How Organizational and Geographic Complexity Influence Performance? Evidence from European Banks

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Abstract

We empirically investigate how complexity stemming from the type of foreign affiliates and the geographic dispersion of such affiliates affects the parent bank's individual risk and profitability. Our analysis is based on detailed hand-collected data on the worldwide locations of subsidiaries and branches of EU banks. Our results show that being present abroad is beneficial for bank stability as it contributes to lower default risk. Banks that are present abroad through both subsidiaries and branches appear to be more stable than banks that are present under one form only. Being present with branches only is the most effective way to reduce risk-taking. Nevertheless, higher geographic dispersion of affiliates around different world regions is associated with higher volatility of earnings and higher profitability.

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1. Introduction

Throughout the persistent liberalization and deregulation of financial systems around the world, banks have progressively grown from standalone entities to large institutions owning or owned by other companies which led to financial conglomerates and bank holding companies (BHC) with numerous domestic and foreign affiliates [Herring and Santomero (1990) and Herring and Carmassi (2010)]. Banks have grown in size, in business types, in affiliate types, and are more and more present worldwide which poses major threats for financial stability [Cetorelli et al. (2014) and Carmassi and Herring (2016)]. Regulators are therefore not only concerned about banks being too-big-to fail but also by the tendency of more and more banks becoming "too-complex-to-fail"[2]. They have thus responded worldwide by advocating restrictions on bank size and scope of activities, ring fencing of activities into legally, functionally, and financially separated entities, setting additional capital requirements to build a capital cushion, and defining living wills and recovery and resolution frameworks in case of (systemically important) banks' collapses [IMF-BIS-FSB (2009)[3], Volcker Rule in Dodd-Franck Act (2010), Liikanen Report (2012), BCBS (2013), and Vickers Report (2013)].

In this work, we extend the literature on bank internationalization to account for both organizational and geographic complexity. We look at how banks are organized abroad by considering the type of their affiliates (subsidiaries or branches). While subsidiaries need to comply with host country regulatory requirements, branches are extensions of the parent bank and in general need to abide home country rules. We investigate how the complexity of a bank's network of foreign affiliates and the geographic dispersion of such affiliates affect the parent bank's individual risk and profitability.

More specifically, we examine whether the way that a bank is present abroad in a different number of countries affects its risk and profitability. We address the issue of foreign bank penetration and organizational complexity by differentiating three types of penetration strategies: 1/ foreign subsidiaries only; 2/ foreign branches only; or 3/ dual strategy with both

[2] A report by the International Monetary Fund (IMF) and Bank for International Settlements (BIS), and Financial Stability Board (FSB) (IMF-BIS-FSB (2009)) defines a complex institution as an institution or financial group that (a) operates diverse types of activities through numerous legal entities (e.g., simultaneously operating banking, insurance and securities subsidiaries); (b) operates across borders with centrally managed capital and liquidity (as opposed to simpler networks of domestic subsidiaries); and/or (c) has exposures to new and complex products and markets that have not been sufficiently tested.

[3] International Monetary Fund (IMF) and Bank for International Settlements (BIS), and Financial Stability Board (FSB): Guidance to Assess the Systemic Importance of Financial Institutions, Markets and Instruments: Initial Considerations. A report to the G20 Finance Ministers and Central Bank Governors.

types of affiliates. Because multinational banks are present in different world regions, we also investigate the influence of geographic complexity captured by the dispersion of affiliates across the globe. We use hand-collected data on the number and location of banks' foreign affiliates around the world for a sample of 825 commercial, cooperative, and savings banks from the 28 European Union countries. We also construct indexes of bank activity restrictions, capital requirements, and official supervisory power to capture the state of banking regulation in each home country. Our data cover the 2011-2013 period and reveal that being present abroad is beneficial for bank stability as it contributes to lower default risk. Also, banks that are present abroad through both subsidiaries and branches appear to be more stable than banks that are present under one form only. Furthermore, being present with branches only is the most effective way to reduce risk-taking of the mother bank. Nevertheless, higher geographic dispersion of affiliates around different world regions is associated with higher volatility of earnings and higher profitability.

The rest of the paper is organized as follows. Section 2 presents related literature and our research focus. Section 3 describes the sample and provides details on the data. In Section 4 we present the econometric methodology and Section 5 discusses the empirical findings and further investigations of our main results. In Section 6 we perform some robustness checks and Section 7 concludes the paper.

2. Related literature and research focus

2.1. Bank complexity

In recent years, many academics have investigated the issue of complexity of financial institutions but no consensus has yet been reached on the general definition and implications of such a concept. From the Atlas of Economic complexity [Hausmann et al. (2011)], "the complexity of an economy is related to the multiplicity of useful knowledge embedded in it. Economic complexity, therefore, is expressed in the composition of a country's productive output and reflects the structures that emerge to hold and combine knowledge." Building on this the Basel Committee on Banking Supervision (BCBS, 2013) proposes three balance sheet indicators of bank overall complexity that first capture the complexity of the funding of banks' operations, second the complexity in supplying the market with liquidity, and third, the value of over-the-counter derivatives. As the BCBS identifies structural complexity as part of overall complexity, other authors have worked on the different dimensions of structural complexity.

Carmassi and Herring (2013), Laeven et al. (2014), and Barth and Wihlborg (2016, 2017) consider the number of subsidiaries as a measure of bank organizational complexity. Yet, as the number of subsidiaries cannot fully capture the level of complexity of a global bank, Cetorelli and Goldberg (2014) provide four metrics of complexity within global financial institutions. First, the standard measure considers the degree to which an institution is structured in different affiliates by counting the number of affiliates (both domestic and foreign). Then, looking at the type of each affiliate, they define a second indicator which is the ratio of the number of non-banking affiliates to the total count of affiliates. Besides the two previous measures of organizational complexity, the authors suggest two normalized indexes to capture business and geographic complexity. As the liberalization of banking systems has enabled banks to carry out a multitude of activities in both domestic and foreign markets, the business complexity sizes-up the diversification of activities conducted by the affiliates. Finally, given that bank expansion strategies depend on where the foreign entities are located, geographic complexity is an indicator of the dispersion of the global banks' affiliates in different world regions.

2.2.2. Foreign complexity and bank performance

An extant literature has examined the development of cross-border activities documenting significant penetration of foreign markets and the rise of multinational banks [Kindleberger (1983), Berger et al. (2000), Claessens and van Horen (2014)]. Such papers have investigated the impact of such trends on either host country or home country bank performance and on global banking stability [Demirguc-Kunt et al. (1998), Claessens et al. (2001), Clarke et al. (2003), Cerutti et al. (2007), Chen and Liao (2011), Chou and Shen (2014), Cerutti (2015), Karyoli and Taboada (2015)]. Banks have grown into larger institutions to exploit potential economies of scale and scope, market power, competition, activity diversification, and differences in bank regulation and supervision.

Clarke et al. (2003) summarize studies on the development of bank internationalization and point to tree main options: cross-border lending, mergers and/or acquisitions of foreign institutions or domestic ones with foreign operations, and setting up de novo entities. The choice of an onshore presence calls for the choice of an organizational form: branch and/or subsidiary. On the one hand, a branch structure is an extension of the parent bank that draws on the parent bank's capital. A branch default directly affects the whole banking group and vice versa, a banking group collapse pulls all branches down. On the other hand, a subsidiary structure is a

separated and independent entity with its individual capital, accounting statements, and financial, regulatory and legal requirements. Because of limited liability, a subsidiary default can be separated from the parent and reciprocally, a parent bank can default without its subsidiaries defaulting. Depending on the regulatory and economic conditions in both the home and host countries, De Haas and van Lelyweld (2010), IMF (2011), and Fiechter et al. (2011) find that foreign bank subsidiaries are more capable to shield themselves from parent financial distress and are less costly to resolve. However, because of the existence of expropriation rules or internal markets with centralized capital and liquidity makes a branch gives the parent bank a greater ability to withstand specific shocks through an effective pool of profits and risks from healthy and troubled offices [Dell'Ariccia and Marquez (2010), Fiechter et al. (2011)]. As both structures do not imply the same degree of support and level of commitment from the foreign parent bank, how banks' foreign complexity affects performance and risk is yet unclear.

Regardless of the recommendation the BCBS (2013) against the use of bank size per se as a measure of large banks' complexity, many papers have looked into such a direction. Hughes and Mester (2013) investigate the relation between large financial institutions and cost advantages to the global market economy and find significant economies of scale for the largest banks but an increase of risk-taking incentives. Cetorelli and Goldberg (2014) examine the complexity of global banking organizations and find that while for U.S. banks with foreign activities and foreign banks operating in the U.S. complexity cannot be associated with the size of global banking organizations, the number of affiliates is the only measure of complexity correlated with size. Focusing on global banks with branch operations in the U.S., Cetorelli and Goldberg (2016) find balance sheet management strategies to be determined by the structure of the parent organization. We extend the literature by defining three[4] organizational strategies followed by banks around the world to isolate more accurately the implications on bank performance. The first strategy consists of operating foreign branches exclusively, the second consists of operating foreign subsidiaries only, and the last one is the dual strategy combining branches and subsidiaries abroad.

Beside the type of foreign organizational strategies banks chose, considering the different locations of the affiliates is also important to understand and capture complexity. Goetz et al.

[4] Given that we analyze parent banks and their network of banking counterparts, we cannot construct the aforementioned business complexity index. In the same line, the organizational complexity metrics we build concerns bank-type affiliates only.

(2016) who have analyzed the geographic expansion of bank holding companies (BHC) argue that by diversifying their activities into various markets, parent banks lower their total exposure to local markets idiosyncratic risk, and thus, finally reduce the BHC's risk. By using either the distance between the capital cities of the parent bank and its affiliates or the number of locations where multinational banks operate, Liang and Rhodes (1988), Deng and Elyasiani (2008), and Fang and van Lelyveld (2014) conclude that geographic diversification in banking is significantly associated with increased value of the banking group, higher risk-adjusted returns, and lower risk. These studies also highlight that an increase of the distance between the parent and affiliates' locations leads to greater estrangement and is associated with higher costs and management issues that might hinder the benefits of geographic diversification. Overreaching multiple markets might increase the exposure to competition and to different economic and regulatory conditions. Indeed, a bank with subsidiaries and/or branches in ten countries part of one world region does not pursue the same goal as a bank with foreign affiliates in ten foreign countries part of different regions. To our knowledge, the existing literature does not investigate the effect on individual parent bank's risk and profitability looking at both the number of affiliates and number of locations. We fill this gap by building a measure that accounts for the type of affiliates, the number of affiliates in each world region, and the total number of regions and go further to analyze geographic complexity in banking.

3. Data, variables and summary statistics

In this section, we describe the bank financial variables and country global indicators we use in our empirical framework.

3.1. Sample

To construct the sample, we consider banks established in the 28 European Union countries[5] and build a panel of bank and country annual data that spans the 2011-2013 period. Information on banks is extracted from the Bureau Van Djik (BvD) Bankscope database. Regarding bank foreign presence around the world, we hand-collect the number and locations of their foreign subsidiaries from Bankscope and the number and locations of their foreign branches from the SNL database, as at the end of 2013. Then, for each bank and its affiliates,

[5] All EU countries are Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and United Kingdom.

we go through bank annual reports and websites to match the collected data and, in cases of discrepancies, we retrieve complementary data. We obtain 1,094 banks specialized in commercial, cooperative, and savings[6] activities. Bank variables based on financial statements are winzorized at 1 % and 99 % levels to limit the influence of outliers and extreme values. We filter the dataset to ensure that observations are available each year and end up with a sample of 825 banks of which 102 are publicly traded on stock markets. Overall, the final sample for our empirical analysis includes 2176 bank-country-year observations.

3.2. Foreign presence and organizational complexity variables

In this paper, one main objective is to determine the extent to which the internationalization of a bank in terms of its worldwide presence and its foreign structure with branches and/or subsidiary influences its stability and profitability. Although the data on affiliates are collected for 2013 solely we assume that because the legal procedures and costs related to opening or closing foreign affiliates are relatively high our measures of internationalization also hold for 2011 and 2012. We use these data to create a dummy variable $Foreign_i$ that takes the value one when the bank *i* from home country *j* owns at least an affiliate (subsidiary and/or branch) abroad, and zero otherwise. We also build a variable Nb_Host_i to measure the presence of each bank around the world through the number of host countries where there is a foreign affiliate. From the aforementioned definitions of subsidiaries and branches, using the two previous variables only might not fully reflect the impact of internationalization on bank performance. Hence, we deepen the analysis with a focus on the complexity of the foreign structure of multinational banks through the organizational forms they establish abroad. Going further than prior studies [Laeven, et al., (2014) , Carmassi and Herring (2013, 2016), and Barth and Wihlborg (2016, 2017)] that used the number of subsidiaries as an indicator of complexity, we build three dummies that more finely map the different strategies banks have established on the period of study. Considering our global sample of 825 banks, $Bank\_S_i$ is a dummy equal to one when the bank is structured through a network of foreign subsidiaries only (at least one subsidiary abroad and zero branch) and zero otherwise; $Bank\_B_i$ is equal to one when the bank owns a network of foreign branches only (at least one foreign branch and no foreign subsidiary) and zero otherwise, and $Bank\_BS_i$ takes the

[6] We focus on banks with these business specializations because the activities conducted by such institutions are globally similar.

value one when the bank has a foreign network with both foreign subsidiaries and branches, and zero if not.

Table 1 breaks down the distribution of the 825 banks among the 28 European Union countries and by specialization (respectively 440 commercial, 207 cooperative and 178 savings banks). Our dataset indicates that French and German banks represent 32% of the whole sample and Latvia and Greece have the fewest representatives. Out of the 825 banks in the sample 160 have foreign affiliates. French and German banks have the broadest international presence in respectively 85 and 71 host countries. 73 banks are present abroad with foreign subsidiaries exclusively, 33 banks with branches only, and the rest of the 54 banks have both types of affiliates abroad.

[Insert **Table 1**

here]

To gauge for geographic complexity, we consider dispersion of the different regions where banks operate their representatives. Given all social, cultural, political, and economic differences among countries, the presence in one or many countries from one or many world regions does not portray the same implications for the mother bank. Once banks have penetrated a specific region, they benefit from experience allowing them to more easily enter in other countries of the same world region. On the basis of the World Bank regional division of all countries around the world, we define the following eight groups[7]: East Asia & Pacific (EAP), Europe (EUR), Central Asia (CA), Latin America & Caribbean (LAC), Middle East & North Africa (MENA), North America (NA), South Asia (SA), and Sub-Saharan Africa (SSA). Following Cetorelli and Goldberg (2014) we construct a normalized Herfindhal index that captures the complexity of foreign banks located in different world regions *r* and ranges from 0 (lowest complexity) to 1 (highest complexity). Given the construction of *GeoComplex*, the lowest complexity also indicates a presence in a unique region and the highest complexity captures a presence in all regions with the same number of affiliates. We use the previously defined regions to build an index for each of the 160 banks that have established entities abroad:

[7] The World Bank (WB) regional division of countries consists of seven groups with Europe and Central Asia (ECA) representing a unique group. Yet, considering the countries and their economic, sociologic, cultural, and political specificities, we divide ECA into Europe (EUR) for countries in ECA and on the Europe continent and Central Asia (CA) for the rest. As well, while examining countries in MENA region as defined by the WB, we remove Malta and Gibraltar from the list and move them in the newly created Europe region.

$$GeoComplex_i = \frac{R}{R-1}\left(1 - \sum_{r=1}^{R}\left(\frac{NbAffiliates_{i,r}}{NbAffiliates_i}\right)^2\right)$$

where R is the total number of regions r around the world (i.e. 8) ; $Nb\_Affiliates_{i,r}$ is the number of affiliates of bank i in region r ; and $Nb\_Affiliates_i$ is the total number of affiliates of bank i. Further, we adjust the definition of *GeoComplex* and split the index into the geographic dispersion of subsidiaries and branches. *GeoComplexS* and *GeoComplexB* respectively measure the geographic complexity of foreign subsidiaries (with $Nb\_S_{i,r}$ and Nb_S_i) and foreign branches (with $Nb\_B_{i,r}$ and Nb_B_i)[8].

Table 2 presents the distribution of banks by country and the three geographic complexity variables. On average, while Swedish banks totalize the highest number of regions where their foreign affiliates (6.33) and specifically subsidiaries (6.33) are located, French banks are the ones that establish their branches in the highest number of regions (2.27). From the average value of the indexes of geographic complexity GeoComplex and GeoComplexS, highly complex banks are originated from Hungary, Sweden, and Portugal.

