UNIVERSITE DE LIMOGES

ECOLE DOCTORALE – Sociétés et Organisations n°526

Faculté de Droit et des Sciences Economiques

Laboratoire d'Analyse et de Prospective Economiques (LAPE) EA 1088

Thèse
pour obtenir le grade de
Docteur de l'Université de Limoges

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Présentée et soutenue publiquement par

Annick PAMEN NYOLA

Limoges, 15 Janvier 2018

Bank Internationalization and Regulatory Framework: Organizational Strategies, Bank Performance, and Systemic Risk

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"The opinion expressed in this thesis are those of the PhD candidate and do not necessarily reflect the views of the University of Limoges."

"La faculté n'entend donner aucune approbation ou improbation aux opinions émises dans les thèses ; ces opinions doivent être considérées comme propres aux auteurs."

To my dear and awesome parents.

At all times and despite everything, I can always feel your love and support.

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SUMMARY

GENERAL INTRODUCTION

The persistent liberalization and deregulation of financial systems and integration of economies over the last decades have changed the organizational structure and behavior of banks in both the domestic and the foreign environments [Kindleberger (1983), Berger et al. (2000), McCauley et al. (2010)]. The evolution towards multinational institutions calls to the specificities of different affiliates forms as they might deeply shape the constraints in terms of legal responsibility and financial support for the expanding bank. These processes have led to a stronger interconnectedness across countries of different levels of economic development and banking markets, increasing the size, the global network, and the potential failures of financial institutions. The substantial changes in all banking systems have raised questions regarding the issues of banks' expansion into multinational banks, the number of large and/or complex institutions, and the share and market power of such important institutions. Complexity evaluates how intricate is a network of different activities, and/or different legal entities, and/or in domestic or foreign markets, and/or exposed to different products. Moreover, throughout these years, economic and financial development have been accompanied by banking regulation reforms so that some markets that were highly protected and regulated now experience significant presence of foreign banks [Barth et al. (2001, 2004, 2008, 2013), Carbo-Valverde et al. (2012), Houston et al. (2012), Karyoli and Taboada (2015)]. Therefore, studies on foreign banks' entry should be conducted both in regards of their causes and consequences.

In setting up foreign operations, the characteristics of the destination country, the characteristics of the parent bank, and the specificities of the chosen organizational forms are critical. Clarke et al. (2003) consider bank foreign expansion in developing economies and show that the share of assets held by foreign banks differs widely across countries but they cannot highlight a clear pattern of foreign bank penetration based on the level of development. Yet, when it comes to characteristics such as banks' size, efficiency, performance, and local laws and regulations, bank expansion in developing countries differs from that in developed countries. Barth et al. (2013), from a thorough and large cross-country survey, provide indexes of bank regulation and supervision to compare and analyze changes over time and countries and their evidence suggests some differences between developing and developed economies. Among the strategies of internationalization, banks can manage cross-border lending, or engage into mergers and acquisitions of domestic and foreign entities or, open de novo entities. Considering the latest strategy as the most invasive one, examining the determinants of banks' operations in poorer, transiting, and richer foreign countries through

the lens of banking regulation and the preferred affiliate structure (branches or/and subsidiaries) might offer new insights in understanding banks' foreign expansion.

From Herring and Santomerro (1990) to Herring and Carmassi (2010) or Claessens and van Horen (2012) and Ceterolli et al. (2014), there is an enriched literature on the transformation of banks from standalone entities to large and/or complex institutions and the creation of financial conglomerates and bank holding companies (BHC) with numerous counterparts at home and abroad. Because of their international, complex, and active networks, such large banks might increase banks' risk and potential contagion worldwide. Yet, no conclusive evidence on the implications of bank internationalization on the parent bank's risk can be drawn from the few aforementioned studies. The focus has been put on the impact of banks' presence abroad on the foreign banks' performance and the home and host country banking sector performance [Demirguc-Kunt et al. (1998); Claessens et al. (2001); Pasiouras and Kosmidou (2007); Chen and Liao (2011)]. Others academics investigate the relation between the entry of large banks and access to credit in the host or the home countries and report either a decline in credit supply in the foreign markets after the entry [(Mian, 2006); Detragiache et al. (2008)] or a similar supply of credit by local and foreign banks [Gianneti and Ongena (2012)]. Therefore, given the additional issue of bank complexity, there is a need for more research on the implications of bank internationalization on bank risk and profitability.

Another critical element in the internationalization of large or complex banks is the relationship to bank risk and how economic shocks might affect such relationship. The latest financial turmoil and "restructuring" on international markets question the potential benefits of bank cross-border activities. Internationalization is common for many banks and even more for large banks, which can also be complex institutions. Since both the global financial crisis and the European sovereign debt crisis, the size and complexity of global financial institutions has occupied the front page on the policy agenda of banking regulators and academic debate. Operating different businesses or having a presence in different markets abroad can alleviate bank risk for institutions that benefit from diversification [Gropp et al. (2010) and Goetz et al. (2016)]. As well, because of market power and intense competition, bank risk can be either reduced [Schaeck et al. (2009), Martinez-Miera and Repullo (2010)] or aggravated for institutions with cross-country ties [Boyd and De Nicolo (2005), Beck et al. (2013)]. However, in addition to the previous considerations, owning affiliates of different types in

many countries and increasing the interconnectedness of some institutions which, if vulnerable can generate high contagion to other markets, bank risk can turn into a systemic risk and then have implications on the global system fragility.

Contribution and structure of the dissertation

Following the overview above, this thesis first examines the drivers of banks expansion abroad and of the choice of the organizational structure they establish in host countries. Second, we analyze the relationship between bank internationalization and bank performance. Finally, considering the recent global financial crisis and European sovereign debt crisis, we investigate whether the impact of bank internationalization on systemic risk depends on the state and soundness of the financial system.

More precisely, this dissertation is comprised of three empirical essays that address the issue of multinational European banks' behavior, performance, and stability. Considering the diversity of the 28 countries and at the same time some similarities due to economic integration in the European Union (EU), probably all specificities of bank foreign expansion can be observed at once in such environment. Indeed, as pointed out in Goddard et al. (2007), there is a necessity for European banks to change their structures and strategies and to expand and diversify their activities in order to improve their performance. The first chapter provides some answers on what determines the attractiveness of developed and developing countries for banks with counterparts in foreign locations and on their preferred affiliates' types. The second chapter investigates the effect of bank presence abroad and specifically the impact of organizational and geographic complexity on the individual risk and profitability. The third chapter focuses on systemic risk and examines whether the effect on bank systemic risk of internationalization with foreign subsidiaries is different during normal times and in distress times.

For each of the three chapters, the motivations, research questions, and contributions to the banking literature are briefly presented in what follows.

Foreign banks expand abroad to follow their international customers, create or pursue business opportunities, take advantage to the banking regulation and to benefit from advantages of countries economic integration. Banks might conduct foreign operations through cross-border lending or physical onshore entry of foreign markets either by setting

new entities or by merging with or acquiring an existing local institution. **Chapter 1** determines for a set of European banks the factors that draw banks to a foreign developing country versus a developed country and the choice of the organizational form banks establish in the foreign markets. Our aim is to investigate how both the host country and the home country regulation affect the decision of where and how to go abroad to both developed and developing countries. For this purpose, we consider banks headquartered in the European Union over the 2011–2013 period and the locations and types of their affiliates (branches and/or subsidiaries) in high-, middle-, or low-income host countries. In fact, as at the time of collection, branch data was available for the sole year 2013 and due to the absence of a historical database, our database of banks' affiliates is limited to 2013. And, checking on banks' websites the location and number of affiliates abroad; we did not find a significant difference in organizational structure in 2013 relatively to 2012 and 2011. We also use the survey of Barth et al. (2012) and construct banking regulation indexes that assess the entry into banking requirements, the bank activity restrictions, the regulatory capital requirements, and the power of supervision. We find that while banks favor a presence in developed economies with numerous entry requirements and activities restrictions and yet weaker supervision, they avoid locations with stronger capital regulation than at home. We also find that low-income countries with stringent entry into banking and regulatory capital requirements, and greater supervisory power are more likely to welcome foreign banks. We then show that host country's banking regulation is an important determinant of the choice of the foreign organizational strategy which can be influenced by the level of development of the host country. Banks are more likely to open branches rather than subsidiaries in developing countries with stringent bank activity restrictions and capital requirements and greater supervisory power. Hence, from the parent bank and regulators perspective, our findings raise questions on the extent of a bank network of foreign affiliates and on whether the increasing number of counterparts in different countries and regions might affect bank performance and financial systems' stability. The following two chapters provide answers to the questions.

Chapter 2 investigates whether and how the bank presence abroad and foreign complexity affect bank performance (i.e. risk and profitability) over the 2011–2013 period. Our main objective is to determine the effect on the parent bank risk and profitability of internationalization through the number of host countries where foreign affiliates are located and their dispersion in different world regions. More precisely, we first define three organizational expansion strategies with branches and/or subsidiaries and second we construct

a normalized indicator of the geographic diversity of affiliates around world regions. Using a sample of commercial, cooperative, and savings banks, we analyze both the organizational and geographic complexity and find strong evidence that multinational banks are less exposed to insolvency as they exhibit lower probability of default, lower leverage risk, and take less risk for a lower profitability. Exploring the impact of banks foreign organizational complexity measured by their exclusive network of foreign subsidiaries or foreign branches only or the dual business strategy with both affiliates' types, we find that the diversification of affiliates is critical for financial stability. More organizational complex banks that expand abroad with both subsidiaries and branches affiliates are more stable and banks that establish foreign branches exclusively are the only ones with significantly lower asset risk. Banks that are more complex are less vulnerable with significant lower risk. Further, considering multinational banks that diversify the location of their affiliates in different regions, we investigate the influence of geographic complexity on bank performance and our results reveal higher volatility of earnings and higher profitability. Our findings challenge the idea that bank complexity might be negative for the stability of banking systems and hence bring forth the necessity to study the systemic dimension of risk.

Finally, **Chapter 3** evaluates for European listed banks the impact of the international presence and geographic expansion through subsidiaries on banks' systemic risk during the 2005–2013 period. Previous studies have focused on the issues of too-big- and too-complex-to-fail institutions and Global Systemically Important Banks (G-SIBs) and analyzed the bank individual risk but not its exposure to systemic risk, the magnitude of systemic shocks, and the contagion risk. Taking on this void in the literature, we investigate how the peak of the 2008–2009 global financial crisis and the height of the 2010–2011 European sovereign debt crisis have affected such measures. We test the relationships between internationalization and foreign complexity and systemic risk before the crisis (2005–2007), during the enlarged window of the severe financial stress (2008–2011), and in the aftermath period (2012–2013). We find that internationalization and foreign complexity are important drivers of bank systemic risk, particularly during the 2008–2011 financial stress years. Our findings contribute to the ongoing debate on the merits of imposing systemic risk-based and organizational complexity capital surcharges (as in Basel III requirements), and carry various policy implications for too-complex and systemically important banks.

CHAPTER 1

How does regulation affect the organizational form of foreign banks' presence in developing versus developed countries?

This chapter draws from the working paper “How does regulation affect the organizational form of foreign banks' presence in developing versus developed countries?” co-authored with Alain Sauviat and Amine Tarazi.

1.1. Introduction

The liberalization of financial systems in most developing countries has totally reshaped the structure of banking industries worldwide and led to an intensive development of multinational banks [Kindleberger (1983), Berger et al. (2000), McCauley et al. (2010)]. Banking markets which were previously highly protected and regulated, specifically in developing countries, have experienced significant changes with a stronger presence of foreign banks. Over the decades, to benefit from such trends, banks have mastered cross-border lending plans through syndicated loans, engaged into mergers and acquisitions of domestic and foreign entities or, opened de novo entities [Focarelli and Pozzolo (2001), Focarelli et al. (2002), Buch and DeLong (2004)]. Yet, foreign bank penetration strategies are dependent on market characteristics and regulations in place in each country [Goddard et al. (2007), Buch et al. (2014)].

This paper investigates the determinants and the organizational forms of foreign bank presence in developed as opposed to developing countries by focusing on the regulatory environment in both home and host countries. We hereby build a bridge between two strands of the literature dedicated to banks' international expansion. Some works have looked into how banks go abroad (foreign branch or subsidiary) [Ball and Tschoegl (1982), Dell'Ariccia and Marquez (2010), Fiechter et al. (2011)] and into the impact of international banking regulations [Barth et al. (2001, 2004, 2008, 2013), Carbo-Valverde et al. (2012), Houston et al. (2012), Cihak et al. (2012), Karyoli and Taboada (2015)]. Other papers have investigated the presence and the role played by foreign banks in developing countries specifically [Clarke et al. (2003), Cerutti et al. (2007), Cerutti et al. (2010)]. We hence fill a gap by examining the determinants of banks' expansion abroad, in developed countries as opposed to developing countries, and under which form such expansion takes place. Specifically, among the different aforementioned strategies of internationalization, we look into why banks operate in a host country rather with branches or with subsidiaries. In particular, we construct a unique hand-collected database of banks in the European Union and their affiliates in 154 countries. Taking into account the level of economic development is important because the effectiveness and actual role played by regulatory factors is expected to be different in mature and in emerging financial systems.

Organizational forms play a major role because they deeply shape the constraints in terms of legal responsibility and financial support for the expanding bank. A subsidiary, which is an entity with 50% or more of its shares owned by another company, competes

directly and deeply on the domestic market, engages in full banking activities, abides the laws of that country, owns a full accounting statement, and is a total independent entity from the parent bank. On the contrary, a branch is an extension of the parent bank which undergoes the home country supervision and all its activities, assets, incomes, and costs are accounted for by the parent bank. The evolution of the organizational structure of a multinational bank can be measured by the number of its foreign subsidiaries and branches. Ball and Tschoegl (1982), Fisher and Molyneux (1996), Breakley and Kaplanis (1996), Herrero and Martinez Peria (2007), and Dell'Ariccia and Marquez (2010) highlight the differences between running a subsidiary or a branch in a host country. A subsidiary operates under limited liability and therefore the parent bank is shielded from great losses and yet more exposed to expropriation risk. Conversely, with a branch, the parent bank maintains its capital at home and to some extent avoids some of the constraints imposed by foreign regulators.

