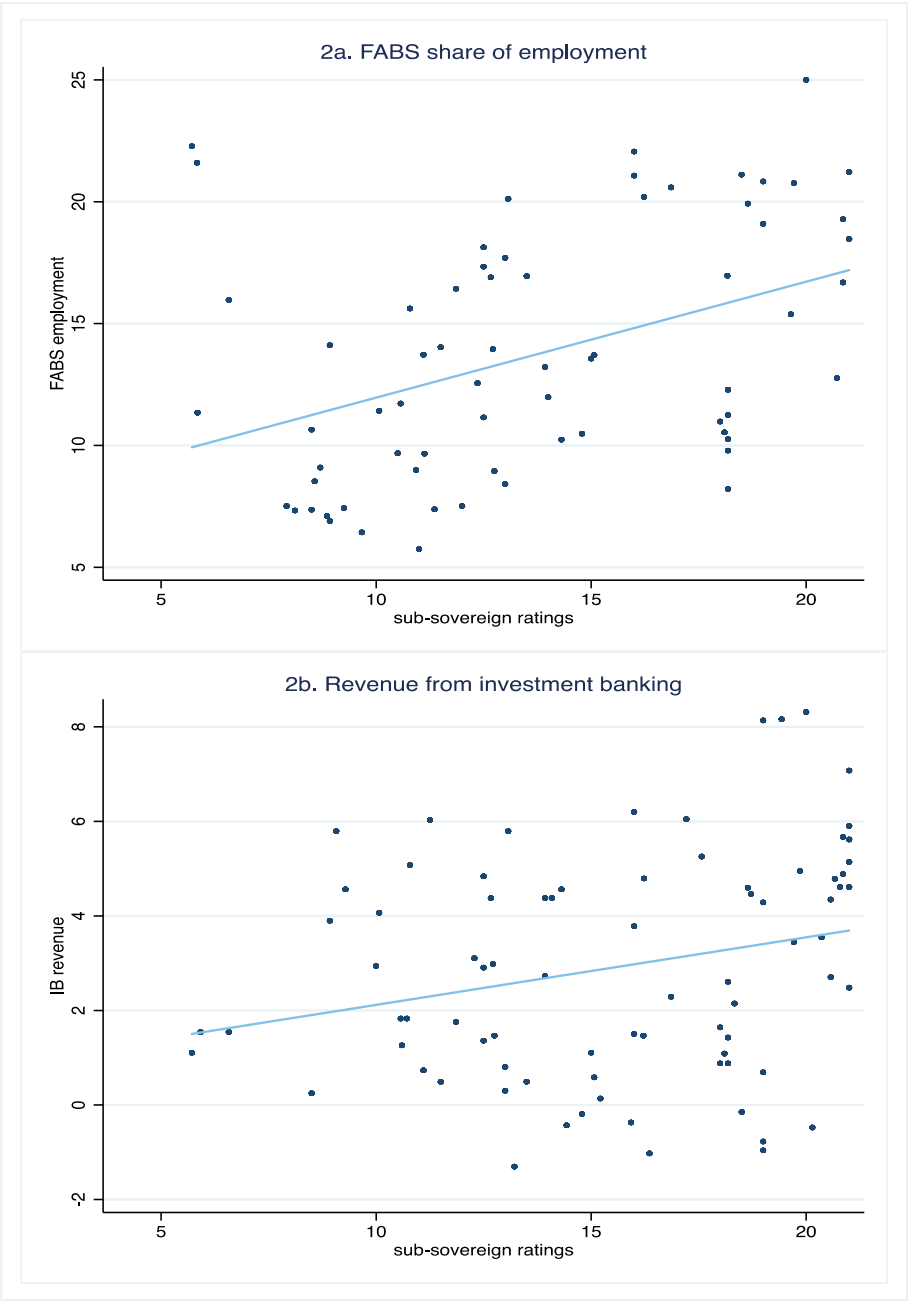

Fig. 2. Correlation between sub-sovereign ratings and selected variables. Notes: FABS for 'financial and business services', IB for 'investment banking'; FABS shares in %; investment banking revenues in natural logarithm; all variables in full-time averages. *Source:* Moody's, Oxford Economics, Dealogic, and authors' elaboration.