[Insert **Table 2** here]

3.3. Bank risk and profitability variables

To capture the effect of bank internationalization and complexity on bank performance, we calculate different indicators of banks risk and profitability. As common in the empirical banking literature, we compute the Zscore to proxy bank stability [Boyd and Graham (1986), Laeven and Levine (2009), Demirguc-Kunt and Huizinga (2010)]. This time-varying variable serves as the main indicator of riskiness and is calculated as:

$$Zscore_{i,j,t} = \frac{mROA_{i,t} + mEQTA_{i,t}}{SDROA_{i,t}}$$

Where $ROA_{i,t}$ is the return on assets of bank i in year t, $EQTA_{i,j,t}$ is the ratio of total equity over total assets, and $SDROA_{i,j,t}$ is the standard deviation of return on assets. We apply a three-year window[9] and follow a widespread method to calculate moving averages m$ROA_{i,j,t}$ and m$EQTA_{i,j,t}$ and standard deviations $SDROA_{i,j,t}$. The Zscore measures the distance from bank insolvency which is defined as the number of standard deviations by which the return on assets

8 In Appendix A we present the detailed list of host countries that constitute each of the eight regions. Figure A.1 maps the seven world regions by the World Bank sub-division.

9 We calculate the Zscore using four-year and then five-year rolling window but the considerable loss of observations made the variables statistically unfit for the regressions.

must fall below its mean to deplete equity. This construction with accounting information enables us to estimate bank distance to default and express "absolute" level of risk-taking[10]. Given that Zscore is interpreted as the inverse of the probability of bank failure, higher values reflect higher levels of bank financial stability or lower exposure to bankruptcy risk.

We then follow Goyeau and Tarazi (1992) and Lepetit et al. (2008) for a deeper insight and split the Zscore into its two components Zscore1 and Zscore2[11] to respectively measure bank portfolio risk and leverage risk:

$$Zscore1_{i,j,t} = \frac{mROA_{i,j,t}}{SDROA_{i,j,t}} \qquad Zscore2_{i,j,t} = \frac{mEQTA_{i,j,t}}{SDROA_{i,j,t}}$$

This breakdown of Zscore shows whether bank default risk is mainly driven by asset risk or leverage risk. An increase in Zscore1 and Zscore2 indicates lower asset risk and leverage risk respectively.

Because Zscore, Zscore1, and Zscore2 distributions are heavily skewed, we follow Laeven and Levine (2009) and Houston et al. (2010) and apply the natural logarithm to smooth the higher values of these variables. In the rest of the paper, we will refer to $ln(Zscore_{i,j,t})$, $ln(Zscore1_{i,j,t})$, and $ln(Zscore2_{i,j,t})$ when we refer to the different risk measures.

Additionally, we complete the previous risk measures with the three-year rolling-window standard deviation of the return on assets $SDROA_{i,j,t}$ for each bank. An increase in the standard deviation indicates higher returns' volatility and therefore higher risk-taking behaviors. Finally, to measure the profitability of each bank, we consider the three-year moving average of the return on assets ROA[12].

2.3.4. Control variables

3.4.1. Bank-level variables

We control for bank size with the natural logarithm of total assets *logTA*. Large banks benefit from their portfolios of customers to develop broader international networks where the

[10] We also experiment another approaches of Zscore based on Yeyati and Micco (2007) and Lepetit and Strobel (2013) using three-year, four-year and five-year rolling window to calculate moving average $mROA_{i,t}$ and standard deviation $SDROA_{i,t}$ and combining them with the current period values of $EQTA_{i,t}$. Comparing all regressions, we either find no changes in our main results or the significance tests are favor the use of the "classic" method (the tables are available from the authors upon request).

[11] $Zscore = Zscore1 + Zscore2 = \frac{mROA_{i,j,t}}{SDROA_{i,j,t}} + \frac{mEQTA_{i,j,t}}{SDROA_{i,j,t}}$

[12] Considering the ROA instead of the return on equity (ROE) allows us to fully consider the bank's ability to generate earnings from its investments.

profit opportunities, and business or risk diversification might be greater. Either they generate economies of scale and scope that could increase their profitability or they face costs that make them less profitable. Additionally, as size is often associated to complex structure and diversified activities, such banks have advanced management skills which should make them less risky and more stable or, in contrary, moral hazard induced by their "too-big-to-fail" status can exacerbate their incentives to engage into risk-taking activities. We go further and add the ratio of a bank's total assets to its country aggregate bank assets *MarketShare* to capture whether the importance of a bank relatively to its home banking industry affects its stability. For banks confronted to competition in such local markets, the effect can be ambiguous [Caminal and Matutes (2002), Boyd and de Nicolo (2005), Agoraki et al. (2011)]. Higher *MarketShare* could be associated with higher market power and thus higher risk taking. However, the impact on profitability is undetermined because such banks can be more or less efficient which in turn could encourage them to invest in less risky portfolios.

We also control for leverage by introducing the ratio of equity to total assets (*EQ_TA*). Strongly capitalized banks are expected to be more efficient at bank management and use their expertise to raise funds at lower costs which should increase their profitability. Higher capital ratios provide a greater cushion against financial distress and contribute to make the bank safer and decrease its failure risk. However, high levels of capital could also encourage banks to take more risk. We also include efficiency by considering the cost to income ratio (*CIR*) which is expected to decrease bank financial stability [Athanasoglou et al. (2008), Barry et al., (2011)].

The bank's business model (focus versus diversification) is also likely to affect its performance. Reliance on non-traditional banking activities can be associated to higher risk and profitability [Boyd and Graham (1986, 1988), Stiroh (2004), Lepetit et al. (2008), De Jonghe (2010)]. Demirguc-Kunt and Huizinga (2010) suggest that expansion into non-interest activities increases the rate of return on assets and could offer some risk diversification benefits whereas DeYoung and Torna (2013) argue that during the financial crisis the probability of bank failure has decreased with fee-based income but increased with asset-based nontraditional banking activities. We capture the diversification across sources of income such as interest activities, commission and fees activities and trading activities with *IncomeDivers* [Laeven and Levine (2007), Beltratti and Stulz (2012)]. Comprised between zero and one with higher values indicating greater diversification, the degree of diversification is calculated as:

$$IncomeDivers = 1 - \left| \frac{Net\ Interest\ Income - Other\ Operating\ Incone}{Total\ Operationg\ Income} \right|$$

We further introduce the ratio of net loans to total assets (*L_TA*) to account for the extent to which banks are focused on traditional intermediation activities given that pursuing lending activities is more likely through foreign subsidiary whereas promoting modern banking activities by exporting the mother bank's skills and technology is expected to be easier through branches. Banks where the ratio is higher can be more profitable and less risky if the loans in the portfolio are also profitable, perform well, and are secured [Acharya et al. (2006)].

To determine whether the presence of public owners in the bank's capital influences its profitability and risk, we build the dummy *Listed* equal to one when the bank is publicly listed and zero if not. Banks traded on stock markets should be more profitable and riskier [Barry et al. (2011), Saghi-Zedek and Tarazi (2015)]. Finally, to control for the difference of influence of bank specialization types on the financial performance, we define dummies variables *Coop* and *Savg* which take the value one respectively for cooperative and savings banks.

[Insert **Table 3** here]

We present in Table 3 the descriptive statistics and sources of all individual bank-level variables used in our empirical work.

3.4.2. Country-level regulatory, macroeconomic and institutional variables

Our study focuses on the performance of the parent bank that conducts international activities. Considering that the main bank undergoes the regulation of its home country, we include home country regulatory variables in our regressions as local regulators are particularly concerned by the parent bank's behavior as they are directly affected by its policy. We follow Barth et al. (2001, 2004, and 2013) and use the data from the Bank Regulation and Supervision Survey carried out by the World Bank to define three regulatory variables. Because the data are not available annually, we use the latest 2012 survey to create the country-level regulation variables for the 2011-2013. Various authors have worked on these regulatory parameters and their findings point to contrasting effects showing that the multi-faceted of bank regulation and supervision might increase or as well decrease bank risk and profitability [Furlong and Keeley (1989), Hellmann et al. (2000), Gonzalez (2005), Klomp and de Haan (2012), Barth et al. (2013), Beck et al. (2013)].

Bank Activity Restrictions (*Restrictions*) is an index that assesses the conditions under which banks can engage in four categories of activities: securities activities, insurance activities, real estate activities, and nonfinancial businesses except those businesses that are auxiliary to

banking business. For each category of activities, there are four possibilities that are weighted from 1 to 4 when they are respectively unrestricted (=1), permitted (=2), restricted (=3), and prohibited (=4). Hence, the index ranges from a lowest stringency at 1 to the highest at 16 when limitations of banking operations are extremely stringent. Capital Regulatory Index (*RegulCapital*) is a variable that ranges from 0 to 18 and is constructed as the sum of 18 binary "yes" or "no" answers regarding the country's overall and initial capital stringency indexes. This variable provides information on certain risk elements, market value losses, and minimum capital rules. Also, it tells us which types of funds were used to initially capitalize a bank and whether the funds are officially verified. Official Supervisor Power (*Supervision*) is an index that evaluates whether supervisory authorities have the power to take specific preventive and corrective actions based on auditing, internal/board/ownership rights structure, profits and losses and other balance sheets items. The index ranges from 0 to 22 and a higher value indicates a greater power. Beltratti and Stulz (2012) found that better performing and profitable banks come from strictly regulated countries in terms of activities *Restrictions*, *RegulCapital* stringency and official *Supervision*.

We also consider macroeconomic and institutional variables from the Global Financial Development Database (GFDD 2015), and the World Development Indicators (WDI 2015) provided by the World Bank. Country characteristics might affect financial stability since banks from a country with stronger institutional factors tend to perform better in normal as well as crisis periods [John et al. (2008)]. The growth rate of the real gross domestic product (*GDP growth*) is used to capture business opportunities in the country and we expect more stable and profitable banks when growth is higher. Finally, we consider the variable *LegalStrength* that measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. Strength of legal rights is an index that ranges from 0 to 10 with higher scores indicating that these laws are better designed to expand access to credit.

In Table 4 we show the distribution of banks by country with the descriptive statistics and sources of all macroeconomic and institutional variables.

[Insert **Table 4** here]

4. Empirical Methodology

We investigate the impact of bank internationalization and foreign organizational complexity on bank risk and profitability. At first, considering the full sample of banks we analyze the presence of a bank abroad, the degree of such presence in host countries, and the choice of the foreign organizational structure i.e. an exclusive strategy with foreign subsidiaries or branches only or a dual strategy with both types of affiliates. We estimate $I_{i,j,t}$ i.e. the performance of bank *i* from home country *j* at time *t*, through the following equations including the aforementioned control variables and country and year dummies, respectively D_j and D_t:

$$I_{i,j,t} = \alpha_0 + \beta_1 International_i + \delta_1 Financial_{i,t} + \delta_2 Country_{j,t} + D_j + D_t + \varepsilon_{i,j,t} \quad (1)$$

$$I_{i,j,t} = \alpha_i + \beta_1 Organizational_i + \delta_1 Financial_{i,t} + \delta_2 Country_{j,t} + D_j + D_t + \varepsilon_{i,j,t} \quad (2)$$

Then, focusing solely on the sub-sample of 160 banks that operate foreign entities, we estimate the influence of the geographic dispersion of those affiliates on bank risk, risk-taking behavior, and profitability.

$$I_{i,j,t} = \alpha_i + \beta_1 Geographic_i + \delta_1 Financial_{i,t} + \delta_2 Country_{j,t} + D_j + D_t + \varepsilon_{i,j,t} \quad (3)$$

Where, for bank *i* from country *j* at time *t*, $I_{i;j;t}$ alternatively represents each of the five measures of bank performance: the four bank risk variables $ln(Zscore_{i,t})$, $ln(Zscore1_{i,t})$, $ln(Zscore2_{i,t})$, and $SDROA_{i,j,t}$, and bank profitability $ROA_{i,j,t}$; $International_i$ in Eq. (1) is either $Foreign_i$ a dummy that takes the value one when the bank is present abroad, and zero otherwise or Nb_Host_i the number of host countries where a bank owns an affiliate ; $Organizational_i$ in Eq. (2) measures the foreign organizational complexity alternatively with $Bank\_S_i$, a dummy for owning foreign subsidiaries only, or $Bank\_B_i$, a dummy for owning foreign branches only, or $Bank\_BS_i$, a dummy for owning both affiliate types abroad ; $Geographic_i$ in Eq. (3) measures the bank geographic complexity alternatively with $GeoComplex_i$, $GeoComplexS_i$, and $GeoComplexB_i$; $Financial_{i,j,t}$ is the vector of bank explanatory characteristics (*logTA*, *MarketShare*, *EQ_TA*, *CIR*, *IncomeDivers*, *L_TA, Listed, Coop, Savg*) ; and $Country_{j,t}$ contains the three home country regulatory indexes (*Restrictions*, *Capital*, *Supervision*) and the macroeconomic and institutional variables (*GDPgrowth*, *LegalStrength*). All dependent and control variables were defined in Section 3.

Our baseline econometric model investigates the effect of bank internationalization on five dependent (risk and profitability) variables. Given all time-invariant and dummy variables,

we cannot use the fixed effect (FE) option which will omit those variables. Yet, from the results of the Hausman specification test [Hausman (1978)], the random effect (RE) is inconsistent for the estimation of our model. Hence, to take into account all parameters, we set on the Hausman-Taylor (HT) estimator as it addresses correlation between explanatory variables and seems more appropriate [Hausman and Taylor (1981), Baltagi (2005), Greene (2012)]. Finally, we follow Baltagi et al. (2003), Baltagi (2005), and Bouvatier (2014) by applying a Hausman test between the FE and HT estimators to identify the mix of endogenous variables that will generate the most consistent HT estimation. Eq. (1), Eq. (2) and Eq. (3) are estimated using the HT random effect model with standard errors clustered at bank-level.

Table 5 shows the overall correlation coefficients among all variables. Overall, the test statistics reveal no major collinearity issues, which enable us to use the variables simultaneously in the regressions.

[Insert **Table 5** here]

5. Econometric results

We first investigate the effects of bank foreign presence and affiliates complexity with subsidiaries or/and branches on the parent bank's risk and profitability. Second, we analyze the influence of the geographic complexity of banks with foreign affiliates. Third, we conduct further explorations to examine how the sub-sampling of banks by different size of the balance sheet and the shock of the sovereign debt crisis might produce changes on the bank performance.

5.1. Effect of foreign presence and foreign organizational complexity on bank risk and profitability

We report in Table 6 the estimated coefficients of Eq. (1) from the Hausman-Taylor specification. The dummy Foreign that assesses the presence of a bank abroad significantly indicates lower risk and lower profitability (columns (1a)–(5a)). The coefficients are positive for two risk indicators (Zscore and Zscore2) and negative for the risk-taking proxy (SDROA) and profitability (ROA). Relatively to banks with only domestic activities, building a foreign network tends to increase the parent bank individual financial stability while decreasing the profitability. Considering the other axis of internationalization defined by the number of host

countries where a bank is present, the effect is similar albeit a lesser significance of some coefficients. While banks operating in many foreign countries face lower bankruptcy and leverage risks (higher Zscore and Zscore2), they engage into fewer risk-taking activities for poorer profitability. On a statistical view, the impact of the foreign presence on bank performance is always greater than the number of host countries. One possible explanation for this result is that as parent banks evaluate the benefits and riskiness of internationalization at the first stage of the decision of going abroad, the widespread of the network which is decided at a second stage is henceforth associated with and additional effect of small intensity.

[Insert **Table 6** here]

From the estimations of Eq. (2) reported in Table 7 we observe the effect of banks foreign organizational complexity on their performance. We first analyze the expansion with foreign subsidiaries exclusively (columns (1c)–(5c)) and the results show a decrease of the bank exposure to risk through lower probability of default and leverage risk as well as lower volatility of the returns on assets and lower profitability (higher Zscore and Zscore2, lower SDROA, and lower ROA). Second, relatively to the previous organizational strategy, the dummy that captures the structure with foreign branches exclusively (columns (1d)–(5d)) indicates a strong negative impact on bank asset risk. This significant effect can be explained by the fact that a branch being an extension of the parent bank which has it assets and activities accounted for by the main entity, owing this affiliate directly affects the parent bank's asset risk. Third, we focus on the complexity with both foreign subsidiaries and branches (columns (1e)–(5e)) and the results show that banks operating both organizations abroad are significantly less profitable. Moreover, such institutions are also less vulnerable as all default risk, leverage risk, variability of returns, and returns on assets decrease. Comparing the three sets of dummies on a statistical angle, banks operating a more complex network of foreign subsidiaries and branches have coefficients with greater absolute values which make them financially more stable (and less profitable) than banks with foreign branches exclusively which, with the exception of a greater effect on asset risk, are more stable than banks owning subsidiaries only abroad

[Insert **Table 7** here]

Looking at the control variables in Table 6 and Table 7, some findings differ from previous studies. As our estimations run on a period after the global financial and sovereign

debt crises, probably banks have experienced a change of behaviors and do not align with some existing literature. For instance, the results show that large banks that conduct activities in many countries (Table 6) display higher risk, more volatile returns, and higher profitability (lower Zscore and Zscore2, higher SDROA, and higher ROA). Yet, large banks with international affiliates (Table 6), either an exclusive form or a mix structure (Table 7), we only observe more volatile returns on assets and higher profitability. In contrast, banks with more market power are less profitable (lower ROA) and globally engage in less risky activities (lower SDROA). In all regressions, while better-capitalized banks are only associated with a lower variability of the returns, less cost-efficient banks display more asset risk (lower Zscore1) and less profitability. Similar to Lepetit et al. (2008) and Saghi-Zedek and Tarazi (2015), our results indicate that on the whole, banks that rely more on non-traditional intermediation activities are more risky (lower Zscore, Zscore1, and Zscore2) and banks with higher loans-to-total assets ratio globally exhibit less bank fragility (higher Zscore, Zscore1, and Zscore2 and lower SDROA). Conversely, publicly traded banks have poorer profitability, take less risk, and are less vulnerable than privately owned banks. This finding is opposite to what was hypothesized [Shehzad et al. (2010), Barry et al. (2011), Saghi-Zedek and Tarazi (2015)]. Probably, the recent economic shocks have weighted heavily on financial markets and actors have preferred to reduce their exposure to risk at the expense of their profitability. Finally, as expected, relatively to commercial banks, cooperative and savings banks are found to be financially more stable (higher three Zscore and lower SDROA) but also less profitable.