Our study builds on the existing literature on multinational banks' foreign operations and extends it to account for the organizational forms banks develop abroad given the regulation in place and the degree of development of each country. We construct for the year 2013 a sample of 1,251 banks from the 28 European Union countries. 289 of these banks conduct foreign activities under 20,850 foreign affiliates in 154 host countries with different levels of economic development. Following Barth et al. (2001, 2004, 2008, and 2013) and their survey updated in 2012, we build for all home and host countries four bank regulation indexes that measure the entry requirements into the banking system, the restrictiveness in bank activities, the stringency of capital requirements, and the power of supervisors. Our aim is to investigate how regulation affects the organizational form of banks' presence in developing as opposed to developed countries. From this perspective, our work is closely linked to Cerutti et al. (2007) who show that the world's top 100 banks look at legal differences when operating either branches or subsidiaries in Latin America and Eastern Europe. We extend the literature by specifically differentiating the level of development of the host countries as a factor that could influence the type of entry and business model in presence of a different regulatory environment. First, we determine both home and host factors and bank characteristics that influence the presence of banks in high-, middle-, or low-income foreign countries. Second, after controlling for the factors that explain such foreign expansion, we analyze whether banks penetrate the host market with an exclusive business model of subsidiaries only or branches only or with a dual business model of both forms. Our findings show that rather than countries with weak regulation, banks prefer being present in countries with strong bank regulation and supervision. Such a result is amplified in low-

income countries where severe entry conditions, stringent capital requirements, and greater supervisory power increase the likelihood for banks to operate foreign entities. Nevertheless, bank activity restrictions make low-income countries less likely to host foreign banks. Moreover, banks are more likely to run foreign branches in high-income countries that strongly restrict their activities and in middle and low-income countries with stringent capital requirements and supervisory power.

The remainder of the paper is organized as follows. Section 1.2 reviews the literature and Section 1.3 describes the data, the foreign organizational form variables we construct, and presents the empirical methodology as well as the other variables used in our study. In Section 1.4 we discuss the results and in Section 1.5 we perform some additional estimations and robustness checks. Section 1.6 concludes and provides some policy implications.

1.2. Related literature

1.2.1. *Banks' foreign presence and regulatory framework*

Previous research on bank internationalization has looked in different directions. Many papers have focused on foreign entry in the U.S. or entry by U.S. banks in foreign countries. Fieleke (1977) surveys the growth of U.S. banking abroad and argues that the observed fast expansion is essentially motivated by the profitability of foreign branches and the stability of lending rates in host countries which contributes to lower risk. Other papers have shown that because of former regulatory restrictions and government obstacles to foreign activity, the establishment of foreign banks affiliates had strongly relied on past cross-border experience, the maturity of the foreign banking market, per capita income, foreign direct investment (FDI), and foreign trade [Goldberg and Saunders (1980, 1981a), Hultman and McGee (1989), Groose and Goldberg (1991), Heinkel and Levi (1992), Goldberg and Groose (1994), Shiers (2002)]. Regulation plays an important role in foreign expansion as a bank might target fragile countries with low requirements and high expected profits to evade stricter conditions at home. The authors also find that these factors affecting the decision to expand overseas do play significant and different roles in the choice of the organizational entity set in foreign markets. Considering that a foreign branch undergoes the parent bank's country regulation and that a foreign subsidiary abides the host country regulation, the motivations behind how to penetrate foreign markets differ greatly. From the literature, FDI had a major influence on the extent of U.S. branching activity around the world and the extent of foreign subsidiaries in the U.S., banks from countries with small capital markets tended mainly to establish

subsidiaries, and foreign branches were sometimes used as a method to escape home banking regulation. Other works highlight the importance of expertise in banking services, participation in interbank markets and the concentration of multinational customers and firms [Terrell and Key (1977), Goldberg and Johnson (1990), Parkhe and Miller (1998)]. They point to the facts that establishing foreign subsidiaries needs a capital injection which require the parent bank to have internal equity capital in excess or to raise it on the market. They also find that banks usually establish branches to serve their international customers through wholesales banking services whereas subsidiaries are often used to conduct retail-banking business and compete strongly with local institutions. Globally, similar conclusions have been reached in studies focusing on other countries such as Indonesia [Cho (1990)], Japan [Yamori (1998)], Germany [Buch (2000)], and China [Xu (2011)].

The numerous reforms of domestic and international banking regulations have continuously raised conflicting questions about the management of foreign-owned institutions and the stabilization of financial markets. Some authors have argued that more stringent regulatory requirements significantly affect cross-border banking as banks can either invest in a stringent country if they prefer to secure their investments rather than pursuing potentially high but not guaranteed profits or avoid such locations where they might have less room for maneuver. For instance, examining over 3,000 international bank mergers, Buch and DeLong (2008) find that the significant effect of tougher supervisory authorities on mergers differ as it is negative in the acquiring home countries and positive in the targeted host countries. Banks from less supervised country are attracted to countries with strong supervision where they wish to export their domestic loopholes and engage in aggressive competition with local institutions which are constrained by their strong local supervisors. As authorities of such host markets fear an increase of risk from foreign investors, they will discourage mergers. Hence, weak host country bank supervision could give banks the ability to shift risk from themselves to both home and host supervisors. Moreover, by investigating the effects of banking market structure, governance, and changes in bank supervision, Chen and Liao (2011) find that the compliance of the host country to the Basel guidelines increases foreign bank operations and profitability. Further, Allen et al. (2012) assess the impact of the Basel III banking regulation reforms and find that in the long-term the structural implications might reduce the supply of credit, and disrupt the economy. Regarding the stringency of capital and liquidity requirements, they also find that operating a foreign subsidiary will be less likely in the short run. Finally, other papers conclude that depending on bank’s ownership structure, home bank

regulation, in terms of greater capital requirement, tighter restrictions on bank activities, stringent supervisory power, and lower barriers to entry amplifies costs, reduces foreign bank lending standards and leads to an increase of risk-taking activities in foreign markets and cross-border risks spillover [Laeven and Levine (2009), Ongena et al. (2013)].

1.2.2. *Foreign bank presence, economic development, and crisis*

Another strand of the literature has focused on foreign bank entry in emerging, transition and developing countries and examined the implications on domestic markets. Goldberg and Saunders (1981b), Miller and Parkhe (1998), and Clarke et al. (2003) have documented that besides chasing their customers abroad[1], foreign banks are principally interested in exploiting local lending opportunities and are more likely to use subsidiaries than branches to provide a wide range of activities. Jeon et al. (2011) examine the link between foreign bank penetration and the competitive structure of host emerging banking sectors in Asia and Latin America and find spillover effects from foreign to domestic banks. Bonin et al. (2014) analyze the evolution of banking in transition countries from Central Eastern Europe (CEE), South Eastern Europe (SEE), and the former Soviet Union (FSU) and study the effect of the global financial crisis. They show that the banking sector in such regions consists in a majority of foreign-owned institutions and has experienced significant retail credit surges over the years. Yet, given the local regulatory and supervisory policy responses the systemic impact in the three regions was rare and banks overall outperformed banks in more developped countries. Going further in considering both developed and developing markets, other studies show that because foreign banks perform better than domestic banks, higher competition either increases the efficiency and financial stability of the host country banking industry [Claessens et al. (2001, 2007, 2014), Lensink and Hermes (2004), Olivero et al. (2011), Giannetti and Ongena (2012)], or accelerates consolidation through mergers or acquisitions [Clarke et al. (2006)]. Koçak and Özcan (2013) have deeply documented the literature of multinational firms' market entry decisions from four theoretical perspectives namely strategic interactions, economic geography externalities, density dependence in ecological traditions, and institutional rules. Additionally, in times of crises, Adams-Kane et al. (2013), de Haas and van Lelyveld (2014), and Cerutti (2015) show that foreign banks that are exposed to their parent home country risk after a crisis and that are not supported by their parent bank through a group internal capital market change their patterns of lending by

[1] See Williams (2002) for a review of the literature on the "follow the customers" internationalization hypothesis.

decreasing credit supply in emerging, transition and developing host countries. However, foreign banks from non-crisis developed parent home countries increase their lending relatively to developing domestic institutions. Also, countries that have experienced a crisis tend to face higher foreign bank entry after the crisis than before [Cull and Martinez Peria (2007)].

1.3. Data and model

In this section we describe our sample of banks, the method we use to look into each bank's organizational structure abroad, and present the econometric specification used to estimate the likelihood of banks' presence abroad and the foreign affiliate types in host countries. We also present the country-level regulatory and institutional variables and bank-level variables used in our investigation.

1.3.1. *Banks and their international affiliates*

Our study is based on a hand-collected database specifying where and how banks are present abroad. Considering the European Union[2] (EU) with the diversity of the 28 countries and at the same time some similarities due to the economic integration in the Union [Goddard et al. (2007)], probably all specificities of bank foreign expansion can be observed at once. Thus, banks headquartered in the EU should provide a relevant environment for our empirical analysis. The data on banks and subsidiaries are retrieved from the Bureau Van Djik (BvD) Bankscope database and some of the banks' websites. Additionally, to complete the number of affiliates, we hand-collect all the branches and their location from the SNL database. At the time of collection, branch data was available for the year 2013 only and due to the absence of a historical database, our database of banks' affiliates is limited to 2013. Checking on banks' websites the locations and number of the affiliates abroad across 5 years (2010–2014), we did not find a significant difference in organizational structure in 2013 relatively to 2012 and 2011, unlike for the other years. Therefore, we assume that the structure observed in 2013 can be applied to 2012 and 2011 and hence, this study is based on the period 2011–2013. We extract from Bankscope information on 4,900 European banks. However, in order to keep the most representative institutions, we apply filters regarding the availability of all financial

[2] 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.

information and the nature of the main activity[3] of the bank. We end up with 1,251 European Union (EU) banks. 434 of these banks are global ultimate owners (EU GUO)[4], 358 are the controlled subsidiaries (CS) of these EU GUO (i.e. EU CS), and 459 banks are subsidiaries controlled by an ultimate owner outside the EU (i.e. non-EU CS).

Table 1.1 – Distribution of European Union' banks in 2013

EU Countries	All banks	Banks with a foreign activity	Host countries HC (154)
Euro Area	**943**	**234**	///
Austria	115	28	34
Belgium	31	12	18
Cyprus	10	6	6
Estonia	3	0	0
Finland	10	5	8
France	182	43	69
Germany	239	34	68
Greece	8	4	10
Ireland	10	1	10
Italy	120	34	30
Latvia	7	3	8
Lithuania	6	0	0
Luxembourg	46	22	21
Malta	8	2	3
Netherlands	15	7	40
Portugal	25	13	24
Slovakia	9	0	0
Slovenia	13	4	7
Spain	86	16	35
Non Euro Area	**309**	**55**	///
Bulgaria	13	2	4
Croatia	27	5	2
Czech Republic	15	2	3
Denmark	70	6	24
Hungary	14	4	7
Poland	29	3	6
Romania	16	4	2
Sweden	22	4	37
United Kingdom	102	25	66
Total : 28	**1,251**	**289**	///

Source: Bankscope, SNL Database, bank web pages

[3] We consider six types of specialization: Bank Holding & Holding Companies, Commercial Banks, Cooperative Banks, Investment Banks, Real Estate & Mortgage Bank, and Savings Bank.

[4] We work only with the Global Ultimate Owner (GUO) and the Controlled Subsidiary (CS) entities defined in Bankscope at the control level of 50.01% of shares, i.e. GUO is a company which is the ultimate owner of a corporate group according to the ultimate ownership definition of at least 50.01% and the CS is a company which is controlled or majority owned at least at 50.01% by another company. A widely-owned bank (with no majority shareholder) is also classified as a GUO.

Table 1.1 reports the sample of 28 EU countries, the number of banks for each country and the number of countries where banks are established abroad. We observe that Germany and France have the highest number of banks whereas Lithuania and Estonia have the fewest. Of the 289 banks of our sample with operations in at least one of the 154 host countries, 43 French banks are present in 69 foreign countries, 34 German banks in 68 countries, 34 Italian banks in 30 countries and 25 British banks in 66 countries.

To identify the expansion of the 1,251 banks, we filter the full data set of affiliates and link each affiliate to its direct owner. Specifically, we identify all affiliates in the database by their official identification number and we mark those for which we observe more than one occurrence. Focusing on the marked entities and the associated bank at each time of appearance, we go through websites and annual reports to determine which bank is the direct parent of the affiliate. Hence a foreign branch or a foreign subsidiary is accounted only once as the affiliate of its immediate owner. Overall, to avoid duplicates of affiliates in the sample, we control whether the affiliates of a EU CS, a EU GUO, or a non-EU CS are identified only as the affiliates of their direct CS or GUO parent and we remove them elsewhere in the database if not.

Table 1.2 shows the distribution of all the 154 home and host countries into three income-groups. Going from the four groups of countries in the 2013 classification of the gross national income (GNI) per capita from in the World Development Indicators (2015)[5] by the World Bank, we construct our three income-group specifications used in this study. Indeed, due to the scarcity of country-level data and the relatively closeness of some countries to each other, we merge the two lowest categories to create our low-income group. In this paper, 55 low-income economies are defined as those with a GNI per capita of $4,125 or less; 35 middle-income economies have a GNI per capita of more than $4,125 but less than $12,736, and 64 high-income economies, a GNI per capita of $12,736 or more.