The first variable to enter all models is the sovereign rating. In line with literature and Moody's methodology we observe the variable to be significant at the 99% level, across all specifications, with a parameter value between 0.6 and 0.7 in most cases. This is close to what is reported in previous research (see for instance Jannone-Bellot et al., 2017).

Furthermore, with the exception of GDP per capita, the statistical significance of which weakens in models 2–7, all other time-varying measurements are highly significant in the majority of our specifications. All signs are as expected: GDP per capita is positively associated with sub-sovereign ratings, net debt and unemployment have consistently negative coefficients, and those for gross operating balance and capital spending are always positive.

The positive relationship between population share and sub-sovereign ratings suggests that Moody's seems to acknowledge an economic advantage of large cities and regions. Sub-sovereign governments in countries with English common law legal system origin get higher credit ratings. This is consistent with Fuchs and Gehring' (2017) and Yalta and Yalta' (2018) results on 'home bias' in Moody's ratings, as having English legal origins can be considered a form of cultural and institutional proximity to the US, the home country of Moody's. US military presence also has a positive and significant impact, corroborating Yalta and Yalta's (2018) findings. All else the same, cities and regions located in countries with substantial geopolitical ties with the US tend to receive more favourable ratings by Moody's.

Models 3–7 demonstrate that all proxies for financial centres are positively and statistically significantly (with significance ranging between 95% and 99%) related to sub-sovereign credit ratings. According to models 3 and 4, cities included in the GFCI tend to receive ratings about a rating category higher than what would be expected based on economic fundamentals. Similarly, model 5 indicates that the higher the average share of employment in FABS in a city or region, the higher its rating. Moreover, models 6 and 7 confirm that areas with large presence of investment banking are more likely to receive a higher rating by Moody's.

4.1. Robustness checks

In order to test the robustness of our findings, we conduct two additional exercises. First, we re-run the models in Table 3 using an alternative numerical conversion for credit ratings. Second, we repeat our main regressions for the part of our sample that corresponds to the post-crisis period (2010–2017). All results are presented in Table 4.

With regard to the first exercise, Alfonso et al. (2007) suggest that a numerical scale in which bottom categories are grouped together might allow for a more efficient estimation, given the relative scarcity of observations with low ratings.[11] In line with this suggestion, we establish an alternative scale, wherein the bottom five rating scores of Moody's are considered jointly (Caa1, Caa2, Caa3, Ca and C). This leaves us with 17 rating categories in total. As before, the higher the number, the higher the credit rating, e.g. $Aaa = 17, Aa1 = 16$, etc. As for the second exercise, our primary aim is to protect against a potential structural break in our series, as well as to assess whether the crisis has had an impact on any of the biases identified in the analysis.

In their vast majority our results remain consistent with what we reported earlier. As shown on the left-hand side of Table 4, the alteration of the numerical scale of ratings does not produce any notable divergence, either in parameter values or in statistical significance. As for the second exercise, some reduction in statistical significance can be observed in certain time-varying controls. Moreover, the first specification of the GFCI falls below the 90% significance level. The parameter values and significance of all other proxies for financial centres, however, remain similar to our baseline results (see the last four columns of Table 4).[12]

4.2. Implications of the 'financial centre bias'

There is ample evidence suggesting a significant impact of credit ratings on borrowing costs, particularly at the sovereign level (see for instance Reisen and Maltzan, 1999; Gande and Parsley, 2005; Altdörfer et al., 2019). A direct implication of our results, therefore, is that areas with strong financial centre characteristics are likely to enjoy lower borrowing costs than what is justified by their actual fundamentals. This in itself can have a number of repercussions.