Regarding the home country variables, we find that the regulatory environment of the parent bank has strong influence on its risk and profitability. First, across all regressions, banks whose home country regulators have put stringent restrictions on banking activities appear less vulnerable with higher Zscore, Zscore1, and Zscore2 and lower SDROA. This result aligns with Boyd and Graham (1986) and serves as direct evidence that engaging into less securities, insurance, real estate, and non-financial activities tend to reduce the bank risk. However, because of the negative, albeit non-significant effect on the bank profitability, we fall short to support Barth et al. (2013)'s idea that more restrictions on activities are associated with less bank efficiency and fewer profits or Pasiouras et al (2009) who argued that stringent restrictions might force banks to focus or specialize more and perform better in the permitted activities. Second, stringent capital regulation at home tends to have a strong and conclusive effect on all four risk measures. Parent banks in markets with stringent capital requirements take less risk (lower SDROA) and are financially more stable (higher Zscore, Zscore1, and Zscore2). More stringency seems to give banks a propensity to engage into riskless operations and display

secured behavior in order to meet the authority recommendations. Third, in regards of the previous variables, the effects of greater home country supervisory power on banks' performance are opposite. Closer monitoring is significantly associated with lower distance to default, higher asset risk, higher leverage risk (lower Zscore, Zscore1, and Zscore2), and lower returns on assets. Stronger supervisory policies do not ensure more stable financial systems [Levine (2003), Laeven and Levine (2009), Barth et al. (2013a), Tabak et al. (2016)]. While Chortareas (2012) and Barth et al. (2013b) find that powerful supervision improve the governance and efficiency of banks' operations, increase banks' profitability, and reduce the volatility of the returns, our results show significant drops in profitability and no impact on bank risk-taking behavior. Finally, contrary to the studies suggesting lower risk and higher profitability for banks in countries with higher GDP annual growth rate [Molyneux and Thornton (1992), Beltratti and Stulz (2012), Distinguin et al. (2013)], we find that banks from country with higher growth rate appear more risky and more profitable. Additionally, in country with strong legal rights designed to better expand the access to credit, banks exhibit higher risk and poorer profitability. Possibly, during the 2011-2013 period, an environment where collateral and bankruptcy laws were extremely protective towards the rights of borrowers and lenders had ultimately worked against easing the lending and banks have contributed more in deposit insurance funds. This might have created a moral hazard giving banks an incentive to engage into excessive risk-taking operations and thus increase the banking system fragility.

5.2. Impact of geographic complexity on risk and profitability

We report in Table 8 the estimations of Eq. (3)[13] for all affiliates, subsidiaries, and branches. The results globally show that the geographic dispersion of foreign affiliates has a strong and significant influence on the financial stability of the parent bank, which appears relatively less risky and more profitable but with more volatile returns on assets. More specifically, analyzing the location of all affiliates in different world regions, the coefficients associated to GeoComplex indicate that while banks exhibit lower probability of default, asset risk, and leverage risk (higher Zscore, Zscore1, and Zscore2) for a higher profitability (higher ROA), they also take more risk (higher SDROA). Operating affiliates in multiple world regions with different social-economic-cultural characteristics enable banks to manage better and increase the potential benefits of country diversification. Then, considering the geographic

[13] Note that equation Eq. (3) runs on the smaller sample of 160 banks that operate foreign operations around 154 countries in 8 world regions, relatively to Eq. (1) and Eq. (2) that consider the full sample of 825 banks.

dispersion of banks' foreign subsidiaries, we find similar results i.e. banks establishing subsidiaries in many regions display higher three Zscore, higher SDROA, and higher ROA. Conversely, GeoComplexB indicates that the dispersion of branches across different world regions is also strongly and significantly negatively associated with bank probability of failure, asset risk, and leverage risk (higher Zscore, Zscore1, and Zscore2) but and a slightly poorer profitability (significance at 10%).

Considering the rest of control variables, we discuss some major results that differ from what was founded in Table 6 and Table 7. For instance, whereas the size of the bank uniformly contributes to lower the risk (higher three Zscore), higher market share leads to more risk-taking behavior (lower Zscore1 and higher SDROA) and higher asset risk only when the geographic complexity of subsidiaries is the variable of interest. Moreover, highly capitalized banks as well as loaned-up banks globally appear less vulnerable (higher Zscore, Zcore1, and Zscore2) but engage more into riskier operations which increase the variability of the returns and the returns as well (higher SDROA and ROA). We also find that banks that rely more on non-traditional banking activities take more risk and are less profitable. Regarding home country regulation, all coefficients significant at a 5% level maximum indicate that banks facing high restrictions on bank activities from their home regulators and banks complying to with stringent capital requirements tend to create more returns on assets. Conversely, when facing greater supervisory power form their local authorities, parent banks exhibit higher profitability and more variability of the returns. Finally, the growth rate of the GDP and the strength of the legal system of the home country are globally negatively associated with the bank risk and positively with the risk-taking proxy (SDROA) and the profitability (ROA).

[Insert **Table 8** here]

5.3. Further explorations of bank internationalization

We investigate in this section other factors that might produce any change on the effect of bank internationalization on bank risk and profitability. First, to test whether the size of the bank plays a role on the relation between bank foreign presence and bank performance, we analyze different sub-samples of banks defined by a threshold of total assets. Second, given that the year 2011 marks the peak time of the European sovereign debt crisis, we consider that year

as a time of great financial instability and investigate the specific effect during the severity of economic shock.

5.3.1. Bank size

We hypothesize that as banks usually gain advanced management skills and economies of scale and scope from their size[14], the effect of internationalization might differ across banks of different sizes [Bhagat et al. (2015), Laeven et al. (2016), Odlfather et al. (2016)].

To investigate the effects of size on the individual parent bank risk and profitability, we break the full sample into two groups based on the value of the balance sheet. First, we follow the European Central Bank (ECB) in their definition of different criteria[15] that make a bank significant enough that high supervisory standards are applied consistently. We build the sub-sample *ECB* of banks with a balance sheet size above a total of assets of 30 billion Euros (40 billion US dollar)[16]. Second, as 50% of the banks in the full sample have a total of assets of at least 3.190 billion US dollar, we use the corresponding threshold (i.e. the median of the full sample in Table 3) to define the other sub-sample *Large*. For both groups of banks we run Eq. (1) and Eq. (2) and estimate the specific influence of foreign activities on the bank performance.

Contrary to the global sample where we find that internationalization and foreign complexity are associated with lower risk and lower profitability for multinational banks, Table 9[17] indicates opposite results for *ECB* banks. First, from Eq. (1), while banks that are deemed significant for regulatory authorities slightly have higher asset risk and more volatile returns for a higher profitability (higher SDROA and ROA), the widespread of their foreign operations in many countries no longer affects strongly the bank performance. Second, regarding the organizational complexity, between the exclusive strategy with either subsidiaries or branches only and the mix model with both affiliate types, most of the results of Eq. (2) align with Eq. (1). Albeit the significance at a 10% level, the presence of an *ECB* bank abroad with subsidiaries

[14] The Basel Committee on Banking Supervision (BCBS, 2013) recommends against the use of the size of the balance sheet as a measure of the complexity of large banks but acknowledges that large banks behave differently from other banks.

[15] https://www.bankingsupervision.europa.eu/banking/list/criteria/html/index.en.html The four significance criteria of the European Central Bank concern the Size (the total value of its assets exceeds €30 billion) ; the Economic importance (for the specific country or the EU economy as a whole) ; the Cross-border activities (the total value of its assets exceeds €5 billion and the ratio of its cross-border assets/liabilities in more than one other participating Member State to its total assets/liabilities is above 20%) ; the Direct public financial assistance (it has requested or received funding from the European Stability Mechanism or the European Financial Stability Facility).

[16] Since our data are in US dollar we approximately set the threshold at 40 billion USD as the average exchange rate on the 2011-2013 period was about 1€ = $1.334946 (World Bank – World Development Indicators database).

[17] We report only the results obtained for the variables of interest. The rest of detailed results are available from the authors.

exclusively leads to poorer profitability, higher probability of default and leverage risk, and less risk-taking behavior. The foreign complexity through branches exclusively is the only organizational structure that continues to lower the parent bank individual asset risk in addition of higher default risk, more volatile returns, and higher profitability. Conversely, the effect of the penetration with foreign subsidiaries and branches is similar to the overall foreign presence i.e. banks take more risk and are more profitable (higher SDROA and ROA).

Turning to the sub-sample of *Large* [18] banks, the effects on the volatility of the return on assets have disappeared. As well, the foreign organizational complexity with branches only has no effect on the bank performance. Relatively to ECB banks, the five last columns of Table 9 indicate that *Large* banks that conduct cross-border operations in various host countries face more probability of failure, asset risk, and leverage risk (lower Zscore, Zscore1, and Zscore2). Regarding the foreign expansion strategies, while establishing subsidiaries exclusively abroad positively affects the bank asset risk only, the more complex strategy with both types of affiliates also affects the default risk and leverage risk in addition. Globally, we find that *Large* banks are financially more vulnerable and less profitable than other banks.

On a whole, our results partly align with Bertay et al. (2013) who find that systematically large banks tend to have poorer profitability yet they do not display a clear and conclusive positive or negative behavior toward risk. Indeed, in all regressions we show that bank total value of assets negatively and strongly affects the profitability as well as the probability of default, the asset risk, and the leverage risk for lower returns variability. This finding supports the view that the size of a bank's balance sheet does not match the concept of complexity. Too-big-to-fail or significant banks under the direct supervision of the regulatory authority are not necessarily too-complex banks.

[Insert **Table 9** here]

5.3.2. Influence of the crisis on bank risk and profitability

We examine whether the turmoil of the financial system might affect the impact of bank internationalization and foreign complexity on bank performance. The recent global financial crisis showed how the interconnectedness of financial institutions could act in the contagion and amplification of shocks. To capture the effect of the acute year of the sovereign debt crisis,

[18] The banks are *Large* in regards of the size of the total assets above the median (3.19 billion US dollar) of the full sample.

we build the dummy *Sov11*[19] that takes the value one for the year 2011 and zero otherwise and include it in the baseline equations to define the following models:

$$I_{i,j,t} = \alpha_0 + (\beta_1 + \beta'_1 Sov11) * International_i + \beta_2 Sov11 + \delta_1 Financial_{i,t} + \delta_2 Country_{j,t} + D_j + D_t + \varepsilon_{i,j,t} \quad (4)$$

$$I_{i,j,t} = \alpha_i + (\beta_1 + \beta'_1 Sov11) * OrgComplex_i + \beta_2 Sov11 + \delta_1 Financial_{i,t} + \delta_2 Country_{j,t} + D_j + D_t + \varepsilon_{i,j,t} \quad (5)$$

$$I_{i,j,t} = \alpha_i + (\beta_1 + \beta'_1 Sov11) * Geographic_i + \beta_2 Sov11 + \delta_1 Financial_{i,t} + \delta_2 Country_{j,t} + D_j + D_t + \varepsilon_{i,j,t} \quad (6)$$

We report in Table 11 the estimated coefficients[20] of all three previous equations from the Hausman-Taylor specification.

From Eq. (1), the dummy Foreign that assesses the presence of a bank abroad significantly indicates lower risk and lower profitability. The coefficients are positive for two risk indicators (Zscore and Zscore2) and negative for the risk-taking proxy (SDROA) and profitability (ROA). Moreover, at the peak time of the sovereign debt crisis our results indicate that relatively to the other years, the effect of the bank presence abroad on its risk and profitability is similar in sign, greater in value, and more significant. Looking at the Wald test, we confirm that building a foreign network tends to be negatively associated with both risk and profitability and such effect is intensified during distress times. Considering the other axis of bank internationalization defined by the wide presence of a bank in different host countries, we observe that whereas during the crisis the banks located in multiple countries face lower bankruptcy risk, lower leverage risk, and engage in fewer risk-taking operations for poorer profitability, after the crisis the results express lower SDROA and ROA only.

In Eq. (2) we observe the effect of banks foreign organizational complexity on their performance. First, the results of the expansion with foreign subsidiaries exclusively show that while after the crisis we observe lower volatility of the returns and lower profitability, the effect was more pronounced during the sovereign debt crisis as the bank risk had decreased (higher Zscore and Zscore2). The Wald tests confirm that owning foreign subsidiaries diminishes the

[19] From the timeline given by the Banque de France (2010, 2012), the financial crisis started in July 2007 and turned into a global economic crisis in early 2009. The aftermath of this period led to the European sovereign debt crisis which started in the late 2009 in some countries and had profoundly affected all European economies in 2011.

[20] We only report the results obtained for the variables of interest. The rest of detailed results are available from the authors upon request.

profitability and the exposure to bank risk. Second, having an organizational structure with foreign branches exclusively strongly and negatively affects the bank asset risk during the sovereign debt crisis, contrary to the other strategies. Yet, the overall Wald tests point to lower probability of failure and lower risk-taking behavior. Third, regardless of the state of the banking systems, the dual presence abroad is significantly associated with less profitable and less vulnerable institutions as all default risk, leverage risk, volatility of returns, and returns on assets are lower.

Finally, the estimations of Eq. (3) show that the regional dispersion of foreign affiliates negatively affects the stability of the parent banks, which appear relatively less profitable, more risky, and have more volatility of their returns on assets. Considering the location of all affiliates in different world regions, the coefficients associated to GeoComplex indicate that while the probability of default and the leverage risk increase during the 2011 sovereign debt crisis, they decrease after the crisis. However, the total effect measure by the Wald test mirror the results of the crisis time with lower Zscore, lower Zscore2, higher SDROA, and lower ROA. From the geographic dispersion of foreign subsidiaries, we find no real influence on the parent bank's default risk but a strong increase of the risk-taking behavior and a slight decrease of the profitability (significance at 10%). In contrast, GeoComplexB indicates that the dispersion of branches is strongly significant and negatively associated with bank probability of failure, asset risk, and leverage risk (higher Zscore, Zscore1, and Zscore2).

[Insert **Table 10** here]

6. Robustness checks

We conduct additional regressions to analyze the sensitivity of our main results obtained in Section 5.

First, we follow previous papers [Barth and Wihlborg (2016, 2017), Carmassi and Herring (2013), and Laeven et al. (2014)] that use the number of all affiliates or the number of subsidiaries to measure bank complexity. We substitute the binary variables in Eq. (2) by the continuous variables $Nb\_Affiliates_i$, Nb_S_i, and Nb_B_i that respectively represent the natural logarithm of the actual number of all affiliates, all subsidiaries, and all branches a bank *i* owns abroad. Globally, considering the variables of interest, the regressions mirror some of the previous findings with the dummies of organizational complexity (Table 7) and the indexes of

geographic complexity (Table 8) in terms of signs but for poorer significance. The results indicate that owning numerous affiliates or branches abroad is positively associated with profitability and negatively with bank risk through lower probability of failure, lower asset risk, and lower leverage risk (higher Zscore, Zscore1, and Zscore2). However, operating multiple foreign subsidiaries only leads to more risk-taking behavior. The rest of bank- and country-related coefficients confirm the previous findings.

Second, we build additional geographic complexity indexes in which the EU and the Euro Area are considered as other world regions. We run regressions of Eq. (3) and overall the main results remain unchanged.

Third, we focus on the 102 listed banks and investigate the effect of internationalization and foreign organizational complexity on the bank financial stability and profitability. From the report of the variables of interest[21], banks traded on public markets are globally less vulnerable (higher Zscore, Zscore1, and Zscore2) and more profitable (higher ROA). Moreover, listed banks setting up the business strategy with foreign subsidiaries exclusively display higher earnings volatility.

Finally, we estimated the three baseline equations Eq. (1), Eq. (2), and Eq. (3) using the random effects models instead of the Hausman-Taylor. Our main results regarding the eight internationalization and foreign complexity variables on bank risk and profitability globally remain unchanged.

[21] Detailed results for all estimations of Eq. (1) and Eq. (2) are available from the authors upon request.