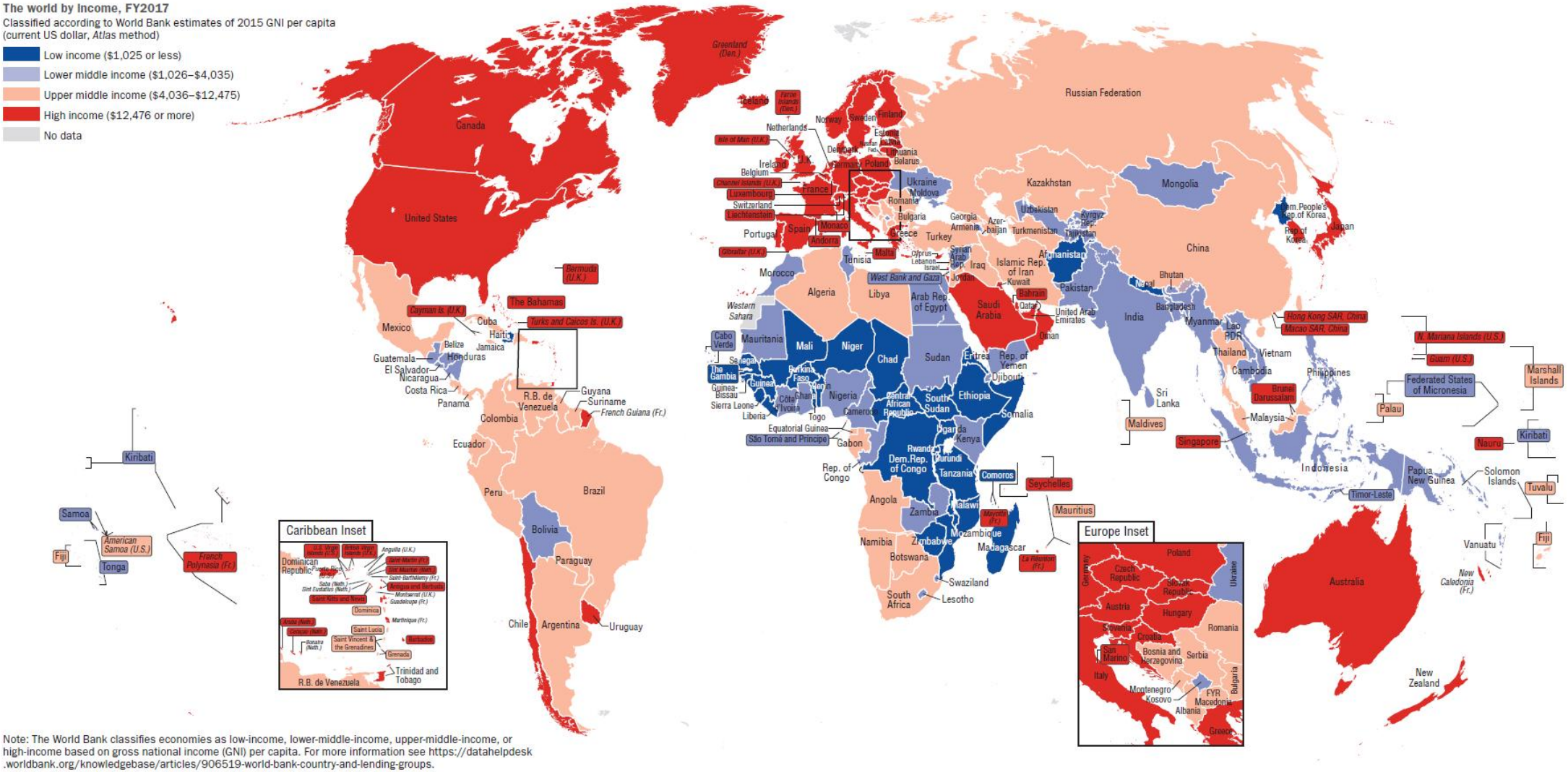
[5] In the original classification, the World Bank divides the countries into four groups according to 2013 gross national income (GNI) per capita: low-income (GNI ≤ $1,045), lower-middle-income ($1,045 < GNI ≤ $4,125), upper-middle-income ($4,125 < GNI < $12,736), and high-income (GNI ≥ $12,736). Due to the availability of information, we were not able to find the map of 2013 so we present in Figure 1.1 the map of all countries by the four level of development for 2017.

Table 1.2 – Income-group classification of all countries

We consider a slightly modified version of the classification of income-groups provided in the World Development Indicators (2015) by the World Bank. In his paper, 55 low-income economies are defined as those with a GNI per capita of $4,125 or less; 35 middle-income economies have a GNI per capita of more than $4,125 but less than $12,736, and 64 high-income economies, a GNI per capita of $12,736 or more. In Table 1.2, we list all 154 host countries by the defined income per habitant categories. In the original classification, the World Bank divides the countries into four groups according to 2013 gross national income: low-income (GNI ≤ $1,045), lower-middle income ($1,045 < GNI ≤ $4,125), upper-middle-income ($4,125 < GNI < $12,736), and the high-income (GNI ≥ $12,736).

Low-income: 55 countries (GNI per Capita ≤ $4,125)		**Middle-income: 35 countries ($4,125 < GNI per capita < $12,736)**		**High-income: 64 countries (GNI per capita ≥ $12,736)**		
Armenia	Malawi	Albania	Romania (**EU**)	Andorra	Israel	Sweden (**EU**)
Bangladesh	Mali	Algeria	Serbia	Antigua and Barbuda	Italy (**EU**)	Switzerland
Burkina Faso	Mauritania	Angola	South Africa	Argentina	Japan	Taiwan
Burma	Moldova, Rep. of	Azerbaijan	Thailand	Australia	Korea	United Arab Emirates
Burundi	Morocco	Belarus	Tunisia	Austria (**EU**)	Kuwait	United Kingdom (**EU**)
Cambodia	Mozambique	Bosnia and Herzegovina	Turkey	Bahamas	Latvia (**EU**)	United States of America
Cameroon	Nepal	Botswana	Turkmenistan	Bahrain	Liechtenstein	Uruguay
Cape Verde	Nigeria	Brazil		Belgium (**EU**)	Lithuania (**EU**)	Venezuela
Chad	Pakistan	Bulgaria (**EU**)		Bermuda	Luxembourg (**EU**)	
Congo	Palestine	China		Brunei Darussalam	Macau	
Congo, Rep. Dem.	Philippines	Colombia		Canada	Malta (**EU**)	
Côte d'Ivoire	Rwanda	Dominican Republic		Cayman Islands	Netherlands (**EU**)	
Djibouti	Sao Tome and Principe	Fiji		Chile	New Caledonia	
Egypt	Senegal	Gabon		Croatia (**EU**)	New Zealand	
Ethiopia	Sierra Leone	Gibraltar		Curacao	Norway	
Gambia	Sri Lanka	Kazakhstan		Cyprus (**EU**)	Oman	
Georgia	St. Pierre and Miquelon	Lebanon		Czech Republic (**EU**)	Poland (**EU**)	
Ghana	Tanzania	Libya		Denmark (**EU**)	Portugal (**EU**)	
Guinea	Timor-Leste	Macedonia		Equatorial Guinea	Puerto Rico	
Guinea-Bissau	Uganda	Malaysia		Estonia (**EU**)	Qatar	
Haiti	Ukraine	Maldives		Finland (**EU**)	Russian Federation	
India	Uzbekistan	Mauritius		France (**EU**)	San Marino	
Indonesia	Vanuatu	Mexico		French Polynesia	Saudi Arabia	
Kenya	Viet Nam	Mongolia		Germany (**EU**)	Seychelles	
Kosovo	Wallis and Futuna	Montenegro		Greece (**EU**)	Singapore	
Kyrgyzstan	Zambia	Panama		Hong Kong	Slovakia (**EU**)	
Laos	Zimbabwe	Paraguay		Hungary (**EU**)	Slovenia (**EU**)	
Madagascar		Peru		Ireland (**EU**)	Spain (**EU**)	

Figure 1. 1 – Map of all world countries into four groups of level of economic development



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

To identify banks' foreign strategy, we create a binary variable, $Foreign_{i,j,k}$, which takes the value 1 for each affiliate of bank *i* from EU country *j* located in a country *k* ($\neq j$), and 0 if there is no representative of the bank in *k*. We then build a second qualitative variable that maps the business models of banks each time $Foreign_{i,j,k}$ is equal to 1. This second variable $Affiliate_{i,j,k}$ accounts for the three possible choices of expansion in country *k*. $Affiliate_{i,j,k}$ takes the value 0 when bank *i* operates solely with subsidiaries in host country *k*, 1 when it operates only with branches, and 2 when it operates both branches and subsidiaries.

Table 1.3 – EU Banks foreign affiliates around the world in 2013

Table 1.3 reports the distribution of banks' affiliates around the world for the year 2013. We separate the host countries by their geographical location and the levels of development following the World Development Indicators (2015) by the World Bank. The World Bank divides the countries into four income-groups by the amount of GNI per capita: low-income (GNI ≤ $1,045), lower-middle income ($1,045 < GNI ≤ $4,125), upper-middle-income ($4,125 ≤GNI < $12,736), and high-income (GNI ≥ $12,736). To differentiate our levels of development, we adjust the World Bank classification and merge the lower-middle-income and low-income to constitute our low-income group; the upper-middle-income represents our middle-income group; and the high-income group is unchanged. Foreign strategy is the ratio of the total number of foreign subsidiaries FS to the total number of foreign branches FB.

Foreign affiliates in host countries *k*	Only foreign subsidiaries in *k*	Only foreign branches in *k*	Both foreign subsidiaries and branches in *k*
20,850	713	2,595	17,542

Continents (Host countries)	Foreign affiliates	Foreign subsidiaries FS	Foreign branches FB	Foreign strategy (FS / FB)
Africa (41)	197	84	113	0.743
America (21)	9,311	246	9,065	0.027
Asia (41)	1,775	173	1,602	0.108
Europe (44)	9,466	506	8,960	0.056
Pacific (7)	101	13	88	0.148
Total : 154	**20,850**	**1,022**	**19,828**	

Income-groups (Host countries)	Foreign affiliates	Foreign subsidiaries FS	Foreign branches FB	Foreign strategy (FS / FB)
High Income (64)	10,134	709	9,425	0.075
Middle Income (35)	9,010	196	8,814	0.022
Low Income (55)	1,706	117	1,589	0.074
Total : 154	**20,850**	**1,022**	**19,828**	

Source: Bankscope, SNL Database, banks web pages, World Bank

In 2013, the dataset is made of 1,251 parent banks of which 289 conduct activities in 20,850 foreign affiliates across 154 countries. Table 1.3 presents the distribution of foreign branches and subsidiaries by continents and income-groups. Regarding that presence of banks affiliates abroad, we distinguish the exclusive business model with only one type of organizational form in the host country *k* from the dual model with both forms in the host country *k.* The exclusive model numbers 713 subsidiaries only and 2,595 branches only while the dual model totalizes 309 subsidiaries and 17,233 branches[6]. Gauging banks' foreign strategy by a simple foreign subsidiaries/foreign branches ratio FS/FB, we can see that foreign presence takes less the form of subsidiaries than branches and that this tendency is more pronounced in Europe (0.056) and America (0.027) than in other continents (Africa (0.745), Pacific (0.148) and Asia (0.108)). Rather than branch, banks prefer to operate the subsidiary structure in the world regions with predominantly low-income group countries.

1.3.2. *Econometric methodology*

Our aim is to evaluate how both home and host countries' bank regulations affect the likelihood for banks to expand in developed and developing foreign countries and the organizational strategies banks build abroad. The empirical methodology is hence structured to address the two questions of foreign banking location and business models.

First, we run a Probit model to estimate the likelihood for a bank to operate an affiliate in a host country or not. We determine the factors that influence the decision of expanding abroad; i.e. the dummy $Foreign_{i,j,k}$ takes the value 1, and more specifically in each of the three income-group countries. The first part of our analysis is modeled as follows:

$$Foreign_{i,j,k} = \begin{matrix} \alpha_0 + \beta_1 Country\_Regulation_{j,k} \\ + \beta_2 Host\_GDP\ per\ Capita\ (log)_k \\ + \beta_3 Country\_Institutional_{j,k} \\ + \beta_4 Bank\_Financial_i + \varepsilon_{i,j,k} \end{matrix} \quad (1)$$

where $Country\_Regulation_{j,k}$ is a vector of home and host countries' bank regulation variables: *Host_Entry into Banking Requirements*, *Diff (Host-Home)_Bank Activity Restrictions, Diff (Host-Home)_Capital Regulatory index,* and *Diff (Host-Home)_Official Supervisory Power*. *Host_GDP per Capita (log)*$_k$ captures the host country level of development; $Country\_Institutional_{j,k}$ is a vector of both home and host countries

[6] We do not report the detailed number of foreign affiliates and form of presence in each host country. The tables are available from the authors upon request.

macroeconomic, market structure and institutional variables: *Diff (Host-Home)_Economic Freedom score*, *Host_Foreign Bank Share*, *Host_Bank Concentration*, *Host_Depth of Credit Information index*, *Host_Size (log GDP)*, the dummy *Common Official Language*, *Distance* between capitals in kilometers, and *Bilateral Trade ratio*. The Bank_Financial$_i$ vector of individual bank-specific characteristics is comprised of the *Specialization* dummy variable, the cost to income ratio (*CIR*), the loans to total assets ratio (*L_TA*), the non-interest income to net income ratio (*NII_NI*), the return on average assets (*ROAA*), and bank size (log of total assets (log*TA*)).

When estimating Eq. (1) for each high-, middle-, and low-income-group country, we remove the host country GDP per capita among the explanatory variables.

Second, we go deeper in the study of banks' internationalization strategies by focusing on the business models banks establish in a host country by investigating whether they follow a single strategy (exclusive choice of affiliate type) or a dual strategy (dual choice of an affiliate type). Indeed, while some multinational banks operate a strict and exclusive organizational form in the host country with either foreign subsidiaries only or foreign branches only, others set up both types of affiliates in the same host country.