To begin with, as discussed earlier it is often the case that, due to information asymmetries and uncertainty, some areas tend to attract a disproportionate amount of financial resources, while other areas struggle (Verdier, 2002; Klagge and Martin, 2005; Degl'Innocenti et al., 2018b). In this context, more favourable ratings can widen and consolidate further an economic gap between financial centres and their adjacent regions on one side, and the rest of the country on the other. Better ratings can allow areas with strong financial centre characteristics to attract an even greater volume of capital flows, particularly from institutional investors, such as pension funds, required by law to invest in safe assets, typically above the speculative rating grade (Ba1 in Moody's scale). Aided by lower borrowing costs, this can enable local administrations to boost their investment in infrastructure, such as transport and communication, business parks, industry incubators and accelerators, as well as amenities, and in that way attract even more skilled human resources from the periphery of their countries. Indirectly, the economic gap might increase further if the more favourable borrowing conditions for local administrations affect local businesses, for instance due to the creation of a more stable economic environment. Furthermore, the

[11] About 2.5% of our sample corresponds to observations with a credit rating of Caa1 or lower.

[12] One issue we faced in the second exercise was that STATA was unable to perform the maximum likelihood estimation for model 6 due to the encountering of a discontinuous region in the data. To overcome this difficulty, we reduced the size of the model by removing all time-invariant control variables and re-run the model.

financial centre bias might give rise to a self-fulfilling loop, wherein areas with strong financial centre characteristics maintain healthy fundamentals due to rating agencies expecting them to do so. Or, to put it differently, less advantaged areas might find it even harder to catch up in face of the uneven expectations of credit rating agencies. Another indirect way in which the financial centre bias in credit rating might impact the regional and urban economic landscape of a country is by making other areas imitate the growth strategy of financial centres - a strategy likely to be counter-productive, unless based on a genuine understanding of local characteristics and advantages.

5. Conclusions

In this paper we investigate the proposition that Moody's sub-sovereign ratings might be biased in favour of areas that exhibit strong financial centre characteristics. To test the proposition, we employ a large sample of sub-national areas from 39 countries and use a wide range of proxies for measuring financial centre characteristics. These are based on the Z/Yen Global Financial Centres Index (GFCI), the local share of employment in financial and business services sourced from Oxford Economics, and the investment banking revenue earned from transactions underwritten in the city. These measures complement each other as they focus on the key dimensions of financial centres: their international competitiveness, size of the relevant labour pool, and position in the one of the most strategically important and elite type of financial transactions. Our results confirm our proposition, by presenting strong evidence for the existence of a 'financial centre bias' in sub-sovereign ratings. This bias holds for all measures of financial centre characteristics considered here and withstands various robustness checks.

Our results offer an important contribution to the literature on bias in credit ratings and financial markets more generally. In particular, we extend findings on the existence of a 'home bias' in sovereign ratings to the sub-national level. In our view, the 'financial centre bias' can be explained by cultural proximity. Just as sovereign ratings are biased towards countries that are culturally close to the home country of the CRA producing the ratings, we argue that sub-sovereign ratings are biased towards cities and regions with strong financial centre characteristics, which represent the 'home' and 'natural habitat' of CRAs. What is more, the economic significance of this 'financial centre bias' is comparable to that of 'home bias' in sovereign ratings. As with Fuchs and Gehring (2017) who find that on a 21-point scale, home country gets on average a rating one category higher than what justified based on fundamentals, we also find that the inclusion of a city in the GFCI results in a rating about a notch higher than what indicated by fundamentals.

The persistent influence of credit rating agencies in contemporary financial markets, and the continuing rise in the participation of sub-national governments in global bond markets highlight the importance of our findings. Faced with an environment of fiscal decentralisation, sub-national governments increasingly rely on private financing for covering their day-to-day and long-term needs, including infrastructure. Nonetheless not all areas enter the market on the same terms. While financial centres might already be in a position of receiving a disproportionate amount of human and financial resources from the rest of their countries (Verdier, 2002; Klagge and Martin, 2005; Degl'Innocenti et al., 2018b), their favourable treatment by rating agencies can further amplify their advantage, either directly or indirectly. Cheaper municipal borrowing, facilitated by more favourable ratings, for example, can allow financial centres to invest more in high quality infrastructure, such as transport and communication, business parks, industry incubators and accelerators, and other growth enhancing assets.