7. Conclusion

In this paper we empirically investigate whether the complexity of their foreign network of affiliates affects parent banks' individual risk and profitability. Specifically, we examine the impact of bank presence abroad, the number of host countries, the organizational complexity of foreign affiliates through an exclusive business model of subsidiaries only or branches only or a mix model with both types of affiliates, and the geographic dispersion of affiliates around eight world regions. We hand-collect structural data for the 2011-2013 period from various sources and assemble them to construct a dataset of 825 commercial, cooperative, and savings banks from the 28 European Union countries.

We find strong evidence that the presence of a bank in foreign markets is significantly associated with lower earnings volatility and lower default risk but also poorer profitability. Looking deeper at the way that banks are present abroad our findings show that banks operating abroad with both foreign subsidiaries and branches are more stable than banks with foreign branches exclusively which are also more stable than banks that only operate subsidiaries abroad. Moreover, a closer look at the geographic dispersion of affiliates shows that higher dispersion is beneficial in terms of default risk but associated with higher risk-taking and higher profitability. Further investigation shows that the results amplify during the sovereign debt crisis indicating that banks engaged in cross-border operations tend to be less vulnerable during crisis times as internationalization might help them to better resist or smooth economic shocks.

Our findings challenge the idea that bank complexity might be detrimental for the stability of banking systems and have several policy implications. Our findings do not indicate that more stringent home banking regulation systematically and uniformly lead to greater financial stability and higher profitability but we do find that bank activity restrictions and stringent capital regulation are negatively associated with bank risk and positively with profitability. However, strong supervisory power produces opposite effects on bank performance i.e. higher risk and poorer profitability. Consequently, regulators and supervisors should be cautious in implementing a stringent regulation if their objective is to limit individual bank risk and contagion risk to ensure the soundness of the financial system.

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Table 1
Sample of banks

The table displays the distribution of our sample of commercial, cooperative, and savings banks among the 28 European Union countries. Of this sample of 825 banks, 102 are publicly traded and 160 conduct foreign operations. We extract information on specialization types and subsidiary from Bankscope and on branches from the SNL database. "/" indicates unavailable or unknown data.

Country (28 EU)	Number of banks	Listed banks	Commercial banks	Cooperative banks	Savings banks	Banks with a foreign activity	With foreign subsidiaries only	With foreign branches only	With both types of foreign affiliates	Number of host countries
Austria	89	4	32	20	37	19	10	4	5	23
Belgium	20	/	17	2	1	6	2	1	3	20
Bulgaria	9	2	7	1	1	2	/	/	2	4
Croatia	19	8	19	/	/	4	2	/	2	3
Cyprus	3	0	3	/	/	1	/	/	1	6
Czech Republic	11	1	10	1	/	2	/	2	/	1
Denmark	44	17	22	2	20	5	2	/	3	25
Estonia	3	/	3	/	/	/	/	/	/	/
Finland	7	2	6	1	/	5	3	2	/	8
France	146	19	61	66	19	29	18	3	8	85
Germany	168	4	64	48	56	16	5	5	6	71
Greece	1	/	1	/	/	/	/	/	/	/
Hungary	6	1	6	/	/	1	/	/	1	6
Ireland	3	/	3	/	/	1	/	1	/	5
Italy	82	13	36	24	22	17	12	2	3	36
Latvia	2	/	2	/	/	1	/	/	1	8
Lithuania	5	1	5	/	/	/	/	/	/	/
Luxembourg	29	/	27	/	2	12	7	2	3	19
Malta	4	2	2	1	1	/	/	/	/	/
Netherlands	8	1	7	/	1	5	/	3	2	18
Poland	23	11	21	1	1	2	1	/	1	3
Portugal	14	4	10	/	4	7	2	1	4	25
Romania	8	2	8	/	/	4	3	/	1	2
Slovakia	4	1	3	/	1	/	/	/	/	/
Slovenia	6	/	5	1	/	/	/	/	/	/
Spain	62	6	12	39	11	9	3	3	3	38
Sweden	13	3	12	/	1	3	/	/	3	39
United Kingdom	36	/	36	/	/	9	3	4	2	13
Obs.	825	102	440	207	178	160	73	33	54	

Table 2

Descriptive statistics of Geographic Complexity

The table displays the distribution of the 160 banks that conduct foreign activities among EU countries and the descriptive statistics of the three indicators of geographic complexity for all foreign affiliates (*GeoComplex*), foreign subsidiaries (*GeoComplex**S***), and foreign branches (*GeoComplex**B***). The detailed method of calculation can be found in Section 3. "/" indicates unavailable or unknown data.

Country (28 EU)	Banks with a foreign activity	No. host countries	No. world regions (mean)	GeoComplex (mean)	No. world regions_**S** (mean)	GeoComplex**S** (mean)	No. world regions_**B** (mean)	GeoComplex**B** (mean)
Austria	19	23	1.16	0.04	1.13	0.05	1.11	0.01
Belgium	6	20	1.83	0.18	1.80	0.24	1	0
Bulgaria	2	4	1.50	0.21	1.50	0.29	1.50	0.21
Croatia	4	3	1	0	1	0	1	0
Cyprus	1	6	2	0.01	1	0	2	0.01
Czech Republic	2	1	1	0			1	0
Denmark	5	25	2.80	0.19	2.80	0.28	1.33	0.01
Estonia	/	/	/	/	/	/	/	/
Finland	5	8	1.60	0.23	1.67	0.25	1.50	0.18
France	29	85	2.10	0.14	2.08	0.21	2.27	0.20
Germany	16	71	1.81	0.15	1.91	0.20	1.82	0.18
Greece	/	/	/	/	/	/	/	/
Hungary	1	6	2	0.56	2	0.51	2	0.56
Ireland	1	5	1	0			1	0
Italy	17	36	1.06	0.03	1	0	1	0
Latvia	1	8	2	0.25	1	0	2	0.28
Lithuania	/	/	/	/	/	/	/	/
Luxembourg	12	19	1.25	0.13	1.20	0.11	1	0
Malta	/	/						
Netherlands	5	18	1.60	0.07	2.50	0.40	1	0
Poland	2	3	1	0	1	0	1	0
Portugal	7	25	2.57	0.47	2.50	0.49	1	0
Romania	4	2	1	0	1	0	1	0
Slovakia	/	/	/	/	/	/	/	/
Slovenia	/	/	/	/	/	/	/	/
Spain	9	38	2.33	0.24	2.83	0.46	1.83	0.11
Sweden	3	39	6.33	0.44	6.33	0.82	1.67	0.05
United Kingdom	9	13	1.33	0.17	1.20	0.11	1.17	0.05
Obs.	160		160	160	127	127	87	87
Mean			1.74	0.14	1.78	0.19	1.44	0.08
Std. Dev			1.54	0.25	1.57	0.31	1.06	0.17
Median			1	0	1	0	1	0
Min			1	0	1	0	1	0
Max			8	0.89	8	0.95	7	0.68

Table 3

Bank individual characteristics - variables definition, summary statistics, and sources

In this table we summarize the definition and descriptive statistics for all bank-level characteristics downloaded from Bankscope, SNL database and the different banks web pages; detailed definitions are provided in Section 3. The full balanced sample consists of 825 commercial, cooperative and savings banks and totals 2176 bank-year observations on the 2011-2013 period.

Variable name	Definition	Source	Obs.	Mean	Std.Dev.	Median	Min	Max
Foreign Organizational Complexity								
Foreign	Dummy equal to one when the bank owns at least one foreign affiliate (subsidiary and/or branch), and zero if not	Bankscope, SNL, and Web pages	2176	0.20	0.40	0	0	1
Nb_Host	Number of foreign countries where a bank has a foreign presence		2176	0.82	3.76	0	0	47
Nb_Affiliates	Total number of foreign affiliates (subsidiaries and branches)		2176	22.03	242.70	0	0	4938
Bank_S	Dummy equal to one when the bank owns foreign subsidiary only, and zero otherwise	Bankscope and Web pages	2176	0.09	0.29	0	0	1
Nb_S	Number of foreign subsidiaries per bank		2176	0.78	4.19	0	0	60
Bank_B	Dummy equal to one when the bank owns foreign branch only, and zero otherwise	SNL and Web pages	2176	0.04	0.20	0	0	1
Nb_B	Number of foreign branches per bank		2176	21.24	240.15	0	0	4901
Bank_BS	Dummy equal to one when the bank owns both foreign subsidiary and foreign branch, and zero otherwise	Bankscope, SNL, and Web pages	2176	0.06	0.24	0	0	1
Dependant variables								
Risk								
Zscore	Zscore = (mROA + mEQ_TA) / σROA , measure of the bank default risk and financial stability	Bankscope	2176	243.38	574.97	70.19	1.10	3944.26
ln(Zscore)	Natural logarithm of Zscore		2176	4.44	1.32	4.25	0.23	8.28
Zscore1	Zscore1 = mROA / σROA, measure of bank asset risk		2176	8.86	15.99	3.36	0.00	103.00
ln(Zscore1)	Natural logarithm of Zscore1		2176	1.29	1.33	1.21	-2.35	4.73
Zscore2	Zscore2 = mEQ_TA / σROA, measure of bank leverage risk		2176	234.05	558.87	66.60	1.75	3841.63
ln(Zscore2)	Natural logarithm of Zscore2		2176	4.37	1.34	4.20	0.56	8.25
SDROA	Standard deviation of the return on assets t-year rolling (%)		2176	0.26	0.57	0.12	0.00	12.49
Profitability								
ROA	Return on assets = ratio of net income to total assets (%)		2176	0.60	0.66	0.41	0.00	8.66
Bank-level variables								
TA	Total assets (millions USD)	Bankscope	2176	23565.77	77784.06	3190.33	15.77	580117.00
Size (logTA)	Natural logarithm of total assets (millions USD)		2176	8.15	1.95	8.07	2.76	13.27
MarketShare	Ratio of the bank total assets to the total amount of assets in the country (%)		2176	1.80	4.97	0.10	0.00	27.91
EQ_TA	Equity to total assets, measure of leverage/bank capitalization (%)		2176	10.49	9.20	8.53	0.92	95.93
IncomeDivers	One minus the absolute value of the difference between net interest income and other operating income divided by the total operating income, measure of income diversification (%)		2176	0.59	0.25	0.62	0.00	0.98
CIR	Cost to income ratio (%)		2176	61.88	17.55	63.25	6.51	191.14
Loans_TA	Net loans to total assets (%)		2176	57.08	22.95	62.16	0.26	96.81
Listed	Dummy equal to one if the bank is publicly trade and zero otherwise	Bankscope and Web pages	2176	0.12	0.32	0	0	1
Coop	Dummy equal to one if the bank has a "Cooperative" banking specialization		2176	0.26	0.44	0	0	1
Savg	Dummy equal to one if the bank has a "Savings" banking specialization		2176	0.22	0.41	0	0	1

Table 4

Country characteristics - summary statistics and sources

This table reports country-level regulatory, macroeconomic and institutional variables computed from various sources and using data from 2011-2013. Bank regulation and supervision variables come from the latest survey of Barth et al. (updated 2012) provided by the World Bank (WB); detailed definitions are in Section 3. *Restrictions* is the index of the restrictiveness in the participation into bank activities such as securities, insurance, real estate and the ownership power in nonfinancial firms; *Capital* is an index of the stringency of the requirements in terms of minimum capital adequacy, risk and market value losses, sources of funding used to capitalize a bank and the level of official appraisal; *Supervision* is the measure of the official power in all actions taken by the authorities to prevent and correct problems regarding auditing, internal/board/ownership rights structure, profits and losses and other balance sheets items. Others country characteristics are from the WB Global Financial Development Database (GFDD) and World Development Indicators (WDI). *GDP growth* is the growth rate of the real gross domestic product; and *LegalStrength* measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. "//" indicates unavailable data and all variables were winsorized at 1% and 99% levels to limit the influence of outliers.

Country (28 EU)	Number of banks	Restrictions [1 – 16]	Capital [0 – 18]	Supervision [0 – 22]	GDP growth (%)	LegalStrength [0 – 12]
Austria	89	5	11	10	1,37	6,33
Belgium	20	6	15	9	0,59	5
Bulgaria	9	7	13	9	1,27	7,67
Croatia	19	9	13	10	-1,01	6,33
Cyprus	3	11	13	10	-2,46	7,67
Czech Republic	11	12	4	10	-0,03	5,67
Denmark	44	10	9	10	0,34	7,67
Estonia	3	10	14	11	4,77	6,33
Finland	7	7	13	6	0,17	7
France	146	9	12	9	0,75	5
Germany	168	7	13	8	1,47	6,33
Greece	1	9	12	7	-5,79	4,33
Hungary	6	6	11	11	0,24	6,33
Ireland	3	7	14	7	0,88	7,67
Italy	82	10	11	11	-1,32	3,67
Latvia	2	8	14	10	4,81	8,33
Lithuania	5	9	12	10	4,34	5
Luxembourg	29	10	13	11	1,21	4,33
Malta	4	11	12	11	1,02	3,67
Netherlands	8	6	13	10	-0,43	5,67
Poland	23	14	14	9	2,69	7,67
Portugal	14	8	11	11	-1,96	3,67
Romania	8	5	13	11	1,48	7,67
Slovakia	4	13	11	9	1,89	7
Slovenia	6	8	12	11	-0,98	4,33
Spain	62	7	13	9	-0,96	5,67
Sweden	13	10	2	5	1,86	7
United Kingdom	36	5	10	6	1,05	8,33
Obs.	825	84	84	84	84	84
Country-Year Obs.		2176	2176	2176	2176	2176
Mean		8,04	11,75	9,11	0,66	5,82
Standard Dev.		2,08	2,06	1,38	1,54	1,64
Median		7	12	9	.4	5
Min		5	2	5	-6,37	3
Max		14	15	11	9,56	10
Source		*Barth et al.*	*Barth et al.*	*Barth et al.*	*WB GFDD*	*WB WDI*

Table 5
Correlation matrix

Respectively, the numbers are used to identify the following variables: **1:** Listed | **2:** Coop | **3:** Savg | **4:** Foreign | **5:** Nb_Host | **6:** Bank_S | **7:** Bank_B | **8:** Bank_BS | **9:** Size (logTA) | **10:** MarketShare | **11:** EQ_TA | **12:** CIR | **13:** Loans_TA | **14:** IncomeDivers | **15:** ln(Zscore) | **16:** ln(Zscore1) | **17:** ln(Zscore2) | **18:** SDROA | **19:** ROA | **20:** Restrictions | **21:** RegulCapital | **22:** Supervision | **23:** GDP growth | **24:** LegalStrength

Given that some coefficients have high values, we have tested for collinearity among variables and the potential strong significance. Overall, the test statistics reveal no major issues at using the variables simultaneously in the regressions. Additionally, we run multiple regressions in which we do not consider the highly correlate variables together and the main results were not affected. The detailed definitions of all variables can be found in Section 3 and their descriptive statistics are presented in the three previous tables.