To conduct our analysis, we estimate the variable $Affiliate_{i,j,k}$ that maps the organizational strategies banks develop abroad.

$$Affiliate_{i,j,k} = \begin{array}{c} \alpha'_0 + \beta'_1 Country\_Regulation'_k \\ + \beta'_2 Host\_GDP\ per\ Capita\ (log)_k \\ + \beta'_3 Country\_Institutional'_k \\ + \beta'_4 Bank\_Financial'_i + \varepsilon_{i,k} \end{array} \quad (2)$$

Focusing only on the importance of host country factors in determining banks' organizational form, the vector Country_Regulation'$_k$ now refers only to the four host country bank regulation variables. Country_Institutional'$_k$ is reduced to *Host_Foreign Bank Share* and *Host_Size (log GDP)*, and Bank_Financial'$_i$ comprises the *Specialization* dummy variable, the cost to income ratio (*CIR*), the equity to total assets (*EQ_TA*), the net interest margin (*NIM*), the non-interest income to net income ratio (*NII_NI*), the return on average assets (*ROAA*), and bank size (log*TA*).

Considering the organizational forms represented by $Affiliate_{i,j,k}$, we proceed with two methods that will fully capture the different business models.

In a first approach, we focus on observations relative to banks that choose to establish a unique type of affiliate in a particular host country. We examine this special case in order to have greater chance of identifying which factors can be associated to the set-up of branches rather than subsidiaries in a host country. Yet, as the issue of "how" banks expand abroad is observable after a bank has decided "where" to expand, we model the sequential process in order to account for the selection bias in the second stage of the decision process. We run a Heckman[7] two-step sample-selection model for banks that conduct foreign activities with a unique type of affiliate in previously chosen host countries. The first step is based on Eq. (1) in which we use/consider the value 1 of the dependent variable $Foreign_{i,j,k}$ only when all the affiliates of a bank *i* in the host country *k* are of the same type (subsidiaries or branches exclusively). Through this first step, we investigate the factors that affect banks' decision to establish exclusive business entities abroad. In the second step of the Heckman procedure, we determine the likelihood to operate with foreign branches only instead of foreign subsidiaries only. So, we solely consider the cases where $Affiliate_{i,j,k}$ takes the value 1 (i.e. only branches) or 0 (i.e. only subsidiaries).

Second, we also follow a broader approach by considering the three outcomes of the dependent variable $Affiliate_{i,j,k}$ and therefore including the value 2 (i.e. both branches and subsidiaries). This allows us to use the whole sample to estimate Eq. (2) with a multinomial Probit model and determine the likelihood for a bank *i* from home country *j* to conduct its activities in host country *k* through either both foreign organizational forms or only one form: branch or subsidiary.

In both approaches, to estimate Eq. (2) for each high-, middle- and low-income-group specification, we do the same as for Eq. (1) and remove the host country GDP per capita.

1.3.3. *Country-level bank regulation variables*

We follow Barth et al. (2001, 2004, 2008, and 2013) to define regulatory variables and use the data from the Bank Regulation and Supervision Survey (BRSS) carried out by the World Bank towards each country regulatory authorities. We use information giving the state of regulation in 2010 to create four country-level regulation and supervision variables.

The four indexes that we use are the following[8]:

[7] Heckman (1976, 1979), Puhani (2000), Lee (2003), Greene (2012)

[8] We provide in Appendix 1.A the detailed description of all four indexes from the Barth et al. BRSS (updated in 2012).

Entry into Banking Requirements is an index that accounts for all the documents that are legally required to be submitted before the issuance of the banking license in the country. Its value ranges from 0 to 9 and a higher value indicates a more restrictive entry and should positively drive the establishment of foreign subsidiaries [Cerutti et al. (2007)].

Bank Activity Restrictions is an index that assesses the ability for a bank to can engage in securities activities, insurance activities, real estate activities, and nonfinancial businesses except those businesses that are auxiliary to banking business. The index ranges from a lowest stringency at 1 to the highest at 16 when limitations of banking operations are extremely stringent. As Goldberg and Saunders (1981b), Miller and Parkhe (1998), and Clarke et al. (2003) have highlighted that subsidiaries offer a wider range of activities than branches, we expect a higher value of this index to be associated with a higher occurrence of subsidiaries than branches.

Capital Regulatory Index is a variable that ranges from 0 to 18 and provides information on certain risk elements, market value losses, and minimum capital rules. Also, it tells us whether certain funds were used to initially capitalize a bank and whether they are officially verified. As a branch does not own any personal capital, a high index means greater stringency which negatively affects the probability to operate a foreign subsidiary. Setting up an independent entity such as a subsidiary imposes for parent banks to raise a larger amount of funds [Goldberg and Saunders (1981a), Dell'Ariccia and Marquez (2010), Ongena et al. (2013)].

Official Supervisor Power is an index that evaluates whether supervisory authorities have the power to take specific preventive and corrective actions on the basis of 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. The effect of this variable can go both ways for the choice of the host country as well as for the choice of the form of entry [Buch and DeLong (2008), Chen and Liao (2011), Ongena et al. (2013)]. Banks might prefer stringent countries where they expect a tougher supervision that will limit excessive risk-taking behavior. Conversely, some institutions might look for a weaker control and a freedom to run their business anyhow. Also, we expect different effects on the choice of the affiliate types since a subsidiary is totally under the supervision of the host country regulators and a branch complies with the parent home country directives.

As a bank might consider its home country regulation comparatively to the host country regulation as an important factor, we calculate the differences between home country and host country regulation for the three latter variables by subtracting home country values from host

country values *Diff (Host-Home)_Bank Activity Restrictions*, *Diff (Host-Home)_Capital Regulatory index,* and *Diff (Host-Home)_Official Supervisor Power*.

Table 1.4-a reports for the full sample of 154 countries and each income-group (high-income, middle-income and low-income) the descriptive statistics of all four bank regulation and supervision variables for the year 2010. Between the three income-groups, the statistical analysis indicates few and weak differences in the scatter of the extremes values (minimum and maximum). Yet, on average, low-income host countries have the most stringent bank activity restrictions and bank entry requirements. Home countries and high-income host countries have the highest capital requirements and middle-income host countries the lowest. Moreover, banks in low-income countries face a closer and tighter supervision than those in other countries.

Table 1.4-a – Country-level bank regulation and supervision summary statistics

Country-level bank regulation and supervision variables: *Bank Activity Restrictions* = the restrictiveness in the participation into securities, insurance, real estate activities and the ownership power in nonfinancial firms; *Entry into Banking Requirements* = all the documents applicants are legally entitled to provide in order for the authority to grant a banking license in the country, *Capital Regulatory index* = the requirements in terms of minimum capital adequacy, risks and market value losses, sources of funding used to capitalize a bank and the level of official appraisal; *Official Supervisory Power* = 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. These qualitative variables for the year 2010 were winsorized at 1% and 99% levels to limit the influence of outliers.

Variables	Obs.	Mean	Std. Dev.	Median	Min	Max
Host countries = 154 | Home Countries = 28						
Host_Bank Activity Restrictions	133	9.87	2.51	10	4	14
Host_Entry into Banking Requirements	133	8.57	0.70	9	6	9
Host_Capital Regulatory index	133	9.91	4.00	11	0	15
Host_Official Supervisory Power	133	9.88	1.75	10	6	14
Home_Bank Activity Restrictions	28	8.54	2.39	8.5	5	14
Home_Capital Regulatory index	28	11.71	2.81	12.5	2	15
Home_Official Supervisory Power	28	9.32	1.72	10	5	11
Diff (Host-Home)_Bank Activity Restrictions	3,696	1.35	3.44	2	-10	9
Diff (Host-Home)_Capital Regulatory index	3,696	-1.82	4.86	-1	-15	13
Diff (Host-Home)_Official Supervisory Power	3,696	0.56	2.43	0	-5	9

Note: Of the 154 countries in the sample (64 High income / 35 Middle income / 55 Low income), the Barth et al. 2012 survey provides regulatory information for 133 countries only (56 High income / 33 Middle income / 44 Low income).

Variables	Obs.	Mean	Std. Dev.	Median	Min	Max
High income Host countries = 64 | Home Countries = 28						
Host_Bank Activity Restrictions	56	9.55	2.75	10	4	14
Host_Entry into Banking Requirements	56	8.52	0.81	9	6	9
Host_Capital Regulatory index	56	11.05	3.65	12	0	15
Host_Official Supervisory Power	56	9.54	1.83	10	6	13

Diff (Host-Home)_Bank Activity Restrictions	1,542	1.03	3.63	1	-10	9
Diff (Host-Home)_Capital Regulatory index	1,542	-0.67	4.59	0	-15	13
Diff (Host-Home)_Official Supervisory Power	1,542	0.22	2.50	0	-5	8

Variables	Obs.	Mean	Std. Dev.	Median	Min	Max
Middle income Host countries = 35 | Home Countries = 28						
Host_Bank Activity Restrictions	33	9.48	2.55	9	4	14
Host_Entry into Banking Requirements	33	8.54	0.67	9	6	9
Host_Capital Regulatory index	33	8.90	4.33	10	0	15
Host_Official Supervisory Power	33	9.79	1.76	10	6	12
Diff (Host-Home)_Bank Activity Restrictions	922	0.95	3.45	1	-10	9
Diff (Host-Home)_Capital Regulatory index	922	-2.81	5.09	-2	-15	13
Diff (Host-Home)_Official Supervisory Power	922	0.47	2.43	0	-5	7

Variables	Obs.	Mean	Std. Dev.	Median	Min	Max
Low income Host countries = 55 | Home Countries = 28						
Host_Bank Activity Restrictions	44	10.57	2.02	10.5	6	14
Host_Entry into Banking Requirements	44	8.66	0.57	9	7	9
Host_Capital Regulatory index	44	9.20	3.89	10	0	15
Host_Official Supervisory Power	44	10.39	1.53	10	7	14
Diff (Host-Home)_Bank Activity Restrictions	1,232	2.03	3.08	2	-8	9
Diff (Host-Home)_Capital Regulatory index	1,232	-2.51	4.74	-2	-15	13
Diff (Host-Home)_Official Supervisory Power	1,232	1.06	2.27	1	-4	9

Source: World Bank (Bank Regulation and Supervision Survey)

For each country we sum all four indexes to define a variable named Global Regulation that ranges from 23 to 48 and we split it into three levels that identify different intensity of regulation: Stringent [40-48], Moderate [36-40], and Lax [23-35]. In Table 1.4-b the ratio of foreign subsidiaries to foreign branches (FS/FB) indicates that the tendency of establishing foreign subsidiaries is higher in stringent (0.087) and lax (0.061) regulated host-countries than in the moderate ones (0.033). From Table 1.4-c we can see that regardless of the level of economic development, having lax regulation is always associated with the higher ratio FS/FB (0.081, 0.103, and 0.325 respectively in high-, middle-, and low-income countries). However, the ratio of foreign subsidiaries to foreign branches observed in the case of low-income countries with stringent regulation (0.211) indicates that when banks expand in developing and highly regulated economies, they likely prefer to operate the subsidiary structure.

Table 1.4-b – Distribution of banks' affiliates around the world in 2013 by levels of global regulation

Global regulation [23-48] = Activity + Entry + Capital + Supervision (Host countries)	**S**tringent [40-48] (43)	**M**oderate [36-40] (52)	**L**ax [23-35] (38)	**Total : 133**
Foreign affiliates	5,977	11,089	3,659	**20,725**
Foreign subsidiaries FS	344	357	293	**994**
Foreign branches FB	5,633	10,732	3,366	**19,731**
Foreign strategy (FS / FB)	**0,061**	**0.033**	**0.087**	**0.050**

Note: Since only 133 countries of the 154 in the sample have regulatory information from the Barth et al. 2012 survey, we cross regulation and foreign affiliates for only 20,725 branches and subsidiaries of the 20,850 in the sample.

Table 1.4-c – Distribution of banks' affiliates around the world in 2013 by levels of global regulation and economic development

		High income				Middle Income				Low income			
	All	**Total**	**S**	**M**	**L**	**Total**	**S**	**M**	**L**	**Total**	**S**	**M**	**L**
Foreign affiliates	**20,725**	**10,033**	4,496	2,531	3,006	**9,007**	1,332	7,075	600	**1,685**	149	1,483	53
Foreign subsidiaries FS	**994**	**690**	276	190	224	**195**	42	97	56	**109**	26	70	13
Foreign branches FB	**19,731**	**9,343**	4,220	2,341	2,782	**8,812**	1,290	6,978	544	**1,576**	123	1,413	40
Foreign strategy FS / FB	**0.050**	**0.074**	0.065	0.081	0.081	**0.022**	0.033	0.014	0.103	**0.069**	0.211	0.05	0.325

*Global regulation is calculated as the sum of the four banking regulation and supervision variables and ranges from 23 to 48. We define the levels **S**tringent [40-48] ; **M**oderate [36-40] ; **L**ax [23-35] on the basis of multiples graphic and statistical analysis of the sample of countries and affiliates.*

1.3.4. *Country-level macroeconomic, market structure and institutional variables*

Various macroeconomic and institutional factors can also influence the bank's decision to enter a foreign country and the affiliate structure established abroad. Globally, most of the variables we use are common in the literature on bank internationalization strategies and come from the Financial Development and Structure dataset (2013), the Global Financial Development Database (2015), and the World Development Indicators (2015) provided by the World Bank.

We consider *GDP per capita*[9] as the likelihood to attract foreign investors is expected to be higher for developed economies. This variable captures the level of economic development

[9] We test the robustness of the results with the growth rate of the per capita GDP and find the coefficient signs not to be significantly different.

and business opportunities in the host country [Yamori (1998), Buch (2000), Claessens et al. (2001)]. A high-income country is more likely to attract subsidiaries than branches as through a deeper penetration of the local markets, a subsidiary signals a desire to establish a stronger link in the host country, and is then better suited to ensure the loyalty of the bank to its wealthier customers and vice-versa [Kindleberger (1983), Chou and Shen (2014)].