There are two types of policy implications that stem from our analysis. First, CRAs should be forced to make their sub-sovereign rating methodologies more transparent and predictable. Given the global interconnectedness of contemporary bond markets such reform can best succeed if carried out by an institution of international governance, such as the International Monetary Fund, or the Financial Stability Board of the G20. Secondly, national governments need to make regions and cities less dependent on the judgement of CRAs. To this end they need to expand their fiscal support towards lower levels of governance, e.g. by increasing earmarked grants for infrastructure development, and by providing them access to affordable interest rates, particularly for the purpose of long-term investment. Such approach should also be matched with a coherent and coordinated framework for economic development, where each region is encouraged to flourish based on its own distinct advantages.

One desirable extension of our work, subject to data availability, would be to test the existence of 'financial centre bias' in the sub-sovereign ratings of other CRAs. Moreover, more research is needed in the direction of measuring the quantitative impact of sub-sovereign credit ratings on local bond yields. Another direction for future research would be to identify particular aspects of cultural proximity that may drive the financial centre bias. In this regard, a combination of quantitative and qualitative research, including interviews with credit rating analysts, would be recommendable. Finally, future work could capture in a formal mathematical model the interactions between sub-sovereign ratings, borrowing costs, and their implications for urban development.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. List of countries and locations (39 countries, 259 locations; in italics and underlined if identified by Z/Yen as a global financial centre; solely in italics if an area with a global financial centre inside it).

Country	Location	Country	Location
Argentina	*Buenos Aires, City of*	Mexico	Centro, Municipality of (Villahermosa)
Argentina	*Buenos Aires, Province of*	Mexico	Chiapas, State of
Argentina	Chaco, Province of	Mexico	Chicoloapan de Juarez, Municipality of
Argentina	Chubut, Province of	Mexico	Chihuahua, State of
Argentina	Cordoba, Municipality of	Mexico	*Ciudad de Mexico*
Argentina	Cordoba, Province of	Mexico	Coacalco, Municipality of
Argentina	Formosa, Province of	Mexico	Coatzacoalcos, Municipality of
Argentina	Mendoza, Province of	Mexico	Colima, Municipality of
Argentina	Rio Cuarto, Municipality of	Mexico	Corregidora, Municipality of
Australia	*New South Wales (State of) Australia*	Mexico	Cuautitlan Izcalli, Municipality of
Australia	Northern Territory of Australia	Mexico	Cuautla, Municipality of
Australia	Queensland (State of) Australia	Mexico	Culiacan, Municipality of
Australia	South Australia (State of) Australia	Mexico	Durango, Municipality of
Australia	Tasmania (State of) Australia	Mexico	Durango, State Of
Australia	*Victoria (State of) Australia*	Mexico	Ecatepec de Morelos, Municipality of
Australia	Western Australia (State of) Australia	Mexico	Guadalajara, Municipality of
Austria	Carinthia, State of	Mexico	Guadalupe, Municipality of
Austria	Lower Austria, State of	Mexico	Guanajuato, State of
Austria	*Vienna, City of*	Mexico	Guasave, Municipality of
Belgium	*Flanders, the Community of*	Mexico	Guerrero, State of
Belgium	Walloon Region	Mexico	Hidalgo, State of
Bosnia and Herzegovina	Srpska, Republic of	Mexico	Ixtapaluca, Municipality of
Brazil	Bahia, State of	Mexico	Jalisco, State of
Brazil	Belo Horizonte, Municipality of	Mexico	Lazaro Cardenas, Municipality of
Brazil	Maranhao, State of	Mexico	Leon, Municipality of
Brazil	Minas Gerais, State of	Mexico	Matamoros, Municipality of
Brazil	Parana, State of	Mexico	Merida, Municipality of
Brazil	*Rio de Janeiro, Municipality of*	Mexico	Metepec, Municipality of
Brazil	*Sao Paulo, State of*	Mexico	Mexicali, Municipality of
Canada	*Alberta, Province of*	Mexico	*Mexico, State of*
Canada	*British Columbia, Province of*	Mexico	Monterrey, Municipality of
Canada	Durham, Regional Municipality of	Mexico	Morelos, State of
Canada	Government of Nunavut	Mexico	Nicolas Romero, Municipality of
Canada	*Halton, Regional Municipality of*	Mexico	Nogales, Municipality of
Canada	London, City of	Mexico	Nuevo Leon, State of
Canada	Manitoba, Province of	Mexico	Oaxaca de Juarez, Municipality of
Canada	*Montreal, City of*	Mexico	Oaxaca, State of
Canada	Muskoka, District Municipality of	Mexico	Puebla, State of
Canada	New Brunswick, Province of	Mexico	Queretaro, Municipality of
Canada	Newfoundland and Labrador, Province of	Mexico	Queretaro, State of
Canada	North Bay, City of	Mexico	Ramos Arizpe, Municipality of
Canada	Northwest Territories	Mexico	Reynosa, Municipality of