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
1	1																							
2	-0.09	1																						
3	-0.16	-0.31	1																					
4	0.22	-0.12	-0.13	1																				
5	0.26	-0.08	-0.08	0.45	1																			
6	0.11	-0.06	-0.10	0.65	0.07	1																		
7	-0.02	-0.10	0.01	0.41	0.06	-0.06	1																	
8	0.24	-0.04	-0.10	0.53	0.60	-0.08	-0.05	1																
9	0.27	-0.02	-0.05	0.40	0.38	0.19	0.07	0.36	1															
10	0.32	-0.17	-0.10	0.28	0.36	0.06	0.02	0.37	0.42	1														
11	-0.02	-0.09	-0.06	-0.07	-0.08	-0.02	-0.01	-0.09	-0.34	-0.05	1													
12	-0.07	0.05	0.14	-0.12	-0.03	-0.06	-0.09	-0.06	-0.22	-0.18	-0.11	1												
13	0.03	0.15	0.04	-0.20	-0.20	-0.10	-0.04	-0.18	-0.03	-0.03	-0.02	0.04	1											
14	0.16	0.09	-0.02	0.10	0.05	0.06	0.03	0.06	0.26	0.05	-0.18	0.08	0.12	1										
15	-0.08	0.26	0.23	-0.14	-0.07	-0.08	-0.02	-0.11	-0.02	-0.16	0.02	0.09	0.09	0.03	1									
16	0.01	0.20	0.06	-0.06	-0.04	-0.05	0.03	-0.08	0.10	-0.05	-0.10	-0.17	0.06	0.05	0.79	1								
17	-0.08	0.27	0.23	-0.14	-0.07	-0.08	-0.03	-0.11	-0.03	-0.17	0.02	0.10	0.10	0.02	1.00	0.77	1							
18	-0.01	-0.14	-0.08	-0.01	-0.03	0.01	-0.02	-0.01	-0.11	0.05	0.25	-0.10	-0.07	-0.15	-0.46	-0.35	-0.45	1						
19	0.07	-0.15	-0.20	0.00	-0.05	-0.01	0.04	-0.03	-0.09	0.14	0.36	-0.37	-0.03	-0.12	-0.27	0.10	-0.28	0.62	1					
20	0.28	-0.03	-0.12	-0.01	0.01	0.02	-0.06	0.00	0.19	0.16	-0.02	-0.13	0.15	0.12	-0.09	0.02	-0.10	0.01	0.12	1				
21	-0.05	0.12	-0.01	-0.01	-0.06	0.03	-0.01	-0.04	0.04	-0.05	-0.10	0.04	-0.05	-0.08	0.13	0.10	0.13	-0.04	-0.09	-0.18	1			
22	0.11	-0.01	0.05	0.05	-0.07	0.08	-0.04	0.01	0.03	0.10	-0.09	-0.05	0.07	0.10	-0.17	-0.14	-0.17	0.05	0.02	0.29	0.09	1		
23	-0.06	-0.06	0.05	-0.06	-0.01	-0.05	-0.02	-0.03	-0.04	0.03	-0.01	0.02	-0.04	-0.05	0.06	0.11	0.05	0.03	0.07	-0.13	0.07	-0.32	1	
24	0.00	-0.12	0.02	-0.04	-0.01	-0.07	0.01	0.01	-0.19	0.07	0.09	0.05	-0.06	-0.13	-0.02	-0.06	-0.02	0.04	0.01	-0.23	-0.09	-0.43	0.38	1

Table 6
Influence of bank foreign presence on bank risk and bank profitability

	Bank Foreign Presence					Number of Host Countries				
	Zscore (1a)	Zscore1 (2a)	Zscore2 (3a)	SDROA (4a)	ROA (5a)	Zscore (1b)	Zscore1 (2b)	Zscore2 (3b)	SDROA (4b)	ROA (5b)
Foreign	0.582**	0.362	0.592**	-0.570***	-0.519***					
	(0.29)	(0.29)	(0.29)	(0.14)	(0.13)					
Nb_Host						0.048*	0.008	0.049*	-0.050***	-0.062***
						(0.03)	(0.03)	(0.03)	(0.01)	(0.01)
Size (logTA)	-0.265	-0.096	-0.269	0.239***	0.248***	-0.334**	-0.111	-0.341**	0.230***	0.243***
	(0.17)	(0.17)	(0.18)	(0.08)	(0.07)	(0.15)	(0.16)	(0.15)	(0.07)	(0.07)
MarketShare	4.121*	1.681	4.189*	-2.786***	-1.838*	2.947	2.319	2.907	-2.578***	-1.352
	(2.39)	(2.17)	(2.41)	(1.07)	(0.97)	(1.83)	(1.94)	(1.84)	(1.00)	(0.92)
EQ_TA	1.096	0.114	0.996	-1.611***	0.059	0.778	0.113	0.660	-1.670***	0.017
	(0.92)	(0.89)	(0.92)	(0.40)	(0.35)	(0.83)	(0.87)	(0.83)	(0.39)	(0.34)
CIR	-0.142	-0.899***	-0.107	-0.163	-0.536***	-0.102	-0.924***	-0.062	-0.134	-0.507***
	(0.24)	(0.23)	(0.24)	(0.10)	(0.09)	(0.23)	(0.24)	(0.23)	(0.10)	(0.09)
IncomeDivers	-0.376*	-0.563***	-0.374*	-0.105	-0.047	-0.335*	-0.576***	-0.329*	-0.092	-0.036
	(0.20)	(0.20)	(0.20)	(0.09)	(0.07)	(0.19)	(0.20)	(0.19)	(0.09)	(0.07)
Loans_TA	0.183	0.715***	0.159	-0.270**	-0.040	0.549***	0.651***	0.552***	-0.274**	-0.075
	(0.37)	(0.19)	(0.37)	(0.11)	(0.10)	(0.18)	(0.19)	(0.18)	(0.11)	(0.10)
Listed	0.468***	0.272*	0.483***	-0.182*	-0.117	0.411***	0.330**	0.420***	-0.155*	-0.052
	(0.16)	(0.16)	(0.16)	(0.09)	(0.09)	(0.15)	(0.16)	(0.15)	(0.09)	(0.09)
Coop	2.499**	0.840***	2.607**	-0.390***	-0.385***	1.128***	0.816***	1.152***	-0.343***	-0.343***
	(1.15)	(0.13)	(1.15)	(0.07)	(0.07)	(0.11)	(0.12)	(0.11)	(0.07)	(0.07)
Savg	1.895***	0.917***	1.953***	-0.423***	-0.411***	1.348***	0.882***	1.374***	-0.371***	-0.368***
	(0.45)	(0.14)	(0.45)	(0.08)	(0.08)	(0.12)	(0.13)	(0.12)	(0.08)	(0.07)
Restrictions	0.163***	0.258***	0.159***	-0.092***	0.015	0.153***	0.255***	0.149***	-0.089***	0.015
	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)	(0.02)	(0.02)
RegulCapital	0.159***	0.257***	0.154***	-0.093***	-0.021	0.211***	0.262***	0.209***	-0.099***	-0.027
	(0.05)	(0.04)	(0.05)	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)	(0.02)	(0.02)
Supervision	-0.478***	-0.629***	-0.477***	0.077	-0.164***	-0.379***	-0.611***	-0.376***	0.072	-0.166***
	(0.11)	(0.09)	(0.11)	(0.05)	(0.05)	(0.08)	(0.09)	(0.08)	(0.05)	(0.05)
GDP growth	-0.062***	-0.020	-0.063***	0.022***	0.015**	-0.063***	-0.020	-0.065***	0.022***	0.015**
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
LegalStrength	-0.058***	-0.069***	-0.057***	0.007	-0.011*	-0.059***	-0.069***	-0.058***	0.007	-0.011*
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	2176	2176	2176	2176	2176	2176	2176	2176	2176	2176
No. clusters	825	825	825	825	825	825	825	825	825	825
Hausman test p-value	0.459	0.944	0.436	0.569	0.721	0.488	0.916	0.479	0.676	0.562
Wald test P > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

This table displays the results of the estimation of Eq. (1) regarding the effects of bank presence abroad on bank risk and profitability over the 2011-2013 period. All five groups successively represent our five dependent variables namely *Zscore* the natural logarithm of the measure of the bank default risk and financial stability ; *Zscore1* is the natural logarithm of the measure of bank asset risk ; *Zscore2* is the natural logarithm of the measure of bank leverage risk ; *SDROA* is the standard deviation of the return on assets on a three-year rolling window ; *ROA* is the return on assets that measures profitability as the ratio of net income to total assets. *Foreign*: dummy equal to one when the bank owns at least one affiliate abroad and zero otherwise ; *Nb_Host*: number of foreign countries where a bank has a foreign presence. *logTA*: natural logarithm of total assets (billions USD) ; *MarketShare*: ratio of the bank total assets to the total amount of assets in the country ; EQ_TA: Equity to total assets, measure of leverage/bank capitalization ; *IncomeDivers*: measure of income diversification $IncomeDivers = 1 - \left|\frac{Net\ Interest\ Income - Other\ Operating\ Incone}{Total\ Operationg\ Income}\right|$; *CIR*: Cost to income ratio ; *Loans_TA*: Net loans to total assets ; *Listed*: dummy equal to one if the bank is publicly trade and zero otherwise ; *Coop*: dummy equal to one if the bank has a "Cooperative" banking specialization ; *Savg*: dummy equal to one if the bank has a "Savings" banking specialization. *Restrictions* is the index of the restrictiveness in the participation into bank activities such as securities, insurance, real estate and the ownership power in nonfinancial firms ; *Capital* is an index of the stringency of the requirements in terms of minimum capital adequacy, risk and market value losses, sources of funding used to capitalize a bank and the level of official appraisal ; *Supervision* is the measure of the official power in all actions taken by the authorities to prevent and correct problems regarding auditing, internal/board/ownership rights structure, profits and losses and other balance sheets items ; *GDP growth* is the growth rate of the real gross domestic product; *LegalStrength* measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. We use the Hausman-Taylor specification with a clustering at the bank-level to estimate all equations of our model. We run the Hausman test between the FE and HT estimators to identify the mix of endogenous variables that will generate the most consistent HT estimation. A constant was estimated for all equations but not reported. Variables were winsorized at 1% and 99% levels to limit the influence of extreme values and the table reports robust standard errors in parentheses and the significance of p-value by * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7
Influence of bank foreign organizational complexity on bank risk and bank profitability

	Foreign Subsidiaries Only					Foreign Branches Only					Both Foreign affiliates				
	Zscore (1c)	Zscore1 (2c)	Zscore2 (3c)	SDROA (4c)	ROA (5c)	Zscore (1d)	Zscore1 (2d)	Zscore2 (3d)	SDROA (4d)	ROA (5d)	Zscore (1e)	Zscore1 (2e)	Zscore2 (3e)	SDROA (4e)	ROA (5e)
Bank_S	0.469**	0.339	0.483**	-0.360***	-0.327***										
	(0.23)	(0.26)	(0.23)	(0.13)	(0.12)										
Bank_B						0.542*	0.560**	0.535*	-0.503***	-0.263					
						(0.31)	(0.27)	(0.31)	(0.19)	(0.18)					
Bank_BS											0.943**	0.092	0.968**	-0.692***	-
											(0.43)	(0.38)	(0.44)	(0.19)	(0.18)
Size (logTA)	-0.257	-0.078	-0.261	0.243***	0.249***	-0.263	-0.096	-0.266	0.223***	0.222***	-0.203	-0.102	-0.210	0.239***	0.247***
	(0.18)	(0.17)	(0.18)	(0.08)	(0.07)	(0.18)	(0.17)	(0.18)	(0.08)	(0.07)	(0.18)	(0.17)	(0.18)	(0.08)	(0.07)
MarketShare	4.491*	2.469	4.563*	-3.754***	-2.689**	4.454*	2.266	4.516*	-4.452***	-2.872**	-8.240	2.217	-8.412	-2.660**	-1.564
	(2.56)	(2.73)	(2.57)	(1.24)	(1.12)	(2.64)	(2.58)	(2.66)	(1.40)	(1.25)	(6.83)	(2.05)	(6.82)	(1.04)	(0.95)
EQ_TA	1.103	0.188	1.005	-1.637***	0.037	1.046	0.112	0.949	-1.752***	-0.079	1.236	0.129	1.121	-1.633***	0.044
	(0.91)	(0.89)	(0.91)	(0.39)	(0.35)	(0.91)	(0.89)	(0.91)	(0.41)	(0.35)	(0.89)	(0.88)	(0.89)	(0.39)	(0.34)
CIR	-0.126	-0.907***	-0.091	-0.148	-0.527***	-0.091	-0.882***	-0.056	-0.128	-0.509***	-0.212	-0.914***	-0.172	-0.148	-
	(0.24)	(0.23)	(0.24)	(0.10)	(0.09)	(0.23)	(0.23)	(0.23)	(0.10)	(0.09)	(0.24)	(0.23)	(0.24)	(0.10)	(0.09)
IncomeDivers	-0.370*	-0.569***	-0.368*	-0.093	-0.039	-0.354*	-0.559***	-0.352*	-0.075	-0.026	-0.391**	-0.572***	-0.386*	-0.097	-0.041
	(0.20)	(0.19)	(0.20)	(0.09)	(0.07)	(0.20)	(0.20)	(0.20)	(0.09)	(0.07)	(0.20)	(0.20)	(0.20)	(0.09)	(0.07)
Loans_TA	0.170	0.650*	0.146	-0.184*	0.030	0.163	0.634***	0.140	-0.020	0.101	0.590***	0.648***	0.593***	-0.254**	-0.040
	(0.36)	(0.36)	(0.36)	(0.11)	(0.10)	(0.37)	(0.19)	(0.37)	(0.17)	(0.14)	(0.18)	(0.19)	(0.19)	(0.11)	(0.10)
Listed	0.522***	0.326	0.537***	-0.269***	-0.195**	0.552***	0.344*	0.568***	-0.325***	-0.221**	0.659***	0.331**	0.673***	-0.195**	-0.115
	(0.17)	(0.20)	(0.18)	(0.10)	(0.10)	(0.18)	(0.19)	(0.19)	(0.11)	(0.11)	(0.19)	(0.16)	(0.19)	(0.10)	(0.09)
Coop	2.187*	1.074	2.294**	-0.364***	-0.359***	2.095*	0.839***	2.196*	-0.983*	-0.687	0.906***	0.812***	0.927***	-0.330***	-
	(1.12)	(1.12)	(1.13)	(0.07)	(0.07)	(1.14)	(0.12)	(1.14)	(0.54)	(0.48)	(0.16)	(0.12)	(0.16)	(0.07)	(0.07)
Savg	1.757***	1.024**	1.814***	-0.391***	-0.381***	1.691***	0.883***	1.745***	-0.597***	-0.479**	1.232***	0.881***	1.257***	-0.377***	-
	(0.44)	(0.44)	(0.44)	(0.08)	(0.08)	(0.43)	(0.13)	(0.44)	(0.21)	(0.19)	(0.14)	(0.13)	(0.14)	(0.08)	(0.08)
Restrictions	0.148***	0.275***	0.144***	-0.084***	0.022	0.152***	0.255***	0.147***	-0.092***	0.021	0.164***	0.254***	0.161***	-0.093***	0.013
	(0.03)	(0.04)	(0.03)	(0.02)	(0.02)	(0.04)	(0.04)	(0.04)	(0.03)	(0.02)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)
RegulCapital	0.165***	0.268***	0.159***	-0.096***	-0.023	0.173***	0.259***	0.167***	-0.080***	-0.013	0.200***	0.261***	0.198***	-0.102***	-0.029
	(0.05)	(0.06)	(0.05)	(0.02)	(0.02)	(0.05)	(0.04)	(0.05)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)
Supervision	-0.450***	-0.695***	-0.450***	0.064	-0.175***	-0.436***	-0.615***	-0.436***	0.095	-0.158***	-0.462***	-0.614***	-0.459***	0.070	-
	(0.11)	(0.12)	(0.11)	(0.05)	(0.05)	(0.11)	(0.09)	(0.11)	(0.06)	(0.06)	(0.10)	(0.09)	(0.10)	(0.05)	(0.05)
GDP growth	-0.061***	-0.019	-0.063***	0.022***	0.015**	-0.061***	-0.019	-0.063***	0.022***	0.014**	-0.060***	-0.020	-0.062***	0.022***	0.015**
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
LegalStrength	-0.058***	-0.068***	-0.057***	0.007	-0.011*	-0.058***	-0.069***	-0.057***	0.007	-0.012*	-0.056***	-0.069***	-0.056***	0.007	-0.011*
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	2176	2176	2176	2176	2176	2176	2176	2176	2176	2176	2176	2176	2176	2176	2176
No. clusters	825	825	825	825	825	825	825	825	825	825	825	825	825	825	825
Hausman test p-	0.448	0.934	0.430	0.740	0.311	0.414	0.924	0.394	0.670	0.174	0.464	0.927	0.448	0.685	0.491
Wald test P > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

This table displays the results of the estimation of Eq. (2) regarding the effects of bank foreign organizational complexity geographic complexity on bank risk and profitability over the 2011-2013 period. All five groups successively represent our five dependent variables namely *Zscore* the natural logarithm of the measure of the bank default risk and financial stability ; *Zscore1* is the natural logarithm of the measure of bank asset risk ; *Zscore2* is the natural logarithm of the measure of bank leverage risk ; *SDROA* is the standard deviation of the return on assets on a three-year rolling window ; *ROA* is the return on assets that measures profitability as the ratio of net income to total assets. *Bank_S*: dummy equal to one when the bank owns only subsidiaries abroad, and zero otherwise ; *Bank_B*: dummy equal to one when the bank owns only branches abroad, and zero otherwise ; *Bank_BS*: dummy equal to one when the bank owns both foreign subsidiary and foreign branch, and zero otherwise. *logTA*: natural logarithm of total assets (billions USD) ; *MarketShare*: ratio of the bank total assets to the total amount of assets in the country ; EQ_TA: Equity to total assets, measure of leverage/bank capitalization ; *IncomeDivers*: measure of income diversification $IncomeDivers = 1 - \left|\frac{Net\ Interest\ Income - Other\ Operating\ Incone}{Total\ Operationg\ Income}\right|$; *CIR*: Cost to income ratio ; *Loans_TA*: Net loans to total assets ; *Listed*: dummy equal to one if the bank is publicly trade and zero otherwise ; *Coop*: dummy equal to one if the bank has a "Cooperative" banking specialization ; *Savg*: dummy equal to one if the bank has a "Savings" banking specialization. *Restrictions* is the index of the restrictiveness in the participation into bank activities such as securities, insurance, real estate and the ownership power in nonfinancial firms ; *Capital* is an index of the stringency of the requirements in terms of minimum capital adequacy, risk and market value losses, sources of funding used to capitalize a bank and the level of official appraisal ; *Supervision* is the measure of the official power in all actions taken by the authorities to prevent and correct problems regarding auditing, internal/board/ownership rights structure, profits and losses and other balance sheets items ; *GDP growth* is the growth rate of the real gross domestic product; *LegalStrength* measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. We use the Hausman-Taylor specification with a clustering at the bank-level to estimate all equations of our model. We run the Hausman test between the FE and HT estimators to identify the mix of endogenous variables that will generate the most consistent HT estimation. A constant was estimated for all equations but not reported. Variables were winsorized at 1% and 99% levels to limit the influence of extreme values and the table reports robust standard errors in parentheses and the significance of p-value by * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8
Influence of bank geographic complexity (All affiliates / Subsidiaries / Branches) on bank risk and bank profitability