Because multinational banks are found to be more attracted by host countries with higher GDP [Brealey and Kaplanis (1996) and Focarelli and Pozzolo (2001), Buch and DeLong (2004)], we also use the natural logarithm of the *gross domestic product (logGDP)* as a measure of country economic size. As the development of foreign branches and subsidiaries might depend on the past and current cross-countries relationships, we use CEPII[10] and OECD data to build three variables to measure the home and host countries' economic and cultural closeness. We introduce the natural logarithm of the *Distance* in kilometers between the capital cities and we expect a negative effect of this variable on the likelihood of being present in host country. As the proximity of a country to other countries and markets strongly and positively drives the choice of that country by multinational enterprises (MNEs) [Nachum et al. (2008)], parent banks as well tend to maintain their foreign investments in places close-by [Fisher and Molyneux (1996), Buch (2003, 2005), Claessens and van Horen (2014)]. *Language* is a variable equal to 1 when at least one official language is spoken in both the home and the host country and 0 otherwise. As a proxy of cultural proximity, this binary variable should have a positive effect on the probability of choosing a given country [Berger et al. (2001), Buch and DeLong (2004), Cerutti et al. (2007), Chou and Shen (2013, 2014)]. *Bilateral trade ratio*[11] is computed from the flow of transactions in goods and services between the EU country of origin and the 154 host countries. High commercial and corporate exchanges[12] indicate a strong bond and are likely to intensify cross-border banking operations. The bilateral trade ratio also stands for the "follow-the-customer" hypothesis in the choice of a host country [Kindleberger (1983), Nolle and Mohanty (1998), Esperanca and Gulamhussen (2001), Chou and Shen (2014)].

[10] See Mayer and Zignago (2011) for CEPII distance measure and Melitz and Toubal (2012) for CEPII language.
OECD (2014) "STAN Bilateral Trade Database by Industry and End-Use Category, Rev. 4." OECD-WTO

[11] This variable is the ratio of the home country *j* imports from host country *k* in US dollar and its exports to the same host country *k* over the total volume of imports and exports of that EU country *j* in US dollar $= \frac{Imp_{Host_k \rightarrow Home\ EU_j} + Exp_{Home\ EU_j \rightarrow Host_k}}{Imp_{All \rightarrow Home\ EU_j} + Exp_{Home\ EU_j \rightarrow All}}$

[12] An alternative would be to consider the foreign direct investments between countries as in Ball and Tschoegl (1982) and Buch (2000). Due to data limitation, we use the bilateral trade ratio. Note that the volume of exports and imports has been used in former papers to measure the power of corporate customers [Groose and Goldberg (1991), Miller and Parkhe (1998), Focarelli and Pozzolo (2005)].

We also consider a set of host country banking market variables and institutional variables. *Bank Concentration* measures the percentage of aggregate bank assets held by the three largest banks in the country. A concentrated system could reflect low competition and discourage foreign investors from entering the market [Goldberg and Rai (1996), Sengupta (2007), Claessens and van Horen (2007), Tabak et al. (2012)]. We also account for transparency by considering the *Depth of Credit Information*, an index which measures the rules affecting the scope, accessibility, and quality of credit information available through public or private credit registries. This variable ranges from 0 to 8 and signals the extent to which information is available to facilitate lending decisions, reduce banks' information costs, and sharpen the interest of investors for the country. Banks are more likely to enter countries with private credit reporting agencies that provide high information quality as it reduce starting business' costs for newcomer banks. The results of Tsai et al. (2011) and Chou and Shen (2013) suggest that banks prefer branch entry in a country where a private credit bureau exists, but if this country's credit information quality is high enough, banks tend to prefer a subsidiary entry to a branch entry. We also account for *Foreign Bank Share* which is the ratio of the number of foreign-owned banks (more than 50% of shares are owned by foreigners) to the total number of banks in the system. The expected sign of this variable is undetermined. A higher share of foreign-owned banks in a country can reflect a more business friendly market for foreign investors. Alternatively, because the market can be considered as crowded with foreign entities, this could also reduce the appeal and the expansion in that country [Koçak and Özcan (2013)] especially if licenses become less accessible. Additionally, we retrieve the *Economic Freedom score*[13] from the Heritage Foundation website. This score ranges from 0 to 100 and is an equally weighted average of ten quantitative and qualitative indicators. This variable captures the global risks, strengths and weaknesses of economies and conveys critical information on human dignity, autonomy and personal empowerment. We use it to construct the variable *Diff (Host-Home)_Economic Freedom Score* by subtracting the home country score from the host country score. We expect the freest nations to be the most likely to host international activities [Chou and Shen (2014)].

[13] The Heritage Foundation: The 2015 Index of Economic Freedom. The overall index is dissociated in four categories of indicators: *Rule of Law* (Property Rights, Freedom from Corruption) ; *Government Size* (Government spending, Fiscal Freedom) ; *Regulatory efficiency* (Business Freedom, Labor Freedom, Monetary Freedom) and *Market Openness* (Trade Freedom, Investment freedom, Financial Freedom).

Table 1.5 – Country-level macroeconomics, market structure and institutional summary statistics

Foreign Bank Share = the percentage of the number of banks with assets that are at least 50% foreign-owned among the total of banks in the system, *Bank Concentration* = the proportion of assets held by the three largest banks in a country over the total assets of the banking sector, *Depth of Credit Information index* = an index that facilitates lending decisions by dealing with the rules affecting the scope, accessibility, and quality of credit information from public registry or private bureau, *GDP per Capita (log)* = the logarithm transformation of the $US 2005 constant GDP per capita; *Size (log GDP)* = the logarithm transformation of the $US 2005 constant GDP, *Economic Freedom score* = an equally weighted average of ten quantitative and qualitative indicators (Property Rights, Freedom from Corruption, Government spending, Fiscal Freedom, Business Freedom, Labor Freedom, Monetary Freedom, Trade Freedom, Investment freedom, Financial Freedom) and *Diff (Host-Home)_ Economic Freedom score* is constructed by subtracting the host country score from the home country score, *Bilateral Trade Ratio* = the flow of transactions in goods and services between a EU country and the 154 host countries, *Common Official Language* = a dummy variable that takes the value 1 when at least one official language is spoken in the home and host countries, and 0 otherwise, and *Distance* = in kilometers between the capital cities of the home and host country. These 3-year average values of each country 2011-2013 figures were winsorized at 1% and 99% levels to limit the influence of outliers.

Variables	Obs.	Mean	Std. Dev.	Median	Min	Max
Host countries = 154 | Home Countries = 28						
Host_Economic Freedom score	138	61.24	10.63	61.00	37.25	87.57
Host_Foreign Bank Share	129	0.43	0.32	0.39	0	1
Host_Bank Concentration	131	0.71	0.21	0.70	0.08	1
Host_Depth of Credit Information index	154	4.53	1.64	5.00	1.67	7
Host_GDP per Capita (log)	142	8.54	1.61	8.68	5.59	11.19
Host_Size (log GDP)	142	10.67	2.14	10.39	6.26	16.47
Home_ Economic Freedom score	28	67.46	6.10	69.10	57.03	76.97
Diff (Host-Home)_Economic Freedom score	3,836	-6.99	12.23	-6.87	-39.72	30.53
Bilateral Trade ratio (%)	3,410	0.71	1.76	0.08	0.00	10.75
Common Official Language	4,284	0.07	0.25	0	0	1
Distance between capitals (kilometers)	4,284	5,559.49	3,986.07	5,096.73	59.62	19,586.18
Distance between capitals (log)	4,284	8.28	0.94	8.54	4.09	9.88

Variables	Obs.	Mean	Std. Dev.	Median	Min	Max
High income Host countries = 64 | Home Countries = 28						
Host_Economic Freedom score	53	69.02	9.77	70.00	37.27	87.57
Host_Foreign Bank Share	55	0.39	0.34	0.26	0	1
Host_Bank Concentration	55	0.73	0.23	0.80	0.08	1
Host_Depth of Credit Information index	64	5.12	1.42	5.33	1.67	7
Host_GDP per Capita (log)	61	10.12	0.65	10.12	8.75	11.19
Host_Size (log GDP)	61	11.57	2.17	12.09	6.91	16.47
Diff (Host-Home)_Economic Freedom score	1,458	0.86	11.49	0.85	-39.7	30.533
Bilateral Trade ratio (%)	1,458	1.37	2.42	0.33	0.00	10.75
Common Official Language	1,766	0.06	0.25	0	0	1
Distance between capitals (kilometers)	1,766	5,071.15	4,618.21	3,075.53	59.62	19,586.18
Distance between capitals (log)	1,766	8.02	1.10	8.03	4.09	9.88

Variables	Obs.	Mean	Std. Dev.	Median	Min	Max
Middle income Host countries = 35 | Home Countries = 28						
Host_Economic Freedom score	34	59.80	8.19	61.32	37.25	76.70
Host_Foreign Bank Share	32	0.47	0.33	0.47	0.01	1
Host_Bank Concentration	31	0.68	0.17	0.66	0.33	1
Host_Depth of Credit Information index	35	5.18	1.08	5.33	2.33	6.33
Host_GDP per Capita (log)	33	8.43	0.41	8.50	7.40	9.05
Host_Size (log GDP)	33	10.82	1.77	10.57	7.60	15.34
Diff (Host-Home)_Economic Freedom score	950	-8.39	10.03	-8.20	-39.72	19.67
Bilateral Trade ratio (%)	838	0.39	0.96	0.06	0.00	7.50
Common Official Language	978	0.05	0.22	0	0	1
Distance between capitals (kilometers)	978	5,601.55	3,986.80	5,368.16	168.10	17,627.30
Distance between capitals (log)	978	8.27	0.96	8.59	5.12	9.78

Variables	Obs.	Mean	Std. Dev.	Median	Min	Max
Low income Host countries = 55 | Home Countries = 28						
Host_Economic Freedom score	51	54.11	6.99	55.20	37.25	70.67
Host_Foreign Bank Share	42	0.44	0.30	0.47	0	1
Host_Bank Concentration	45	0.71	0.21	0.70	0.27	1
Host_Depth of Credit Information index	55	3.37	1.59	2.33	1.67	7
Host_GDP per Capita (log)	48	6.66	0.64	6.68	5.59	7.83
Host_Size (log GDP)	48	9.43	1.73	9.17	6.26	14.14
Diff (Host-Home)_Economic Freedom score	1,428	-14.08	9.26	-14.12	-39.72	13.63
Bilateral Trade ratio (%)	1,114	0.09	0.23	0.01	0.00	2.27
Common Official Language	1,540	0.07	0.26	0	0	1
Distance between capitals (kilometers)	1,540	6,092.78	3,018.03	5,604.83	356.67	17,685.19
Distance between capitals (log)	1,540	8.58	0.57	8.63	5.88	9.78

Source: CEPII, Heritage Foundation, OECD-WTO, UNCTAD, World Bank (Financial Development and Structure, Global Financial Development Structure, Supervisory and Deposit Insurance, World Development Indicators)

In Table 1.5 we report the descriptive statistics of all the macroeconomic, market structure and institutional variables calculated on the basis of the 3-year averages from 2011 to 2013. The table also shows the full sample of countries, and each income-group: high-income, middle-income and low-income. We observe that on average in high-income host countries the banking sector is more concentrated, the economic freedom is the highest and the intensity of bilateral trade with the home EU countries is the strongest. As expected, low-income host countries are less transparent with regards to lending operations. They also exhibit lower economic freedom and are less engaged in bilateral exchanges with home countries.

1.3.5. *Bank-level financial characteristics*

From the unconsolidated[14] balance sheets and income statements available in Bankscope, we compute bank-level variables to account for individual factors that could influence the presence and organizational forms of banks abroad. We control for efficiency by considering the cost to income ratio (*CIR*). Less efficient banks have less operating funds which make them are less likely to expand abroad. We also control for bank capitalization by introducing the ratio of equity to total assets (*EQ_TA*). Strongly capitalized banks are expected to expand abroad more easily and, where relevant, operating subsidiaries should be less of an issue for such institutions. Alternatively, in some countries operating branches might also be relatively costly in terms of capital. We further introduce the ratio of loans to total assets (*L_TA*) to control the extent to which banks are focused on traditional intermediation activities and the ratio of non-interest income to net income (*NII_NI*) to capture diversification into other activities such as commission and fee activities and trading activities. A bank's choice of activities (focus versus diversification) is likely to affect the way that it expands abroad. A bank aiming to pursue lending activities is more likely to operate a subsidiary whereas promoting modern banking activities by exporting the mother bank's skills and technology is expected to be easier through branches [Miller and Parkhe (1998)]. Also, we control for bank primary activity. *Specialization* is a dummy variable equal to 1 when retail banking is the principal activity of the bank and 0 when they engage mainly in wholesale banking services. As argued in Goldberg and Saunders (1981b, 1990), through their lending and deposit-taking operations, retail-oriented institutions rely on interest revenues which are less risky and they tend to serve their foreign customers in their foreign subsidiaries. Additionally, we consider the net interest margin (*NIM*) to measure how the performance of banks' investments affect their internationalization decisions, and the return on average assets (*ROAA*) to assess the effects of bank profitability. We expect better performing and profitable banks to engage more in foreign operations as they might benefit from economies of scale from previous activities [Fieleke (1977), Demirguc-Kunt and Huizinga (2000), Focarelli and Pozzolo (2001), Clarke et al. (2003)]. Finally, the natural log of total assets (*TA*) is used as a measure of parent bank size. Large banks might benefit from their portfolios of foreign customers and domestic customers with foreign activities which make them more likely to develop broader international networks. Also, the bigger a bank

[14] We do use unconsolidated data but, given the accounting requirements for subsidiaries and branches and the different level of responsibility towards the parent bank, the financial information of branches could not be separated from the balance sheet of the parent bank whereas all subsidiaries own an independent balance sheet.

gets, the smaller the local market might seem, and hence, foreign markets become more attractive in terms of profit opportunities, and business or risk diversification [Tschoegl (1983), Groose and Goldberg (1991), Cerutti et al. (2007)].