(*continued on next page*)

Appendix A (*continued*)

Country	Location	Country	Location
Canada	Nova Scotia, Province of	Mexico	San Luis Potosi, State of
Canada	*Ontario, Province of*	Mexico	San Luis Rio Colorado, Municipality of
Canada	Ottawa, City of	Mexico	San Pedro Garza Garcia, Municipality of
Canada	Peel, Regional Municipality of	Mexico	Sinaloa, State of
Canada	Prince Edward Island, Province of	Mexico	Sonora, State of
Canada	Quebec, City of	Mexico	Tabasco, State of
Canada	Quebec, Province of	Mexico	Tamaulipas, State of
Canada	Saskatchewan, Province of	Mexico	Tecamac, Municipality of
Canada	St. John's, City of	Mexico	Tlalnepantla, Municipality of
Canada	*Toronto, City of*	Mexico	Tlaquepaque, Municipality of
Canada	*Vancouver, City of*	Mexico	Tlaxcala, State of
Canada	Waterloo, Regional Municipality of	Mexico	Toluca, Municipality of
Canada	Winnipeg, City of	Mexico	Tuxpan, Municipality of (VeraCruz)
Canada	Yellowknife, City of	Mexico	Tuxtla Gutierrez, Municipality of
Canada	*York, Regional Municipality of*	Mexico	Uruapan, Municipality of
Colombia	Bogota, Distrito Capital (Colombia)	Mexico	Valle de Chalco Solidaridad, Municipality of
Colombia	Medellin, City of	Mexico	Veracruz, State of
Croatia	Zagreb, City of	Mexico	Zacatecas, Municipality of
Czech Republic	Brno, City of	Mexico	Zacatecas, State of
Czech Republic	Ceska Lipa, City of	Mexico	Zapopan, Municipality of
Czech Republic	Klatovy, City of	Mexico	Zapotlan el Grande, Municipality of
Czech Republic	Liberec, City of	Mexico	Zitacuaro, Municipality of
Czech Republic	Liberec, Region of	New Zealand	Auckland Council
Czech Republic	Moravian-Silesian, Region of	Norway	*Oslo, City of*
Czech Republic	Ostrava, City of	Peru	Lima, Municipality of
Czech Republic	*Prague, City of*	Poland	Olsztyn, City of
Czech Republic	Prostejov, City of	Poland	Poznan, City of
Czech Republic	South-Moravian Region	Poland	Starostwo Powiatowe w Zywcu
Czech Republic	Trebic, City of	Poland	*Warsaw, City of*
Czech Republic	Uherske Hradiste, City of	Portugal	Azores, Autonomous Region of
Czech Republic	Usti, Region of	Portugal	Madeira, Autonomous Region Of
Czech Republic	Zdar nad Sazavou, City of	Portugal	Sintra, City of
Denmark	Faroe Islands, Government of	Romania	Alba Iulia, Municipality of
Estonia	Tallinn, City of	Russia	Bashkortostan, Republic of
France	Cergy-Pontoise, Intermunicipality of	Russia	Belgorod, Oblast of
France	*Ile-de-France, Region*	Russia	Chuvashia, Republic of
France	Loiret, Departement du	Russia	Khanty-Mansiysk AO
France	Polynesie francaise	Russia	Komi, Republic of
France	Reunion, Region de la	Russia	Krasnodar, City of
Germany	*Baden-Wuerttemberg, Land of*	Russia	Krasnodar, Krai of
Germany	*Bavaria, Free State of*	Russia	Krasnoyarsk, Krai of
Germany	Berlin, Land of	Russia	Mordovia, Republic of
Germany	Brandenburg, Land	Russia	*Moscow, City of*
Germany	Nordrhein-Westfalen, Land of	Russia	*Moscow, Oblast of*
Germany	Saxony-Anhalt, Land of	Russia	Nizhniy Novgorod, Oblast
Greece	*Athens, City of*	Russia	Omsk, City of
Hungary	*Budapest, City of*	Russia	Omsk, Oblast of
Italy	Abruzzo, Region of	Russia	Samara, Oblast of
Italy	Basilicata, Region of	Russia	*St. Petersburg, City of*
Italy	Bolzano, Autonomous Province of	Russia	Tatarstan, Republic of
Italy	Campania, Region of	Russia	Volgograd, City of
Italy	*Lazio, Region of*	Russia	Vologda, Oblast of
Italy	Liguria, Region of	Serbia	Belgrade, City of
Italy	*Lombardy, Region of*	Serbia	Novi Sad, City of
Italy	*Milan, City of*	Serbia	Valjevo, City of