	All affiliates					Subsidiaries					Branches				
	Zscore	Zscore1	Zscore2	SDROA	ROA	Zscore	Zscore1	Zscore2	SDROA	ROA	Zscore	Zscore1	Zscore2	SDROA	ROA
GeoComplex	0.205**	0.324**	0.196**	0.056**	0.535***										
	(0.10)	(0.15)	(0.09)	(0.03)	(0.18)										
GeoComplexS						0.239**	0.086**	0.207**	0.943***	1.290***					
						(0.12)	(0.04)	(0.10)	(0.26)	(0.40)					
GeoComplexB											1.281***	1.410***	1.280***	-0.127	-0.027*
											(0.45)	(0.52)	(0.45)	(0.35)	(0.01)
Size (logTA)	0.352***	0.681***	0.334***	-0.024	0.128***	0.328***	0.567***	0.311***	0.057**	0.230*	0.006**	0.072**	0.002**	-0.038	-0.017*
	(0.11)	(0.17)	(0.11)	(0.07)	(0.04)	(0.11)	(0.15)	(0.10)	(0.02)	(0.12)	(0.00)	(0.03)	(0.00)	(0.04)	(0.01)
MarketShare	-10.615	-13.287	-10.525	2.216***	-1.090	-12.728	-18.820**	-12.469	1.440**	-4.645	-8.161	-12.064	-8.020	2.184***	-1.205
	(7.45)	(8.76)	(7.42)	(0.69)	(2.58)	(8.69)	(9.29)	(8.69)	(0.60)	(2.97)	(8.10)	(9.23)	(8.09)	(0.685)	(1.96)
EQ_TA	2.938***	3.216***	2.856***	0.304***	1.514**	2.388***	2.418***	2.286***	0.886***	1.975***	2.213***	0.083**	2.359**	0.645***	1.317***
	(0.80)	(0.90)	(0.79)	(0.11)	(0.60)	(0.73)	(0.75)	(0.71)	(0.28)	(0.64)	(0.82)	(0.04)	(0.74)	(0.22)	(0.37)
CIR	0.016	-0.868	0.074	0.061**	-0.536***	0.263	-0.695	0.319**	0.102**	-0.487**	-0.04*5	-1.176	0.036	0.076**	-0.656***
	(0.59)	(0.68)	(0.59)	(0.02)	(0.20)	(0.64)	(0.68)	(0.13)	(0.04)	(0.21)	(0.02)	(0.85)	(0.78)	(0.03)	(0.17)
IncomeDivers	-0.625*	-1.064***	-0.605*	0.008**	-0.235**	-0.549	-1.060***	-0.526	0.004**	-0.275**	-1.819***	-2.275***	-1.800***	0.230***	-0.063
	(0.34)	(0.40)	(0.34)	(0.00)	(0.12)	(0.36)	(0.39)	(0.36)	(0.00)	(0.12)	(0.54)	(0.59)	(0.54)	(0.06)	(0.12)
Loans_TA	0.934***	2.041*	0.860**	0.035**	0.868**	0.740***	1.715***	0.653**	0.601***	1.233***	0.750**	2.011***	0.681**	-0.075*	0.690**
	(0.31)	(1.12)	(0.29)	(0.02)	(0.34)	(0.28)	(0.52)	(0.26)	(0.18)	(0.43)	(0.30)	(0.62)	(0.27)	(0.04)	(0.35)
Listed	-1.880	-4.384	-1.730	-0.134*	-1.925	-0.998	-1.653	-0.833	-2.190	-3.125	0.380**	0.455**	0.391**	-0.136	0.040**
	(3.10)	(3.81)	(3.08)	(0.07)	(1.20)	(4.52)	(5.30)	(4.47)	(1.68)	(2.28)	(0.15)	(0.18)	(0.15)	(0.17)	(0.02)
Coop	0.257**	-0.500	0.300**	-0.069	-0.415*	0.184**	-0.635	0.234**	-0.159	-0.562	0.253**	-0.259*	0.284**	-0.013*	-0.273
	(0.10)	(0.67)	(0.12)	(0.12)	(0.22)	(0.08)	(0.82)	(0.10)	(0.26)	(0.38)	(0.11)	(0.15)	(0.12)	(0.01)	(0.28)
Savg	0.024**	-0.975	0.066**	-0.044*	-0.662**	0.380**	-0.391	0.435**	-0.063*	-0.385	0.595***	-0.025**	0.603***	-0.121	-0.405
	(0.02)	(0.92)	(0.03)	(0.02)	(0.30)	(0.15)	(1.02)	(0.17)	(0.03)	(0.52)	(0.21)	(0.01)	(0.21)	(0.17)	(0.28)
Restrictions	0.016**	0.080***	0.012**	-0.017	0.030***	0.058**	0.170***	0.054**	-0.030	0.012**	0.164***	0.365***	0.154***	-0.043	0.090***
	(0.01)	(0.03)	(0.01)	(0.03)	(0.01)	(0.02)	(0.05)	(0.02)	(0.04)	(0.01)	(0.05)	(0.09)	(0.05)	(0.03)	(0.03)
RegulCapital	-0.128	-0.282	-0.120	-0.005*	-0.116	0.007**	0.041**	0.017**	-0.182	-0.209	0.114***	0.205***	0.111***	-0.030	0.047***
	(0.21)	(0.26)	(0.21)	(0.00)	(0.09)	(0.03)	(0.02)	(0.01)	(0.15)	(0.22)	(0.04)	(0.07)	(0.03)	(0.03)	(0.02)
Supervision	-0.155	-0.234	-0.150	0.039***	-0.065	-0.105*	-0.390	-0.094*	0.221***	0.183***	-0.402	-0.656*	-0.395	0.099***	-0.168
	(0.12)	(0.15)	(0.12)	(0.01)	(0.05)	(0.06)	(0.60)	(0.05)	(0.07)	(0.07)	(0.28)	(0.38)	(0.27)	(0.03)	(0.12)
GDP growth	0.021***	0.048***	0.020***	0.000**	0.010***	0.012**	0.042***	0.011**	0.001**	0.016***	-0.017*	-0.027	-0.015*	0.016***	-0.003*
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.05)	(0.01)	(0.00)	(0.00)
LegalStrength	0.052***	0.031***	0.053***	-0.006	-0.003*	0.047***	0.010**	0.049***	-0.005*	-0.006	-0.005*	-0.013*	-0.005*	0.002**	0.008***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.15)	(0.00)	(0.00)	(0.00)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	425	425	425	425	425	338	338	338	338	338	225	225	225	225	225
No. clusters	160	160	160	160	160	127	127	127	127	127	87	87	87	87	87
Hausman test p-value	0.856	0.832	0.856	0.660	0.313	0.971	0.884	0.974	0.669	0.633	0.837	0.809	0.836	0.918	0.364

Wald test P > chi2	0.004	0.001	0.004	0.040	0.000	0.021	0.003	0.019	0.131	0.000	0.003	0.001	0.003	0.024	0.000

This table displays the results of the estimation of Eq. (3) regarding the effects of bank geographic complexity on bank risk and profitability over the 2011-2013 period. All five groups successively represent our five dependent variables namely *Zscore* the natural logarithm of the measure of the bank default risk and financial stability ; *Zscore1* is the natural logarithm of the measure of bank asset risk ; *Zscore2* is the natural logarithm of the measure of bank leverage risk ; *SDROA* is the standard deviation of the return on assets on a three-year rolling window ; *ROA* is the return on assets that measures profitability as the ratio of net income to total assets. *GeoComplex*: indicator of the geographic dispersion of a bank foreign affiliates in different world regions (columns 1–5) ; *GeoComplexS*: indicator of the geographic dispersion of the bank foreign subsidiaries in different world regions (columns 6–10) ; *GeoComplexB*: indicator of the geographic dispersion of the bank foreign branches in different world regions (columns 11–15). *logTA*: natural logarithm of total assets (billions USD) ; *MarketShare*: ratio of the bank total assets to the total amount of assets in the country ; EQ_TA: Equity to total assets, measure of leverage/bank capitalization ; *IncomeDivers*: measure of income diversification $IncomeDivers = 1 - \left|\frac{Net\ Interest\ Income - Other\ Operating\ Income}{Total\ Operationg\ Income}\right|$; *CIR*: Cost to income ratio ; *Loans_TA*: Net loans to total assets ; *Listed*: dummy equal to one if the bank is publicly trade and zero otherwise ; *Coop*: dummy equal to one if the bank has a "Cooperative" banking specialization ; *Savg*: dummy equal to one if the bank has a "Savings" banking specialization. *Restrictions* is the index of the restrictiveness in the participation into bank activities such as securities, insurance, real estate and the ownership power in nonfinancial firms ; *RegulCapital* is an index of the stringency of the requirements in terms of minimum capital adequacy, risk and market value losses, sources of funding used to capitalize a bank and the level of official appraisal ; *Supervision* is the measure of the official power in all actions taken by the authorities to prevent and correct problems regarding auditing, internal/board/ownership rights structure, profits and losses and other balance sheets items ; *GDP growth* is the growth rate of the real gross domestic product; *LegalStrength* measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. We use the Hausman-Taylor specification with a clustering at the bank-level to estimate all equations of our model. We run the Hausman test between the FE and HT estimators to identify the mix of endogenous variables that will generate the most consistent HT estimation. A constant was estimated for all equations but not reported. Variables were winsorized at 1% and 99% levels to limit the influence of extreme values and the table reports robust standard errors in parentheses and the significance of p-value by * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 9
Effect of bank foreign presence and foreign organizational complexity on bank risk and bank profitability

	ECB: TA > 30 billion US dollar					Large: TA > Median (3190.3 million US dollar)				
	Zscore	Zscore1	Zscore2	SDROA	ROA	Zscore	Zscore1	Zscore2	SDROA	ROA
Foreign	-0.574	-0.096*	-0.607	0.123***	0.044**	-0.695**	-0.661**	-0.691**	0.102	-0.080
	(0.41)	(0.06)	(0.42)	(0.03)	(0.02)	(0.27)	(0.31)	(0.27)	(0.10)	(0.09)
Size (logTA)	1.380**	0.292	1.432**	-0.266**	-0.244**	0.914***	1.108***	0.903***	-0.199**	0.133*
	(0.66)	(0.64)	(0.67)	(0.12)	(0.12)	(0.30)	(0.34)	(0.30)	(0.08)	(0.08)
No. Obs.	262	262	262	262	262	1088	1088	1088	1088	1088
No. of clusters	106	106	106	106	106	420	420	420	420	420
Hausman test p-value	0.919	0.710	0.932	0.971	0.808	0.257	0.131	0.266	0.887	0.169
Wald test Prob > chi2	0.010	0.001	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nb_Host	-0.054	-0.017	-0.055	0.012*	-0.001*	-0.076**	-0.126***	-0.073**	0.013	-0.030***
	(0.04)	(0.04)	(0.04)	(0.01)	(0.00)	(0.03)	(0.04)	(0.03)	(0.01)	(0.01)
Size (logTA)	1.584**	0.471	1.617**	-0.333**	-0.198	0.796***	1.190***	0.776***	-0.185**	0.161**
	(0.80)	(0.80)	(0.81)	(0.14)	(0.13)	(0.28)	(0.33)	(0.28)	(0.08)	(0.08)
No. Obs.	262	262	262	262	262	1088	1088	1088	1088	1088
No. of clusters	106	106	106	106	106	420	420	420	420	420
Hausman test p-value	0.940	0.486	0.944	0.993	0.822	0.728	0.955	0.698	0.320	0.154
Wald test Prob > chi2	0.016	0.001	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bank_S	-0.273*	-1.311	-0.204*	-0.042*	-0.059*	-0.572	-1.051**	-0.538	0.010	-0.362**
	(0.16)	(1.13)	(0.11)	(0.02)	(0.04)	(0.38)	(0.52)	(0.37)	(0.13)	(0.17)
Size (logTA)	1.666**	0.470	1.712**	-0.321**	-0.199	0.762***	0.940***	0.750***	-0.158**	0.147*
	(0.78)	(0.90)	(0.78)	(0.14)	(0.14)	(0.27)	(0.32)	(0.27)	(0.08)	(0.08)
No. Obs.	262	262	262	262	262	1088	1088	1088	1088	1088
No. of clusters	106	106	106	106	106	420	420	420	420	420
Hausman test p-value	0.962	0.491	0.970	0.964	0.789	0.101	0.120	0.124	0.608	0.152
Wald test Prob > chi2	0.059	0.122	0.057	0.003	0.000	0.000	0.000	0.000	0.000	0.000
Bank_B	-0.258*	1.734***	-0.438*	0.104**	0.192***	0.161	0.619	0.129	-0.103	0.184
	(0.14)	(0.57)	-0.26	(0.04)	(0.07)	(0.44)	(0.65)	(0.43)	(0.15)	(0.22)
Size (logTA)	1.694**	0.791	1.723**	-0.295**	-0.194	0.754***	0.924***	0.742***	-0.157**	0.141*
	(0.74)	(0.77)	(0.74)	(0.13)	(0.13)	(0.27)	(0.32)	(0.27)	(0.08)	(0.08)
No. Obs.	262	262	262	262	262	1088	1088	1088	1088	1088
No. of clusters	106	106	106	106	106	420	420	420	420	420
Hausman test p-value	0.962	0.593	0.972	0.968	0.807	0.113	0.089	0.136	0.503	0.139
Wald test Prob > chi2	0.068	0.048	0.065	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Bank_BS	-0.677	-0.197*	-0.697	0.125***	0.033**	-0.648*	-1.221**	-0.613*	0.112	-0.375**
	(0.54)	(0.12)	(0.54)	(0.04)	(0.01)	(0.36)	(0.49)	(0.36)	(0.15)	(0.18)
Size (logTA)	1.617**	0.428	1.665**	-0.318**	-0.227*	0.430*	0.648**	0.423*	-0.165**	0.127*
	(0.75)	(0.77)	(0.76)	(0.14)	(0.13)	(0.24)	(0.32)	(0.24)	(0.08)	(0.08)
No. Obs.	262	262	262	262	262	1088	1088	1088	1088	1088
No. of clusters	106	106	106	106	106	420	420	420	420	420
Hausman test p-value	0.950	0.685	0.956	0.977	0.787	0.962	0.609	0.119	0.762	0.844
Wald test Prob > chi2	0.038	0.024	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000

This table displays the results of the estimation of Eq. (1) and Eq. (2) regarding the effects of bank presence in host countries and foreign affiliates structure complexity on bank risk and profitability over the 2011-2013 period for large for two sub-samples of banks. Our five dependent variables are *Zscore* the natural logarithm of the measure of the bank default risk and financial stability ; *Zscore1* is the natural logarithm of the measure of bank asset risk ; *Zscore2* is the natural logarithm of the measure of bank leverage risk ; *SDROA* is the standard deviation of the return on assets on a three-year rolling window ; *ROA* is the return on assets that measures profitability as the ratio of net income to total assets. *Foreign*: dummy equal to one when the bank owns at least one affiliate abroad, and zero otherwise ; *Nb_Host*: number of foreign countries where a bank has a foreign presence ; *Bank_S*: dummy equal to one when the bank owns only subsidiaries abroad, and zero otherwise ; *Bank_B*: dummy equal to one when the bank owns only branches abroad, and zero otherwise ; *Bank_BS*: dummy equal to one when the bank owns both foreign subsidiary and foreign branch, and zero otherwise. We use the Hausman-Taylor specification with a clustering at the bank-level to estimate all equations of our model. We run the Hausman test between the FE and HT estimators to identify the mix of endogenous variables that will generate the most consistent HT estimation. Variables were winsorized at 1% and 99% levels to limit the influence of extreme values and the table reports robust standard errors in parentheses and the significance of p-value by * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10
Effect of bank foreign presence and foreign organizational complexity on bank risk and bank profitability _ **Sovereign debt crisis**