Table 1.6 – Bank-level financial summary statistics

The table displays the descriptive statistics of the banks financial characteristics: *Specialization* is a dummy equal to 1 for retail banks and 0 when they engage in wholesale banking services, *CIR* cost to income ratio; *EQ_TA* capital ratio of equity to total assets; *L_TA* loans to total assets; *NII_NI* non-interest income to net income; *NIM* net interest margin; *ROAA* return on average assets; *TA* total assets). All variables are calculated as the 3-year average value of 2011-2013 figures and were winsorized at 1% and 99% levels to limit the influence of outliers.

Variables	Obs.	Mean	Std. Dev.	Median	Min	Max
			All Banks			
Specialization	1,251	0.66	0.47	1	0	1
CIR	1,251	0.68	0.30	0.66	0.07	2.16
EQ_TA	1,251	0.12	0.12	0.08	0.03	0.65
L_TA	1,251	0.54	0.25	0.59	0.00	0.97
NII_NI (%)	1,251	-0.86	2.78	-0.68	-14.76	9.39
NIM (%)	1,251	2.15	1.53	1.90	-0.11	9.69
ROAA (%)	1,251	0.28	1.66	0.28	-7.37	10.40
TA (billions USD)	1,251	24.44	77.71	2.88	0.01	621.25
			Banks with a foreign presence			
Specialization	289	0.69	0.47	1	0	1
CIR	289	0.65	0.28	0.63	0.07	2.04
EQ_TA	289	0.11	0.12	0.07	0.03	0.65
L_TA	289	0.45	0.25	0.51	0.00	0.93
NII_NI (%)	289	-0.86	2.97	-0.45	-14.76	9.39
NIM (%)	289	1.74	1.46	1.47	-0.11	9.69
ROAA (%)	289	0.27	2.30	0.28	-7.37	10.40
TA (billions USD)	289	73.52	143.85	13.65	0.04	621.25
			Banks with only foreign subsidiaries abroad			
Specialization	137	0.66	0.48	1	0	1
CIR	137	0.66	0.32	0.62	0.07	2.04
EQ_TA	137	0.13	0.14	0.09	0.03	0.65
L_TA	137	0.45	0.28	0.50	0.00	0.93
NII_NI (%)	137	-0.62	3.25	-0.32	-14.76	9.39
NIM (%)	137	2.01	1.79	1.66	-0.11	9.69
ROAA (%)	137	0.49	2.78	0.35	-7.37	10.40
TA (billions USD)	137	35.99	93.27	4.80	0.04	621.25
			Banks with only foreign branches abroad			
Specialization	56	0.59	0.50	1	0	1
CIR	56	0.63	0.24	0.60	0.12	1.47
EQ_TA	56	0.10	0.11	0.06	0.03	0.65

L_TA	56	0.53	0.23	0.58	0.01	0.90
NII_NI (%)	56	-0.65	2.80	-0.54	-14.76	9.39
NIM (%)	56	1.41	0.80	1.37	-0.10	3.39
ROAA (%)	56	0.21	1.91	0.32	-5.46	10.40
TA (billions USD)	56	29.60	45.23	13.45	0.05	205.60
Banks with both foreign subsidiaries and foreign branches abroad						
Specialization	96	0.78	0.42	1	0	1
CIR	96	0.64	0.23	0.64	0.12	1.59
EQ_TA	96	0.08	0.08	0.06	0.03	0.65
L_TA	96	0.42	0.22	0.45	0.00	0.91
NII_NI (%)	96	-1.33	2.61	-0.52	-14.76	1.57
NIM (%)	96	1.55	1.13	1.36	-0.03	5.69
ROAA (%)	96	-0.02	1.64	0.19	-7.37	8.09
TA (billions USD)	96	152.68	198.98	54.66	0.42	621.25

Source: Bankscope

Table 1.6 shows the individual bank variables for the full sample of EU banks and a number of sub-samples. Among the 289 multinational banks, compared to the 56 banks that operate only foreign branches, the 137 banks that are present abroad only with foreign subsidiaries and the 96 banks present with both foreign subsidiaries and branches are larger. Also, although these two subsamples of banks are both less lending-oriented (lower loans to total assets ratio), banks with foreign subsidiaries only are highly profitable and generate the highest interest margin. From these summary statistics, banks with both types of affiliates are the most leveraged and largest by their total assets. Comparatively to the whole sample, banks appear to be more present in foreign countries when they are primarily engaged in retail operations, more efficient in managing their fixed costs, less diversified and when they exhibit higher interest margin.

Table 1.7 reports the overall correlation matrix of all the variables. On the whole the test statistics reveal no collinearity issues.

Table 1.7 – Correlation coefficients matrix

	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. Host_Entry into Banking Requirements	1																							
2. Host_Bank Activity Restrictions	-0.10	1																						
3. Host_Capital Regulatory index	0.32	-0.01	1																					
4. Host_Official Supervisory Power	0.00	0.13	-0.18	1																				
5. Host_Foreign Bank Share	0.05	0.01	0.01	0.10	1																			
6. Host_Bank Concentration	-0.06	-0.06	-0.01	0.10	0.23	1																		
7. Host_Depth of Credit Information	-0.03	-0.21	0.09	-0.26	-0.14	-0.18	1																	
8. Host_GDP per Capita (log)	-0.10	-0.19	0.25	-0.27	-0.11	-0.01	0.59	1																
9. Host_Size (log GDP)	-0.02	-0.12	0.26	-0.30	-0.45	-0.35	0.58	0.60	1															
10. Diff (Host-Home)_Bank Activity	-0.08	0.80	-0.01	0.12	0.01	-0.03	-0.17	-0.15	-0.10	1														
11. Diff (Host-Home)_Cap Regulatory	0.26	-0.01	0.83	-0.16	0.01	0.00	0.07	0.21	0.20	-0.10	1													
12.Diff (Host-Home)_Off Supervisory	0.00	0.10	-0.13	0.76	0.07	0.09	-0.20	-0.20	-0.23	0.18	-0.01	1												
13. Diff (Host-Home)_Economic Freedom	-0.06	-0.16	0.10	-0.05	0.11	0.14	0.40	0.61	0.30	-0.15	0.07	-0.10	1											
14. Bilateral Trade Ratio	0.03	-0.15	0.17	-0.21	-0.26	-0.28	0.28	0.41	0.59	-0.13	0.15	-0.14	0.22	1										
15. Common Official Language	0.06	-0.05	0.06	-0.04	0.03	-0.08	0.01	0.10	0.10	0.02	0.01	0.01	0.13	0.14	1									
16. Distance (log)	0.05	0.23	-0.03	0.19	-0.09	0.02	-0.10	-0.35	-0.08	0.19	-0.03	0.16	-0.14	-0.36	-0.06	1								
17. Specialization	0.02	0.00	0.01	0.00	0.00	-0.03	0.03	0.01	0.05	-0.04	-0.11	-0.10	0.03	0.04	0.04	0.00	1							
18. CIR	-0.02	0.02	-0.01	0.01	0.00	0.03	-0.03	-0.02	-0.05	0.09	-0.04	0.00	-0.03	-0.03	-0.07	-0.03	0.01	1						
19. EQ_TA	-0.01	0.00	-0.01	0.00	0.00	0.01	-0.02	-0.01	-0.03	-0.01	0.04	0.04	-0.02	-0.03	0.02	0.02	-0.08	-0.05	1					
20. L_TA	-0.02	0.02	-0.02	0.01	0.01	0.04	-0.03	-0.02	-0.06	-0.06	0.05	-0.01	0.00	-0.05	-0.08	0.00	-0.01	-0.10	-0.17	1				
21. NII_NI	0.00	0.00	0.00	-0.01	0.00	-0.01	0.01	-0.01	0.01	-0.03	0.01	-0.05	0.00	-0.01	0.02	0.03	0.03	-0.02	0.11	-0.11	1			
23. NIM	-0.01	0.00	-0.01	0.00	0.00	0.02	-0.02	-0.02	-0.03	-0.06	0.00	-0.01	-0.01	-0.03	-0.09	0.00	0.04	-0.09	0.23	0.26	-0.05	1		
23. ROAA	-0.01	-0.01	-0.01	-0.02	0.00	-0.01	0.00	0.00	0.00	-0.04	0.03	0.03	-0.03	-0.02	0.03	0.03	-0.09	-0.45	0.28	-0.04	0.07	0.21	1	
24. Bank size (logTA)	0.06	-0.03	0.04	-0.02	-0.01	-0.11	0.11	0.06	0.17	-0.11	0.02	-0.10	0.11	0.12	0.20	0.00	0.09	-0.24	-0.27	-0.09	0.05	-0.34	-0.08	1

Variables: the country bank regulation and supervision variables (**1 to 4** and **10-12**) account for the year 2010. Institutional variables (**5 to 9** and **13 to 16**) and bank financial characteristics (**17 to 24**) are the 3-year average value of 2011-2013 figures. All variables were winsorized at 1% and 99% levels to limit the influence of outliers and the correlation coefficients are all significant at a 5% level.

Sources: Bankscope, CEPII, Heritage Foundation, OECD-WTO, UNCTAD, World Bank (Bank Regulation and Supervision Survey, Financial Development and Structure, Global Financial Development Structure, Supervisory and Deposit Insurance, World Development Indicators)

1.4. Empirical results

For all the tables, we present the results for the whole sample of countries in column (1) and the results for high-income, middle-income and low-income countries respectively in columns (2), (3) and (4).

1.4.1. *Impact of bank regulation and economic development on banks' foreign location*

Table 1.8 presents the results of the Probit estimation of Eq. (1) and shows that home and host countries' bank regulations are critical factors to foreign expansion. From the whole sample of countries, we observe that banks tend to expand in foreign countries with stricter entry into banking requirements meaning that they might favor sound markets where actors are able to provide all the legal submissions required by the authorities to obtain a banking license. In the same vein, the likelihood to establish affiliates abroad increases when the foreign supervisory power is greater, meaning a preference for countries where banking authorities are expected to be able to prevent and correct a maximum of troubles. However, the presence abroad decreases in host locations with more bank activity restrictions and stringent capital requirements. These findings suggest that in their internationalization process, banks globally seem to aim at diversifying their activities and minimizing the regulatory capital constraints. But, in their prime decision to go abroad, banks from countries with highly regulated banking systems, as most of Europeans banks, are not necessarily trying to take advantage of other countries' regulation and supervision loopholes or trying to escape the stringency of their home authorities. These results extend the findings of Buch and Delong (2008) and Ongena et al. (2013), which have solely focused on the effects of home country regulation.

Looking precisely at the three income-groups of countries, some differences strike out and justify the necessity to take into account the level of economic development to go deeper in the understanding of the impact of regulation on the internationalization of banks. Alike the whole sample results, host country entry requirements have a positive and significant effect on the penetration in high-income countries. Probably banks from regulated and rich countries might prefer secured host markets in similar developed economies. Conversely, in middle- and low-income locations, the likelihood to run a foreign activity decreases with the stringency of entry requirements. Banks might weigh the benefits of entering these markets against the regulatory costs of entering and operating an affiliate. As well, a wider host-home

difference in bank activity restrictions do not supports the presence of banks in middle- and low-income countries. This suggests that banks might engage in cross-border operations with developing economies to diversify their activities. Stringent capital requirements have a uniform negative influence on the likelihood to expand a foreign network, in high- and middle-income countries but no impact in the low-income group. Also, banks are more likely to establish affiliates in high-income countries with a supervisory power weaker than the domestic one which is the opposite in middle-income countries.

On a whole, our results conclude that parent banks have a highly significant incentive to expand in countries with stringent entry requirements into their banking system. As well, comparatively to their home regulation, banks seem to strongly prefer to establish their affiliates in locations with lower restrictions on bank activities and fewer capital rules but with higher power of supervisory authorities. However, across the three income-groups, there are strong peculiarities. In rich countries, banks prefer to settle where more stringent entry and activity conditions lead to sound and secured banking markets, and consistently where the controlling authorities are then more lenient. In middle-income economies, banks seem to seek diversification allowed by wide range of permitted activities but under the supervision of rigorous supervisors. In poorest countries, only diversification guides the choice of banks to settle abroad and it is even the only group of countries where the strength of capital constraints does not hinder the establishment of banks.

In terms of, market structure, macroeconomic and institutional variables, we find that high bank concentration ratio in foreign markets has a negative effect on the entry in all countries. In a host market where the share of assets held by the three largest banks is relatively high, lower profit expectations might discourage foreign bank entries [Claessens and van Horen (2007)]. In addition, considering all host countries, foreign bank share is positively associated with the likelihood to host more foreign entities. The strong presence of foreign banks in a host country signals the attractiveness of the market as it can increase the efficiency and profitability of that local banking sector, and attract new investors [Jeon et al. (2011)]. This result stands particularly for high- and low-income economies with the exception of middle-income countries which have markets in transition and halfway between emerging and developed state. Regarding the depth of credit information, the existence of public and private credit bureaus, coupled with the availability and higher information quality on borrowers is found to favor foreign expansion consistent with Buch (2003) and Tsai et al. (2011). However, we find the opposite for low-income countries suggesting that, when they

expand to developing countries, banks prefer countries where they can be the first movers and where they can play a stronger role in reducing asymmetric information issues on the loan market. Our results also indicate that the likelihood to expand abroad increases with a higher host-home gap in economic freedom scores. Banks from nations with freer rules of law, government size, regulatory efficiency and market openness preferable expand in as free nations possibly, because successfully running their businesses might be easier to achieve. In the line of macroeconomic criteria, the size of the host country, measured by GDP, matters and encourages the presence of banks in foreign countries. However, comparing the three groups of countries, we observe an opposite yet slightly significant sign for high-income economies. Foreign banks probably anticipate fewer profits for new entrants and hence target less the richer countries. This finding is mirrored by the negative impact of high revenue per capita obtained for the whole countries estimation in column (1).