Appendix A (*continued*)

Country	Location	Country	Location
Italy	Molise, Region of	South Africa	Bergrivier, Municipality of
Italy	Naples, City of	South Africa	*Cape Town, City of*
Italy	Piedmont, Region of	South Africa	Ekurhuleni, City of
Italy	Sardinia, Autonomous Region of	South Africa	*Johannesburg, City of*
Italy	Sicily, Autonomous Region of	South Africa	Nelson Mandela, Metropolitan Municipality
Italy	Trento, Autonomous Province of	South Africa	Tshwane, City of
Italy	Umbria, Region of	Spain	Andalucia, Junta de
Italy	Valle d'Aosta, Autonomous Region of	Spain	Barcelona, City of
Italy	Veneto, Region of	Spain	Basque Country (The)
Italy	Venice, City of	Spain	Bizkaia, Diputacion Foral de
Japan	Fukuoka City	Spain	Castilla y Leon, Junta de
Japan	Fukuoka Prefecture	Spain	Castilla-La Mancha, Junta de Comunidades de
Japan	Hamamatsu City	Spain	Catalunya, Generalitat de
Japan	Hiroshima Prefecture	Spain	Extremadura, Junta de
Japan	Kyoto, City of	Spain	Galicia, Comunidad Autonoma de
Japan	Nagoya, City of	Spain	*Madrid, Comunidad Autonoma de*
Japan	Niigata Prefecture	Spain	Murcia, Comunidad Autonoma de
Japan	*Osaka City Government*	Spain	Valencia, Generalitat de
Japan	Sakai City	Sweden	Gothenburg, City of
Japan	Sapporo, City of	Switzerland	Berne, City of
Japan	Shizuoka City	Switzerland	*Lugano, City of*
Japan	Shizuoka Prefecture	Switzerland	Ticino, Republic and Canton of
Japan	Yokohama, City of	Trinidad & Tobago	Tobago House of Assembly
Kazakhstan	*Astana, City of*	Turkey	*Istanbul, Metropolitan Municipality of*
Korea	Daejeon Metropolitan City	Turkey	Izmir, Metropolitan Municipality of
Latvia	*Riga, City of*	Ukraine	Kharkiv, City of
Malaysia	Sarawak, State of	Ukraine	Kyiv, City of
Mexico	Acapulco, Municipality of	United Kingdom	Aberdeen City Council
Mexico	Acolman, Municipality of	United Kingdom	Cornwall Council
Mexico	Aguascalientes, Municipality of	United Kingdom	Guildford Borough Council
Mexico	Baja California, State of	United Kingdom	Lancashire County Council
Mexico	Benito Juarez (Cancun), Municipality of	United Kingdom	Warrington Borough Council
Mexico	Campeche, Municipality of		

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