	Zscore	**Zscore1**	**Zscore2**	**SDROA**	**ROA**
Foreign (β_1)	0.590**	0.313	0.602**	-0.569***	-0.584***
	(0.28)	(0.30)	(0.28)	(0.15)	(0.14)
Sov11*Foreign (β'_1)	0.794***	0.493	0.805***	-0.632***	-0.591***
	(0.29)	(0.31)	(0.30)	(0.15)	(0.14)
Sov11	-0.033	0.129	-0.042	0.009	0.121***
	(0.09)	(0.10)	(0.09)	(0.04)	(0.03)
No. Obs.	2176	2176	2176	2176	2176
No. of clusters	825	825	825	825	825
Wald test: $\beta_1 + \beta'_1$	1.384**	0.805	1.407**	-1.201***	-1.174***
Hausman test p-value	0.735	0.531	0.688	0.532	0.149
Wald test Prob > chi2	0.000	0.000	0.000	0.000	0.000
Nb_Host (β_1)	0.050*	0.002	0.052*	-0.050***	-0.069***
	(0.03)	(0.03)	(0.03)	(0.01)	(0.01)
Sov11*Nb_Host (β'_1)	0.060**	0.003	0.062**	-0.053***	-0.072***
	(0.03)	(0.03)	(0.03)	(0.01)	(0.01)
Sov11	0.008	0.178*	-0.001	-0.006	0.122***
	(0.09)	(0.09)	(0.09)	(0.04)	(0.03)
No. Obs.	262	262	262	262	262
No. of clusters	106	106	106	106	106
Wald test: $\beta_1 + \beta'_1$	-0.087*	-0.039**	-0.087*	0.025***	-0.012**
Hausman test p-value	0.987	0.761	0.989	0.989	0.941
Wald test Prob > chi2	0.036	0.064	0.032	0.004	0.000
Bank_S (β_1)	0.436*	0.255	0.452*	-0.307**	-0.359***
	(0.23)	(0.26)	(0.24)	(0.13)	(0.13)
Sov11*Bank_S (β'_1)	0.623**	0.484*	0.636**	-0.398***	-0.364***
	(0.25)	(0.28)	(0.25)	(0.13)	(0.13)
Sov11	0.009	0.156*	0.000	-0.003	0.117***
	(0.09)	(0.09)	(0.09)	(0.04)	(0.03)
No. Obs.	2176	2176	2176	2176	2176
No. of clusters	825	825	825	825	825
Wald test: $\beta_1 + \beta'_1$	1.058**	0.739	1.088**	-0.705***	-0.723***
Hausman test p-value	0.188	0.947	0.153	0.609	0.674
Wald test Prob > chi2	0.000	0.000	0.000	0.000	0.000
Bank_B (β_1)	0.514*	0.390	0.511*	-0.524***	-0.294*
	(0.30)	(0.29)	(0.30)	(0.19)	(0.17)
Sov11*Bank_B (β'_1)	0.786**	0.671**	0.779**	-0.552***	-0.283*
	(0.31)	(0.31)	(0.32)	(0.19)	(0.17)
Sov11	0.014	0.165*	0.005	-0.013	0.114***
	(0.09)	(0.09)	(0.09)	(0.04)	(0.03)
No. Obs.	2176	2176	2176	2176	2176
No. of clusters	825	825	825	825	825
Wald test: $\beta_1 + \beta'_1$	1.301**	1.061*	1.289**	-1.076***	-0.577*
Hausman test p-value	0.128	0.988	0.107	0.928	0.763
Wald test Prob > chi2	0.000	0.000	0.000	0.000	0.000
Bank_BS (β_1)	0.999**	0.349	1.033**	-0.681***	-0.817***
	(0.42)	(0.46)	(0.42)	(0.20)	(0.19)
Sov11*Bank_BS (β'_1)	1.136***	0.345	1.176***	-0.695***	-0.835***
	(0.44)	(0.48)	(0.44)	(0.20)	(0.19)
Sov11	0.016	0.186*	0.007	-0.009	0.120***
	(0.09)	(0.10)	(0.09)	(0.04)	(0.03)
No. Obs.	2176	2176	2176	2176	2176
No. of clusters	825	825	825	825	825
Wald test: $\beta_1 + \beta'_1$	0.110**	0.005	0.114**	-0.103***	-0.141***
Hausman test p-value	0.464	0.784	0.417	0.914	0.459
Wald test Prob > chi2	0.000	0.000	0.000	0.000	0.000
	0.051**	-0.749	0.090**	0.129***	0.058**

GeoComplex (β_1)	(0.02)	(0.89)	(0.04)	(0.04)	(0.03)
Sov11*GeoComplex	-0.241*	-1.157	-0.191*	0.067**	-0.166
(β'_1)	(0.14)	(0.90)	(0.11)	(0.03)	(0.29)
Sov11	-0.058	0.216***	-0.073	0.039***	0.136***
	(0.16)	(0.07)	(0.16)	(0.01)	(0.04)
No. Obs.	425	425	425	425	425
No. of clusters	160	160	160	160	160
Wald test: $\beta_1 + \beta'_1$	-0.190*	-1.91	-0.101*	0.196***	-0.108*
Hausman test p-value	0.959	0.988	0.957	0.865	0.529
Wald test Prob > chi2	0.006	0.001	0.006	0.007	0.000
GeoComplexS (β_1)	-0.335	-1.104	-0.295	0.259***	0.056**
	(0.63)	(0.85)	(0.63)	(0.07)	(0.03)
Sov11*GeoComplexS	-0.275	-1.157	-0.227*	0.175***	-0.101*
(β'_1)	(0.65)	(0.87)	(0.14)	(0.05)	(0.06)
Sov11	-0.039*	0.182***	-0.049*	-0.025	0.071***
	(0.02)	(0.06)	(0.02)	(0.05)	(0.02)
No. Obs.	338	338	338	338	338
No. of clusters	127	127	127	127	127
Wald test: $\beta_1 + \beta'_1$	-0.610	-2.261	-0.522	0.434***	-0.045*
Hausman test p-value	0.995	0.977	0.995	0.895	0.883
Wald test Prob > chi2	0.018	0.019	0.014	0.004	0.000
GeoComplexB (β_1)	1.516***	1.542***	1.531***	-0.172	-0.227*
	(0.51)	(0.57)	(0.51)	(0.34)	(0.14)
Sov11*GeoComplexB	1.065***	1.000**	1.074***	-0.141	-0.127*
(β'_1)	(0.40)	(0.41)	(0.40)	(0.34)	(0.07)
Sov11	-0.003**	0.184***	-0.016*	0.058***	0.153***
	(0.00)	(0.07)	(0.01)	(0.02)	(0.05)
No. Obs.	225	225	225	225	225
No. of clusters	87	87	87	87	87
Wald test: $\beta_1 + \beta'_1$	2.581***	2.542***	2.605***	-0.313	-0.345*
Hausman test p-value	0.973	0.931	0.974	0.989	0.553
Wald test Prob > chi2	0.031	0.017	0.029	0.108	0.000

This table displays the results of the estimation of Eq. (1), Eq. (2) and Eq. (3) regarding the effects of bank foreign organizational complexity and geographic complexity on bank risk and profitability over the 2011-2013 period. All five groups successively represent our five dependent variables namely *Zscore* the natural logarithm of the measure of the bank default risk and financial stability ; *Zscore1* is the natural logarithm of the measure of bank asset risk ; *Zscore2* is the natural logarithm of the measure of bank leverage risk ; *SDROA* is the standard deviation of the return on assets on a three-year rolling window ; *ROA* is the return on assets that measures profitability as the ratio of net income to total assets. *Foreign*: dummy equal to one when the bank owns at least one affiliate abroad and zero otherwise ; *Nb_Host*: number of foreign countries where a bank has a foreign presence ; *Bank_S*: dummy equal to one when the bank owns only subsidiaries abroad, and zero otherwise ; *Bank_B*: dummy equal to one when the bank owns only branches abroad, and zero otherwise ; *Bank_BS*: dummy equal to one when the bank owns both foreign subsidiary and foreign branch, and zero otherwise ; *GeoComplex*: indicator of the geographic dispersion of a bank foreign affiliates in different world regions ; *GeoComplexS*: indicator of the geographic dispersion of the bank foreign subsidiaries in different world regions ; *GeoComplexB*: indicator of the geographic dispersion of the bank foreign branches in different world regions. *Sov11* is a dummy equal to 1 if the year is 2011, and zero otherwise. We use the Hausman-Taylor specification with a clustering at the bank-level to estimate all equations of our model. We run the Hausman test between the FE and HT estimators to identify the mix of endogenous variables that will generate the most consistent HT estimation. A constant was estimated for all equations but not reported. Variables were winsorized at 1% and 99% levels to limit the influence of extreme values and the table reports robust standard errors in parentheses and the significance of p-value by * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 11
Influence of bank foreign organizational complexity on bank risk and bank profitability

	Number of all affiliates					Number of subsidiaries					Number of branches				
	Zscore	Zscore1	Zscore2	SDROA	ROA	Zscore	Zscore1	Zscore2	SDROA	ROA	Zscore	Zscore1	Zscore2	SDROA	ROA
Nb_Affiliates	0.098*	0.154**	0.097*	-0.001	0.072***										
	(0.06)	(0.07)	(0.05)	(0.03)	(0.03)										
Nb_S						-0.073	-0.180	-0.067	0.055**	0.005					
						(0.17)	(0.22)	(0.17)	(0.02)	(0.08)					
Nb_B											0.169*	0.243**	0.168*	-0.023	0.038*
											(0.09)	(0.11)	(0.09)	(0.04)	(0.06)
Size (logTA)	0.050	0.138*	0.045	-0.003	0.007	0.088	0.248**	0.080	0.001	0.048*	-0.033	0.003	-0.037	-0.029	-0.034
	(0.13)	(0.07)	(0.13)	(0.03)	(0.04)	(0.16)	(0.11)	(0.16)	(0.04)	(0.03)	(0.17)	(0.22)	(0.17)	(0.04)	(0.06)
MarketShare	-7.621	-10.496	-7.546	0.385	-3.137	-6.335	-12.976	-5.973	-0.229	-4.283	-7.732	-11.168	-7.621	1.914**	-1.115
	(7.72)	(8.26)	(7.75)	(2.00)	(2.29)	(8.89)	(9.86)	(8.89)	(2.33)	(2.72)	(8.15)	(9.16)	(8.14)	(0.94)	(1.93)
EQ_TA	1.764**	0.622	1.782**	0.778***	1.222***	1.078*	0.230	1.086*	0.897***	1.344***	2.143*	-0.193	2.290*	0.683**	1.219**
	(0.73)	(1.39)	(0.74)	(0.30)	(0.40)	(0.58)	(1.47)	(0.58)	(0.32)	(0.44)	(1.26)	(3.68)	(1.31)	(0.35)	(0.50)
CIR	-0.321	-1.130*	-0.269	0.121*	-0.489***	0.293	-0.581	0.345	0.022	-0.515***	-0.061	-1.197	0.020	0.079	-0.655***
	(0.61)	(0.64)	(0.61)	(0.07)	(0.18)	(0.69)	(0.73)	(0.69)	(0.19)	(0.19)	(0.77)	(0.84)	(0.77)	(0.17)	(0.17)
IncomeDivers	-0.674*	-1.103***	-0.658*	0.017	-0.198*	-0.499	-1.019**	-0.480	-0.034	-0.269**	-1.821***	-2.276***	-1.802***	0.231*	-0.061
	(0.35)	(0.37)	(0.36)	(0.10)	(0.10)	(0.41)	(0.43)	(0.41)	(0.11)	(0.11)	(0.53)	(0.58)	(0.53)	(0.12)	(0.12)
Loans_TA	1.067**	1.907*	1.017**	0.128	0.909***	0.460	0.843	0.444	0.537***	0.961***	0.683	1.988**	0.611	-0.081	0.679*
	(0.53)	(1.12)	(0.52)	(0.27)	(0.31)	(1.23)	(1.35)	(1.23)	(0.20)	(0.37)	(1.37)	(0.88)	(1.37)	(0.31)	(0.35)
Listed	0.192	0.010	0.211	-0.052	-0.017	0.267	0.432*	0.260	-0.087	0.109	0.278	0.238	0.293	-0.102	-0.019
	(0.42)	(0.49)	(0.42)	(0.09)	(0.15)	(0.52)	(0.26)	(0.52)	(0.13)	(0.21)	(0.65)	(0.84)	(0.64)	(0.15)	(0.25)
Coop	0.567**	-0.015	0.601**	-0.150	-0.394**	0.571**	-0.212	0.617**	-0.201	-0.482**	0.357	-0.110	0.388	-0.033	-0.255
	(0.26)	(0.55)	(0.27)	(0.11)	(0.17)	(0.29)	(0.70)	(0.30)	(0.15)	(0.22)	(0.66)	(0.88)	(0.65)	(0.15)	(0.27)
Savg	0.566**	0.076	0.579**	-0.113	-0.383**	0.634**	-0.053	0.672**	-0.018	-0.254	0.723**	0.171	0.730**	-0.143	-0.357
	(0.26)	(0.58)	(0.27)	(0.11)	(0.18)	(0.29)	(0.71)	(0.30)	(0.14)	(0.26)	(0.36)	(0.94)	(0.36)	(0.17)	(0.28)
Restrictions	0.113**	0.277***	0.106**	-0.032*	0.073**	0.106**	0.225**	0.101**	-0.036*	0.033*	0.151**	0.343*	0.141*	-0.041	0.088**
	(0.05)	(0.11)	(0.05)	(0.02)	(0.04)	(0.05)	(0.11)	(0.04)	(0.02)	(0.02)	(0.08)	(0.21)	(0.07)	(0.04)	(0.04)
RegulCapital	0.120**	0.213*	0.117**	-0.024	0.049**	0.138***	0.223*	0.134**	-0.017	0.059**	0.124*	0.209**	0.121*	-0.031	0.043*
	(0.05)	(0.11)	(0.05)	(0.02)	(0.02)	(0.05)	(0.12)	(0.05)	(0.02)	(0.03)	(0.06)	(0.10)	(0.06)	(0.03)	(0.02)
Supervision	-0.333*	-0.627***	-0.321*	0.061**	-0.211***	-0.343*	-0.717***	-0.323	0.052**	-0.203**	-0.435	-0.684*	-0.428	0.101**	-0.167
	(0.19)	(0.23)	(0.19)	(0.02)	(0.07)	(0.20)	(0.26)	(0.20)	(0.03)	(0.09)	(0.27)	(0.37)	(0.27)	(0.04)	(0.12)
GDP growth	0.017	0.036**	0.017	0.002	0.008*	-0.004	0.024	-0.005	0.004	0.012**	-0.016	-0.028	-0.015	0.016**	-0.004
	(0.03)	(0.02)	(0.03)	(0.01)	(0.00)	(0.04)	(0.04)	(0.04)	(0.01)	(0.01)	(0.05)	(0.05)	(0.05)	(0.01)	(0.01)
LegalStrength	0.043**	0.015	0.044**	-0.005	-0.007	0.045**	0.007	0.047**	-0.006	-0.008	-0.006	-0.014	-0.006	0.002	0.008*
	(0.02)	(0.03)	(0.02)	(0.01)	(0.01)	(0.02)	(0.04)	(0.02)	(0.01)	(0.01)	(0.04)	(0.05)	(0.05)	(0.01)	(0.00)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	425	425	425	425	425	338	338	338	338	338	225	225	225	225	225
No. clusters	160	160	160	160	160	127	127	127	127	127	87	87	87	87	87
Hausman test p-	0.855	0.823	0.855	0.679	0.336	0.971	0.854	0.976	0.696	0.620	0.834	0.826	0.832	0.919	0.385
Wald test P > chi2	0.003	0.000	0.003	0.007	0.000	0.006	0.006	0.005	0.003	0.000	0.015	0.006	0.014	0.105	0.000

This table presents the results of the estimation of Eq. (2) regarding the effects of bank foreign affiliates complexity on bank risk and profitability over the 2011-2013 period. Our five dependant variables are *Zscore* the natural logarithm of the measure of the bank default risk and financial stability ; *Zscore1* is the natural logarithm of the measure of bank asset risk ; *Zscore2* is the natural logarithm of the measure of bank leverage risk ; *SDROA* is the standard deviation of the return on assets on a three-year rolling window ; *ROA* is the return on assets that measures profitability as the ratio of net income to total assets. *Foreign*: dummy equal to one when the bank owns at least one affiliate abroad and zero otherwise ; *Nb_Affiliates*: natural logarithm of the total number of foreign affiliates owned by a bank *Nb_S*: natural logarithm of the number of foreign subsidiaries owned by a bank ; *Nb_B*: natural logarithm of the number of foreign branches owned by a bank. *logTA*: natural logarithm of total assets (billions USD) ; *MarketShare*: ratio of the bank total assets to the total amount of assets in the country ; EQ_TA: Equity to total assets, measure of leverage/bank capitalization ; *IncomeDivers*: measure of income diversification $IncomeDivers = 1 - \left|\frac{Net\ Interest\ Income - Other\ Operating\ Incone}{Total\ Operationg\ Income}\right|$; *CIR*: Cost to income ratio ; *Deposits_TA*: Customer deposits and short-term funding to total assets ; *Loans_TA*: Net loans to total assets ; *Listed*: dummy equal to one if the bank is publicly trade and zero otherwise ; *Coop*: dummy equal to one if the bank has a "Cooperative" banking specialization ; *Savg*: dummy equal to one if the bank has a "Savings" banking specialization. *Restrictions* is the index of the restrictiveness in the participation into bank activities such as securities, insurance, real estate and the ownership power in nonfinancial firms ; *RegulCapital* is an index of the stringency of the requirements in terms of minimum capital adequacy, risk and market value losses, sources of funding used to capitalize a bank and the level of official appraisal ; *Supervision* is the measure of the official power in all actions taken by the authorities to prevent and correct problems regarding auditing, internal/board/ownership rights structure, profits and losses and other balance sheets items ; *GDP growth* is the growth rate of the real gross domestic product; *Concentration* is the proportion of assets held by the three largest banks in a country over the total assets of the banking sector ; *LegalStrength* measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. We use the Hausman-Taylor specification with a clustering at the bank-level to estimate the ten equations of our model. Variables were winsorized at 1% and 99% levels to limit the influence of extreme values and the table reports robust standard errors in parentheses and the significance of p-value by * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 12
Effect of bank foreign presence and foreign organizational complexity on bank risk and bank profitability _ **Listed banks**