Regarding individual bank characteristics, retail-oriented banks are more likely, than other types of banks, to expand in developed as well as developing host countries. This result is in line with previous evidence on the internationalization of retail-oriented banks [Goldberg and Saunders (1981), (1990)]. Our findings suggest that traditional intermediation-oriented banks might benefit from economies of scale and scope and use their expertise in screening small and medium-size borrowers to expand strongly and significantly in both rich countries where the banking system is fully established and in poor countries still in the process of building their banking industry. More generally, as shown by the coefficient of the ratio of non-interest income to net income, more diversified banks, are significantly less likely to expand abroad and specifically in high and middle-income countries. Additionally, as expected, we find that more profitable and larger banks are more likely to expand worldwide in either developed or developing countries; contrary to less costs efficient, loaned-up and less liquid banks with higher cost to income and loans to total assets ratios.

Finally, we note that all gravity variables are highly significant with the expected signs. When the home and the host countries have strong trade ties, are geographically close and share at least one official language, the likelihood of operating a foreign affiliate in the host country increases. These results are consistent with previous findings in the literature on gravity models and international activities [Buch (2003, 2005), Chou and Shen (2014), Claessens and van Horen (2014)].

Table 1.8 – **Probit** estimation of the likelihood for a bank *i* to operate an affiliate in a foreign country *k.*

The table presents regression results of the Probit estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to operate an affiliate in a host country $k \neq j$ (Presence $Foreign_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income groups. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	0.153***	0.159***	-0.088*	-0.132*
	(0.01)	(0.02)	(0.05)	(0.07)
Diff (Host-Home)_Bank Activity Restrictions	-0.006***	0.054***	-0.038***	-0.101***
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Capital Regulatory index	-0.030***	-0.023***	-0.043***	0.014
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Official Supervisory Power	0.030***	-0.074***	0.144***	0.027
	(0.00)	(0.01)	(0.01)	(0.02)
Host_Bank Concentration	-0.864***	-1.395***	-2.958***	-2.995***
	(0.04)	(0.06)	(0.18)	(0.23)
Host_Foreign Bank Share	1.009***	0.990***	-0.388***	0.619***
	(0.03)	(0.05)	(0.10)	(0.17)
Host_Depth of Credit Information Index	0.230***	0.172***	0.384***	-0.116***
	(0.01)	(0.01)	(0.03)	(0.03)
Diff (Host-Home)_Economic Freedom Score	0.018***	0.005***	0.072***	0.031***
	(0.00)	(0.00)	(0.00)	(0.00)
Host_GDP per Capita (log)	-0.363***			
	(0.01)			
Host_Size (log GDP)	0.235***	-0.023*	0.811***	0.204***
	(0.01)	(0.01)	(0.03)	(0.04)
Specialization	0.631***	0.551***	0.682***	0.844***
	(0.02)	(0.03)	(0.05)	(0.10)
Cost to Income Ratio	-0.376***	-0.067	-1.197***	0.252**
	(0.04)	(0.05)	(0.10)	(0.12)
Loans / Total Assets	-0.749***	-0.504***	-1.770***	-1.303***
	(0.04)	(0.05)	(0.09)	(0.14)
Non-Interest Income to Net Income	-0.065***	-0.085***	-0.058***	-0.004
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.049***	0.175***	0.053***	0.043**
	(0.01)	(0.01)	(0.01)	(0.02)
Bank size (logTA)	0.652***	0.632***	0.747***	0.648***
	(0.01)	(0.01)	(0.01)	(0.02)
Common Official Language	0.398***	0.582***	1.333***	0.271**
	(0.02)	(0.03)	(0.06)	(0.11)
Distance between capitals	-0.396***	-0.204***	-1.755***	-1.474***
	(0.01)	(0.01)	(0.04)	(0.06)

Bilateral Trade ratio	0.131***	0.151***	-0.036**	0.346***
	(0.00)	(0.00)	(0.02)	(0.08)
N° Observations	**151,598**	**67,690**	**39,893**	**44,015**
Wald chi2	84,331.1	36,394.4	36,010.6	11,651.1
Prob > chi2	0.000	0.000	0.000	0.000
Pseudo R-squared	0.71	0.67	0.85	0.82

1.4.2. *Host country determinants of the choice of banks foreign affiliates*

We now discuss the results regarding the influence of bank regulation and levels of economic development on "how" banks settle in foreign banking markets. We first consider the entry strategy with an exclusive organizational form (foreign branch versus foreign subsidiary), and second we account for all three models (branch only, subsidiary only, and both types).

1.4.2.1. Exclusive foreign business model: Branches versus subsidiaries

In Table 1.9 we report the results for the second-step[15] of the Heckman estimation of Eq. (2)[16].

From the estimation of the likelihood for banks to expand in a host country with branches exclusively instead of subsidiaries exclusively, we find that host country bank regulation and supervision are indeed critical for foreign organizational form strategies. Considering the global sample with all foreign countries, banks are strongly more likely to establish only branches in locations with fewer requirements to obtain a banking license and weaker supervisory power. Possibly; in foreign countries where the procedures to enter are relatively stringent, and nevertheless banks still desire to conduct operations, they might preferably choose to only set with a stronger structure which is the subsidiary. Yet, at a lower level of significance, we observe an effect in favor of branches when host capital

[15] The first step of this procedure determines what factors influence the decision to operate with a unique type of affiliates in a host country *k* and is reported in Appendix 1.B. Briefly on the regulatory aspect, contrary to Table 1.8, we observe that, regardless the level of development and across all regressions, for banks that wish to set an exclusive business model, the difference of capital requirements between host and home countries portrays a positive, uniform and highly significant influence on the likelihood for banks to conduct foreign operations. As well, considering the whole sample of countries (column (1)) and the middle-income economies (column (3)) we note that banks now have an incentive to penetrate countries with more stringent bank activity restrictions than the home's. However, in developing countries (column (4)), banks greatly adjust their decision of expansion as they seem more likely to have an exclusive foreign presence in low-income countries with numerous barriers to entry, stringent capital requirements and powerful supervisory authorities i.e. banks might have a preference for secured markets in poor economies.

[16] The independence tests of the Heckman two-step model at the bottom of Table 1.9 confirm that the hypothesis of a selection bias in the choice of the foreign affiliate type cannot be rejected in our sample. The use of a two-step model is hence indispensable to make sure that the obtained results are unbiased.

requirements are stringent whereas restrictions of activities do not matter in determining the affiliate' structure. Then considering the three income-group specifications, the results of the rich countries group are quite similar to those of the overall sample, but those of the two others groups show strong discrepancies which validate the need for our thorough analysis of the choice of a foreign business model depending on host countries level of development. We find for intermediate countries that the stringency of entry requirements favors the choice of subsidiaries, as in rich countries, and that strong capital requirements and powerful supervisor favor the choices of branches, as in poor countries where branches are also fostered by the restriction of banking activities.

More specifically, in high- and middle-countries, while banks facing severe bank entry requirements have a greater incentive to operate foreign subsidiaries exclusively rather than branches, those barriers to entry have no influence in the choice of the organizational form established in low-income countries. Moreover, in regards of the weak influence of bank activity restrictions in high- and middle-income locations, banks seem to be weakly tempted to establish foreign branches only in high-income countries with more restricted activities and foreign subsidiaries exclusively in middle-income countries with a wider range of permitted activities. However, in poor foreign countries, the likelihood for banks to operate solely with branches is strongly and positively associated to the restrictiveness of bank activities. This last result is in line with Goldberg and Saunders (1981b), Miller and Parkhe (1998), and Clarke et al. (2003). As foreign banks are interested in exploiting diversified profits opportunities abroad, they are more likely to use subsidiaries rather than branches to provide a wide range of activities where possible. Further, turning to the influence of host countries capital requirements and supervisory power, we find that while developed economies with strong supervision have a greater incentive to host foreign subsidiaries exclusively rather than branches, the capital requirements have no influence. On a contrary, in middle- and low-income countries, more stringent capital rules or stronger supervisory power increases the likelihood to operate only with foreign branches. An increase in the capital regulatory index implies issuing additional capital for the parent bank which makes it more costly to set up a subsidiary. Also, parent banks from developed home countries[17] that are subject to strong supervisory power at home seem less prone to put their subsidiary under the control of the banking authorities of developing countries. Banks might open branches in such countries to harmonize the levels of supervision of their network of foreign affiliates.

[17] Of the 28 countries of the European Union, 26 are part of the high-income group and only Romania and Hungary are classified among middle-income countries.

The country-level factors represented by host country GDP per capita and size both positively and strongly affect the probability to operate the business model with foreign subsidiaries exclusively in all countries. The negative coefficients indicate that banks are less likely to establish branches in countries with relatively rich populations and elsewhere in general. A possible explanation may be that since the size of the host country, measured by GDP, matters and encourages the presence of banks abroad[18], foreign banks anticipated potential profits and growth, and preferably choose a straightforward entry with subsidiaries. However, the foreign bank share is significant only in low-income countries i.e. the power of the foreign actors is critical in developing markets and also lead to a penetration with subsidiaries only which might have more strength and offer more stability to better compete on the local banking system. In terms of bank financial characteristics, beside in low-income countries where there is no effect, the signs associated to banks with a retail business orientation and to large banks are mirrored in the other regressions i.e. all, high-income, and middle-income countries and indicate that establishing foreign subsidiaries only is more common for this kind of banks. Retailed-oriented banks conduct their deposit-taking operations in foreign subsidiaries because they usually aim to deeply penetrate the local market and establish solid ties with their foreign customers [Goldberg and Saunders (1981b), (1990), Cerutti et al. (2007)]. Regardless the level of development of the country, less efficient banks are more likely to expand only with foreign branches since setting up this type of affiliate can be less costly for the parent bank. However, the behavior of leveraged banks varies greatly across the different groups. From the literature [Terrell and Key (1977), Goldberg and Johnson (1990), Parkhe and Miller (1998)] highly capitalized banks tend to set abroad with subsidiary which we confirm with the negative coefficients obtain for the whole sample of host countries and also the high-income countries specifically. Yet, in middle-income countries, the likelihood to operate only with foreign branches instead of foreign subsidiaries increases with the capital ratio.

Table 1.9 – **Heckman** estimation of the likelihood for a bank *i* to operate foreign branches only and no subsidiary in the host country *k*.

The table presents regression results of the **2nd step** of the Heckman two-step sample-selection estimation of Eq. (2): the likelihood for a bank *i* from EU country *j* to operate with foreign branches only in the host country $k \neq j$ (Only branches $Affiliate_{i,j,k} = 1$) instead of with foreign subsidiaries only in the host country $k \neq j$ (Only subsidiaries $Affiliate_{i,j,k} = 0$), for the

[18] See the global Probit estimation of the likelihood for a bank to operate an affiliate in a foreign country *k* (Table 1.8) and the first step of the Heckman specific estimation of the likelihood for a bank to have an exclusive foreign affiliate form in the host country *k* (Appendix 1.B).

whole sample of countries and the three high-, middle-, and low-income-group. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

	Foreign Organizational Form choice: Only subsidiaries = 0 vs Only branches = 1			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	-0.100***	-0.059***	-0.089**	0.087
	(0.01)	(0.02)	(0.04)	(0.10)
Host_Bank Activity Restrictions	-0.002	0.006*	-0.012*	0.103***
	(0.00)	(0.00)	(0.01)	(0.01)
Host_Capital Regulatory index	0.004*	0.000	0.024***	0.047***
	(0.00)	(0.00)	(0.01)	(0.02)
Host_Official Supervisory Power	-0.055***	-0.079***	0.026**	0.096***
	(0.00)	(0.01)	(0.01)	(0.03)
Host_Foreign Bank Share	-0.020	-0.072	-0.093	-0.403***
	(0.03)	(0.05)	(0.08)	(0.14)
Host_GDP per Capita (log)	-0.035***			
	(0.01)			
Host_Size (log GDP)	-0.077***	-0.107***	-0.059***	-0.090***
	(0.01)	(0.01)	(0.02)	(0.02)
Specialization	-0.090***	-0.049**	-0.091**	0.206
	(0.02)	(0.02)	(0.04)	(0.16)
Cost to Income Ratio	0.153***	0.073*	0.617***	0.629***
	(0.04)	(0.04)	(0.09)	(0.16)
Equity / Total Assets	-1.162***	-1.530***	0.796***	-0.350
	(0.11)	(0.13)	(0.23)	(0.41)
Net Interest Margin	-0.008	0.001	-0.036***	-0.009
	(0.01)	(0.01)	(0.01)	(0.03)
Non-Interest Income to Net Income	0.010***	0.003	-0.000	-0.012
	(0.00)	(0.00)	(0.01)	(0.01)
Bank size (logTA)	-0.090***	-0.054***	-0.061***	-0.028
	(0.01)	(0.01)	(0.01)	(0.04)
N° Observations (step 1)	**134,683**	**60,634**	**31,523**	**42,526**
N° foreign affiliates	20,850	10,134	9,010	1,706
N° Censored (step 1 → step 2)	131,570	58,245	30,980	42,345
Uncensored (step 2)	**3,113**	**2,389**	**543**	**181**
Wald test of indep. Eqns.	813.9	817.7	155.8	158.6
Prob > chi2	0.000	0.000	0.000	0.000

As a whole, our baseline estimates show the relevance of taking into account the level of economic development of the host countries and the maturity of their financial system to investigate the regulatory determinants of foreign banks' presence and organizational strategies. Indeed, from Table 1.10 that summarizes our findings, we highlight that when

facing higher barriers to entry, banks favor a foreign presence on mature markets of developed economies where they set subsidiaries rather than branches. As well, more restrictions on bank activities strongly increase the likelihood of penetrating these mature markets while reducing the incentive of entering middle and low-income economies. However, regarding the choice of an organizational strategy, such restrictions on activities affect poor economies where they favor the establishment of branches. Conversely, more stringent capital requirements uniformly discourage any presence abroad and yet, if banks still decide to expand, strong capital rules will lead them to set foreign branches in middle and low-income host countries. Finally, greater supervisory power produces opposite effects. On the one hand, it decreases the likelihood of banks' presence in high-income countries and increases it in middle-income economies. On the other hand, it leads banks to rather operate foreign subsidiaries in mature markets of high-income economies and operate foreign branches in middle and low-income host countries.