	Zscore	Zscore1	Zscore2	SDROA	ROA
Foreign	0.171*	0.025	0.196*	0.050*	0.174**
	(0.10)	(0.66)	(0.11)	(0.03)	(0.08)
Size (logTA)	-0.357	-0.284	-0.365	0.076***	-0.116
	(0.27)	(0.29)	(0.27)	(0.03)	(0.08)
No. Obs.	256	256	256	256	256
No. of clusters	102	102	102	102	102
Hausman test p-value	0.582	0.575	0.570	0.291	0.229
Wald test Prob > chi2	0.042	0.002	0.042	0.000	0.000
Nb_Host	0.059*	0.043***	0.061*	-0.011	0.012**
	(0.03)	(0.01)	(0.03)	(0.01)	(0.00)
Size (logTA)	-0.482*	-0.375	-0.491*	0.117*	-0.148*
	(0.27)	(0.29)	(0.27)	(0.07)	(0.08)
No. Obs.	256	256	256	256	256
No. of clusters	102	102	102	102	102
Hausman test p-value	0.517	0.587	0.502	0.071	0.281
Wald test Prob > chi2	0.040	0.003	0.038	0.000	0.000
Bank_S	-0.237	-0.434	-0.217	0.129**	-0.028
	(0.46)	(0.47)	(0.47)	(0.06)	(0.27)
Size (logTA)	-0.331	-0.216	-0.340	0.095***	-0.109
	(0.23)	(0.25)	(0.23)	(0.03)	(0.08)
No. Obs.	256	256	256	256	256
No. of clusters	102	102	102	102	102
Hausman test p-value	0.588	0.570	0.578	0.241	0.338
Wald test Prob > chi2	0.025	0.001	0.025	0.000	0.000
Bank_B	0.491*	1.452***	0.442*	0.046	0.335**
	(0.25)	(0.51)	(0.23)	(0.37)	(0.16)
Size (logTA)	-0.360	-0.264	-0.367	0.101*	-0.114
	(0.23)	(0.24)	(0.23)	(0.06)	(0.08)
No. Obs.	256	256	256	256	256
No. of clusters	102	102	102	102	102
Hausman test p-value	0.595	0.611	0.587	0.126	0.306
Wald test Prob > chi2	0.047	0.002	0.045	0.000	0.000
Bank_BS	0.493**	0.146*	0.521**	-0.204	0.162**
	(0.22)	(0.08)	(0.23)	(0.22)	(0.08)
Size (logTA)	-0.369	-0.293	-0.375	0.101*	-0.114*
	(0.23)	(0.25)	(0.23)	(0.06)	(0.07)
No. Obs.	256	256	256	256	256
No. of clusters	102	102	102	102	102
Hausman test p-value	0.580	0.601	0.569	0.629	0.219
Wald test Prob > chi2	0.052	0.003	0.051	0.000	0.000

This table displays the results of the estimation of Eq. (1) and Eq. (2) regarding the effects of bank presence in host countries and foreign affiliates structure complexity on bank risk and profitability over the 2011-2013 period for **Listed banks**. Our five dependant variables are *Zscore* the natural logarithm of the measure of the bank default risk and financial stability ; *Zscore1* is the natural logarithm of the measure of bank asset risk ; *Zscore2* is the natural logarithm of the measure of bank leverage risk ; *SDROA* is the standard deviation of the return on assets on a three-year rolling window ; *ROA* is the return on assets that measures profitability as the ratio of net income to total assets. *Foreign*: dummy equal to one when the bank owns at least one affiliate abroad, and zero otherwise ; *Nb_Host*: number of foreign countries where a bank has a foreign presence ; *Bank_S*: dummy equal to one when the bank owns only subsidiaries abroad, and zero otherwise ; *Bank_B*: dummy equal to one when the bank owns only branches abroad, and zero otherwise ; *Bank_BS*: dummy equal to one when the bank owns both foreign subsidiary and foreign branch, and zero otherwise. We use the Hausman-Taylor specification with a clustering at the bank-level to estimate all equations of our model. We run the Hausman test between the FE and HT estimators to identify the mix of endogenous variables that will generate the most consistent HT estimation. Variables were winsorized at 1% and 99% levels to limit the influence of extreme values and the table reports robust standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

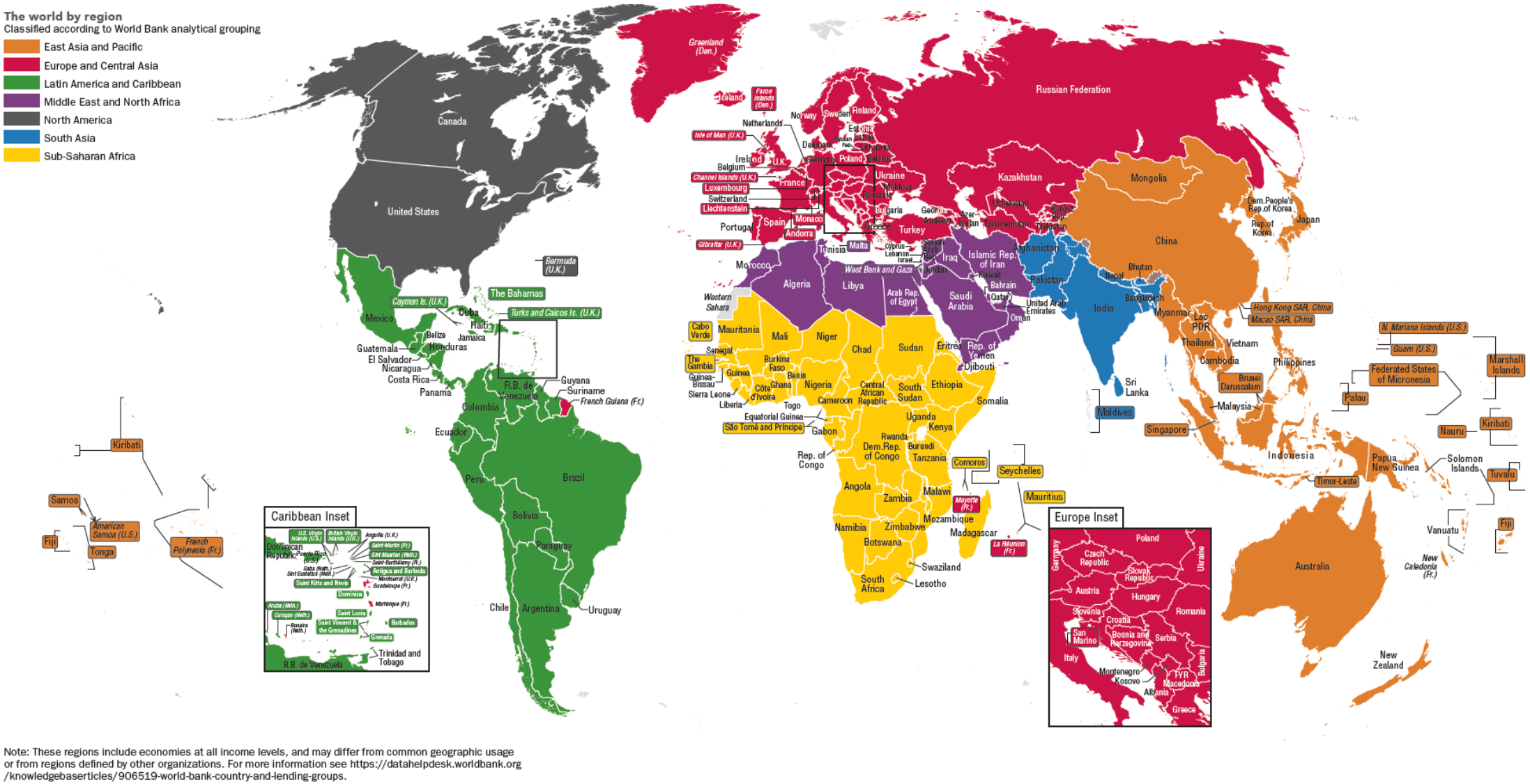
Appendix A

World regions (8) classification of host countries (154) and distribution of banks foreign affiliates

East Asia & Pacific (EAP) 25	Australia ; Brunei Darussalam ; Burma/Myanmar ; Cambodia ; China ; Fiji ; French Polynesia ; Hong Kong ; Indonesia ; Japan ; Korea ; Lao PDR ; Macau ; Malaysia ; Mongolia ; New Caledonia ; New Zealand ; Philippines ; Singapore ; Taiwan ; Thailand ; Timor-Leste ; Vanuatu ; Vietnam ; Wallis and Futuna	Number of EU banks with foreign activity – 26 Number of foreign affiliates – 226 Number of foreign subsidiaries – 81 Number of foreign branches – 145
Europe (EUR) 44	Albania ; Andorra ; Austria (EU) ; Belarus ; Belgium (EU) ; Bosnia and Herzegovina ; Bulgaria (EU) ; Croatia (EU) ; Cyprus (EU) ; Czech Republic (EU) ; Denmark (EU) ; Estonia (EU) ; Finland (EU) ; France (EU) ; Germany (EU) ; Gibraltar ; Greece (EU) ; Hungary (EU) ; Ireland (EU) ; Italy (EU) ; Kosovo ; Latvia (EU) ; Liechtenstein ; Lithuania (EU) ; Luxembourg (EU) ; Macedonia ; Malta (EU) ; Moldova ; Montenegro ; Netherlands (EU) ; Norway ; Poland (EU) ; Portugal (EU) ; Romania (EU) ; San Marino ; Serbia ; Slovakia (EU) ; Slovenia (EU) ; Spain (EU) ; Sweden (EU) ; Switzerland ; Turkey ; Ukraine ; United Kingdom (EU)	Number of EU banks with foreign activity – 150 Number of foreign affiliates – 5424 Number of foreign subsidiaries – 297 Number of foreign branches – 5127
Central Asia (CA) 8	Armenia ; Azerbaijan ; Georgia ; Kazakstan ; Kyrgyzstan ; Russian Federation ; Turkmenistan ; Uzbekistan	Number of EU banks with foreign activity – 25 Number of foreign affiliates – 1368 Number of foreign subsidiaries – 25 Number of foreign branches – 1343
Latin America & Caribbean (LAC) 18	Antigua and Barbuda ; Argentina ; Bahamas ; Brazil ; Cayman Islands ; Chile ; Colombia ; Curacao ; Dominican Republic ; Haiti ; Mexico ; Panama ; Paraguay ; Peru ; Puerto Rico ; St. Pierre and Miquelon ; Uruguay ; Venezuela	Number of EU banks with foreign activity – 21 Number of foreign affiliates – 7048 Number of foreign subsidiaries – 72 Number of foreign branches – 6976
Middle East & North Africa (MENA) 15	Algeria ; Bahrain ; Djibouti ; Egypt ; Israel ; Kuwait ; Lebanon ; Libya ; Morocco ; Oman ; Palestine ; Qatar ; Saudi Arabia ; Tunisia ; United Arab Emirates	Number of EU banks with foreign activity – 10 Number of foreign affiliates – 92 Number of foreign subsidiaries – 25 Number of foreign branches – 67
North America (NA) 3	Bermuda ; Canada ; United States of America	Number of EU banks with foreign activity – 19 Number of foreign affiliates – 2172 Number of foreign subsidiaries – 90 Number of foreign branches – 2082
South Asia (SA) 6	Bangladesh ; India ; Maldives ; Nepal ; Pakistan ; Sri Lanka	Number of EU banks with foreign activity – 6 Number of foreign affiliates – 34 Number of foreign subsidiaries – 5 Number of foreign branches – 29
Sub-Saharan Africa (SSA) 35	Angola ; Botswana ; Burkina Faso ; Burundi ; Cameroon ; Cape Verde ; Chad ; Congo ; Congo, Rep. Dem. ; Côte d'Ivoire ; Equatorial Guinea ; Ethiopia ; Gabon ; Gambia ; Ghana ; Guinea ; Guinea-Bissau ; Kenya ; Madagascar ; Malawi ; Mali ; Mauritania ; Mauritius ; Mozambique ; Nigeria ; Rwanda ; Sao Tome and Principe ; Senegal ; Seychelles ; Sierra Leone ; South Africa ; Tanzania ; Uganda ; Zambia ; Zimbabwe	Number of EU banks with foreign activity – 21 Number of foreign affiliates – 81 Number of foreign subsidiaries – 44 Number of foreign branches – 37

Figure A.1

Map of all world countries into seven world regions



Note: These regions include economies at all income levels, and may differ from common geographic usage or from regions defined by other organizations. For more information see https://datahelpdesk.worldbank.org/knowledgebaserticles/906519-world-bank-country-and-lending-groups.

Source: *World Bank – World Development Indicator (2017) – http://databank.worldbank.org/data/download/site-content/wdi/maps/2017/world-by-region-wdi-2017.pdf*

Appendix B

Descriptive statistics sub-samples of banks

In this table we summarize the descriptive statistics of the sub-samples of ECB banks (106) and Large banks (420) over the 2011-2013 period for all bank-level characteristics downloaded from Bankscope, SNL database and the different banks web pages; detailed definitions are provided in Section 3.

	ECB banks (TA > 30 bil. € / 40 bil. $)						**Large banks (TA > Median 3190.33 mil. $)**					
Variable name	Obs.	Mean	StdDev.	Median	Min	Max	Obs.	Mean	StdDev.	Median	Min	Max
Foreign Organizational Complexity												
Foreign	262	0.61	0.49	1	0	1	1088	0.31	0.46	0	0	1
Nb_Host	262	4.94	9.66	1	0	47	1088	1.52	5.20	0	0	47
Nb_Affiliates	262	171.52	680.64	1	0	4938	1088	43.71	341.92	0	0	4938
Bank_S	262	0.24	0.43	0	0	1	1088	0.14	0.35	0	0	1
Nb_S	262	5.10	10.96	1	0	60	1088	1.48	5.83	0	0	60
Bank_B	262	0.05	0.22	0	0	1	1088	0.06	0.23	0	0	1
Nb_B	262	166.42	674.19	0	0	4901	1088	42.23	338.40	0	0	4901
Bank_BS	262	0.32	0.47	0	0	1	1088	0.12	0.32	0	0	1
Dependant variables												
Risk												
Zscore	262	114.57	278.80	50.62	3.53	3944.26	1088	254.89	596.84	70.47	1.10	3944.26
ln(Zscore)	262	4.01	1.09	3.92	1.26	8.28	1088	4.43	1.38	4.26	0.23	8.28
Zscore1	262	6.43	12.39	2.66	0.01	103.00	1088	10.32	18.17	3.83	0.01	103.00
ln(Zscore1)	262	1.11	1.15	0.98	-2.35	4.73	1088	1.42	1.35	1.34	-2.35	4.73
Zscore2	262	107.91	268.33	46.51	2.59	3841.63	1088	244.15	579.22	66.72	1.75	3841.63
ln(Zscore2)	262	3.93	1.12	3.84	0.95	8.25	1088	4.36	1.40	4.20	0.56	8.25
SDROA	262	0.18	0.23	0.12	0.00	1.98	1088	0.23	0.61	0.10	0.00	12.49
Profitability												
ROA	262	0.50	0.50	0.34	0.00	2.80	1088	0.58	0.65	0.40	0.00	8.66
Bank-level control variables												
TA (million USD)	262	154437.70	174724.70	55502.10	40002.2	580117.00	1088	46016.49	105340.10	13576.40	3194.35	580117.00
Size (logTA)	262	11.40	1.00	10.92	10.60	13.27	1088	9.72	1.19	9.52	8.07	13.27
MarketShare	262	7.45	8.57	3.11	0.21	27.91	1088	3.40	6.60	0.34	0.03	27.91
EQ_TA	262	6.68	4.22	6.17	0.92	49.24	1088	8.53	5.65	7.77	0.92	95.93
IncomeDivers	262	0.68	0.21	0.72	0.00	0.98	1088	58.53	16.20	60.07	6.51	191.14
CIR	262	58.29	16.52	61.33	6.51	109.26	1088	57.34	23.22	63.71	0.26	96.81
Loans_TA	262	50.85	22.82	53.56	0.79	91.78	1088	0.64	0.24	0.69	0.00	0.98
Listed	262	0.32	0.47	0	0	1	1088	0.17	0.38	0	0	1
Coop	262	0.18	0.38	0	0	1	1088	0.27	0.44	0	0	1
Savg	262	0.19	0.39	0	0	1	1088	0.20	0.40	0	0	1