Table 1.10 – **Summary** of the baseline results for banking regulation variables in Table 1.8 and Table 1.9.

The table presents the summary of results for the **Probit** estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to operate an affiliate in a host country *k≠j* (Presence $Foreign_{i,j,k} = 1$) and the **2nd step** of the Heckman two-step sample-selection estimation of Eq. (2): the likelihood for a bank *i* from EU country *j* to operate with foreign branches only in the host country *k≠j* (Only branches $Affiliate_{i,j,k} = 1$) instead of with foreign subsidiaries only in the host country *k≠j* (Only subsidiaries $Affiliate_{i,j,k} = 0$), for the whole sample of countries and the three high-, middle-, and low-income groups. For all four variables, higher values indicate more stringency of the regulation in the host country. The signs +++ / ++ / + (--- / -- / -) indicate an increase (a decrease) of the likelihood of Eq. (1) or Eq. (2) respectively at a 1% ***, 5% **, or 10% * significance level, and empty cells indicate no significance.

	Eq. (1) – Probit Bank presence abroad				**Eq. (2) – Heckman Choice of branches exclusively rather than subsidiaries**			
Host countries	All	High income	Middle	Low	All	High	Middle	Low
Entry into Banking Requirements	+++	+++	-	-	---	---	--	
Bank Activity Restrictions	---	+++	---	---		+	-	+++
Capital Regulatory index	---	---	---		+		+++	+++
Official Supervisory Power	+++	---	+++		---	---	++	+++

1.4.2.2. Multinomial framework: Branches or/and subsidiaries

We report in Table 1.11 the results of the multinomial Probit estimation of Eq. (2) for the whole sample of all host countries and the three income groups separately. Whereas the analysis conducted in section 4.2.1 is limited to around 16 percent of all foreign affiliates, the multinomial regression allows us to consider the complete sample of foreign affiliates. In this multinomial approach we analyze both the likelihood to establish an exclusive business model of foreign branches in the host country instead of foreign subsidiaries only and the likelihood to establish the mix business models of both foreign branches and subsidiaries instead of foreign subsidiaries only.

In the first case regarding the choice of foreign branches only, results for all four regressions globally present similarities in signs and significances that reinforce the previous findings of the Heckman model. For instance, the impact of banking regulation stands in low-income host countries with stringent regulation (i.e. bank activity restrictions, capital requirements, and supervisory power) as banks are still more likely to expand with foreign branches exclusively. Also, with globally stronger significance, weak entry into banking requirements, numerous bank activity restrictions, stringent capital rules, and powerful supervisors in middle-income countries maintain the likelihood to host branches only. However, in developed economies while entry requirements and activities restrictions cease to matter, severe capital rules become a conclusive support for the branches structure only, and great supervisory power continue to favor the expansion with foreign subsidiaries exclusively.

In the second case we explore the alternative of establishing a foreign organizational network with both branches and subsidiaries in the same host country instead of a model made of foreign subsidiaries only. Regardless the level of economic development, the estimation on the whole sample of countries indicate that only bank activity restrictions and supervisory power matter and produce opposite effects since the first variable negatively affects the likelihood of a dual strategy with both branches and subsidiaries and the second positively. These results are perfectly mirrored for developing countries in column (4). However considering the foreign penetration of high- and middle-income countries, seven of the eight coefficients of banking regulation variables are strongly significant and opposite in signs within the two groups of countries, except for bank activity restrictions which favor the dual presence with both branches and subsidiaries in both groups. Thus in rich economies with stronger entry requirements, banks tend to establish a presence in such mature markets with both organizational forms rather than foreign subsidiaries exclusively. Indeed, if barriers

to entry are high and yet the parent banks can meet all the requirements, they might as well build up a stronger and deeper network. Moreover, stringent capital rules and stronger supervisory power in high-income countries increases the likelihood to operate with foreign subsidiaries only rather both forms. Possibly, in developed countries, the parent bank builds the organizational structure that minimizes the capital requirements and related expenses. On the contrary, whereas higher barriers to entry in middle-income economies make banks more likely to establish foreign subsidiaries exclusively, severe capital regulation and authority supervision increase the bank preference to run both types of affiliates in such markets in transition.

Table 1.11 – **Multinomial Probit** estimation the likelihood for a bank *i* to build a foreign organizational strategy in the host country *k* (base outcome $Affiliate_{i,j,k} = 0$).

The table presents regression results of the multinomial Probit estimation of Eq. (2): the likelihood for a bank *i* from EU country *j* to operate with foreign branches only in the host country $k \neq j$ ($Affiliate_{i,j,k} = 1$) or with both foreign organizational forms ($Affiliate_{i,j,k} = 2$) instead of operating with foreign subsidiaries only (base outcome $Affiliate_{i,j,k} = 0$), for the whole sample of countries and the three high-, middle-, and low-income-group. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

Base outcome: the bank operates only foreign subsidiaries in the host country *k* $Affiliate_{i,j,k} = 0$				
The bank operates only foreign branches in the host country *k* $Affiliate_{i,j,k} = 1$				
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into banking requirements	-0.298***	-0.010	-2.753***	-0.157
	(0.06)	(0.07)	(0.26)	(0.58)
Host_Bank Activity Restrictions	-0.025*	-0.004	-0.196***	0.402***
	(0.01)	(0.02)	(0.03)	(0.10)
Host_Capital Regulatory index	0.046***	0.046***	0.312***	0.629***
	(0.01)	(0.01)	(0.04)	(0.16)
Host_Official Supervisory Power	-0.215***	-0.277***	0.135*	0.881***
	(0.02)	(0.02)	(0.07)	(0.18)
Host_Foreign Bank Share	1.180***	1.581***	2.393***	-2.337**
	(0.13)	(0.23)	(0.39)	(0.98)
Host_GDP per Capita (log)	0.060*			
	(0.04)			
Host_Size (log GDP)	-0.127***	-0.013	-0.446***	-0.490***
	(0.03)	(0.04)	(0.08)	(0.17)
Specialization	-0.707***	-0.554***	-1.627***	-1.405
	(0.09)	(0.10)	(0.29)	(0.91)
Cost to Income Ratio	0.914***	0.535***	3.078***	2.729***
	(0.15)	(0.17)	(0.50)	(0.82)
Equity / Total Assets	-4.205***	-4.517***	-0.891	-5.447*
	(0.39)	(0.48)	(1.13)	(2.97)

Net Interest Margin	-0.516***	-0.420***	-0.806***	-0.562
	(0.04)	(0.04)	(0.11)	(0.37)
Non-Interest Income to Net Income	-0.023*	-0.034***	-0.111**	-0.130*
	(0.01)	(0.01)	(0.05)	(0.07)
Bank size (logTA)	0.068***	0.055**	0.402***	0.356**
	(0.02)	(0.03)	(0.07)	(0.16)
The bank operates both foreign subsidiaries and branches in the host country *k*				
***Affiliate*$_{i,j,k}$ = 2**				
Host_Entry into banking requirements	-0.068	0.120*	-0.664***	-0.058
	(0.06)	(0.06)	(0.22)	(0.31)
Host_Bank Activity Restrictions	-0.066***	0.058***	0.093***	-0.204***
	(0.01)	(0.02)	(0.03)	(0.07)
Host_Capital Regulatory index	-0.008	-0.061***	0.079***	-0.001
	(0.01)	(0.01)	(0.03)	(0.08)
Host_Official Supervisory Power	0.043**	-0.098***	0.525***	0.275**
	(0.02)	(0.02)	(0.06)	(0.13)
Host_Foreign Bank Share	0.719***	-0.705***	1.795***	4.173***
	(0.12)	(0.21)	(0.28)	(0.64)
Host_GDP per Capita (log)	-0.357***			
	(0.03)			
Host_Size (log GDP)	0.161***	-0.130***	0.143***	0.402***
	(0.02)	(0.03)	(0.05)	(0.11)
Specialization	1.775***	1.697***	6.807***	0.606
	(0.09)	(0.11)	(0.79)	(0.39)
Cost to Income Ratio	-0.711***	-1.283***	0.519	1.718***
	(0.14)	(0.17)	(0.43)	(0.63)
Equity / Total Assets	0.608*	-2.205***	16.460***	-3.287***
	(0.32)	(0.48)	(1.61)	(1.21)
Net Interest Margin	0.288***	0.326***	0.022	0.524***
	(0.02)	(0.03)	(0.06)	(0.11)
Non-Interest Income to Net Income	-0.001	0.028**	-0.112***	0.160**
	(0.01)	(0.01)	(0.04)	(0.07)
Bank size (logTA)	0.336***	0.274***	0.608***	0.507***
	(0.02)	(0.03)	(0.06)	(0.09)
N° foreign affiliates	20,850	10,134	9,010	1,706
N° Observations	**20,692**	**10,069**	**8,934**	**1,689**
Wald chi2	4,350.4	2,569.7	884.4	440.7
Prob > Wald chi2	0.000	0.000	0.000	0.000

1.5. Further issues and robustness checks

In this section, we run various regressions to go deeper in the analysis of the influence of home and host countries' regulation and supervision on banks internationalization strategies. We also conduct some robustness checks of the previous results to test the consistency of our findings.

1.5.1. *Economic integration and banking abroad: the EU case*

Given the 1993 European Communities Regulation[19] on free establishment of branches from parent's home EU country in any other EU country, we differentiate host countries by their economic integration and run the Heckman regressions on the two subsamples of EU and non-EU host countries[20]. Relatively to the category of high-income countries, higher barriers to entry and weaker supervisory power become significant and make less likely the presence of an EU bank in another EU country. Moreover, banks specialized in deposit-taking activities tend to favor foreign expansion in EU countries. Regarding the choice of the unique organizational form, beside the entry into banking requirements that are now non-significant, the rest of bank regulation and supervision factors mirror the findings for high-income countries. Also, contrary to the previous results, banks that are less efficient or better performing or engage in diversified activities seem to establish foreign subsidiaries in other EU countries rather than branches. Overall, the regressions portray the similar conclusions.

Table 1.12 – **Heckman** estimation of the likelihood for a bank *i* to operate foreign branches only and no subsidiary in the host country *k*. **Host EU and non-EU countries**

The table presents regression results of the **2nd step** of the Heckman two-step sample-selection estimation of Eq. (2): the likelihood for a bank *i* from EU country *j* to operate with foreign branches only in the host country *k≠j* (Only branches $Affiliate_{i,j,k} = 1$) instead of with foreign subsidiaries only in the host country *k≠j* (Only subsidiaries $Affiliate_{i,j,k} = 0$), for the whole sample of countries and the three high-, middle-, and low-income-group. A constant is estimated but not reported. All the variables have been defined in Section 1.3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

	Foreign Organizational Form choice: Only branches = 0 vs Only subsidiaries = 1			
	(1) ALL	(2) Host_High-income	**(3) EU Host countries**	**(4) non-EU Host countries**
Host_Entry into Banking Requirements	-0.100***	-0.059***	0.019	-0.125***
	(0.01)	(0.02)	(0.02)	(0.02)
Host_Bank Activity Restrictions	-0.002	0.006*	0.007**	0.014***
	(0.00)	(0.00)	(0.00)	(0.00)
Host_Capital Regulatory index	0.004*	0.000	-0.001	0.009**
	(0.00)	(0.00)	(0.00)	(0.00)
Host_Official Supervisory Power	-0.055***	-0.079***	-0.023***	-0.009
	(0.00)	(0.01)	(0.01)	(0.01)
Host_Foreign Bank Share	-0.020	-0.072	-0.199***	-0.150***
	(0.03)	(0.05)	(0.05)	(0.05)
Host_GDP per Capita (log)	-0.035***		-0.139***	-0.079***
	(0.01)		(0.02)	(0.01)

[19] S.I. No. 395/1993 European Communities (Branch Disclosures) Regulations, 1993 http://www.irishstatutebook.ie/eli/1993/si/395/made/en/print

[20] We report the first step of the Heckman regression for this robustness check on EU host countries in Appendix 1.C.

Host_Size (log GDP)	-0.077***	-0.107***	-0.013	-0.094***
	(0.01)	(0.01)	(0.01)	(0.01)
Specialization	-0.090***	-0.049**	-0.039*	-0.215***
	(0.02)	(0.02)	(0.02)	(0.02)
Cost to Income Ratio	0.153***	0.073*	-0.194***	0.605***
	(0.04)	(0.04)	(0.04)	(0.05)
Equity / Total Assets	-1.162***	-1.530***	-1.117***	-0.480***
	(0.11)	(0.13)	(0.16)	(0.12)
Net Interest Margin	-0.008	0.001	-0.029**	-0.002
	(0.01)	(0.01)	(0.01)	(0.01)
Non-Interest Income to Net Income	0.010***	0.003	-0.011***	-0.005
	(0.00)	(0.00)	(0.00)	(0.00)
Bank size (logTA)	-0.090***	-0.054***	-0.020**	-0.060***
	(0.01)	(0.01)	(0.01)	(0.01)
N° Observations (step 1)	**134,683**	**60,634**	**35,346**	**99,337**
N° foreign affiliates	20,850	10,134	4,396	16,454
N° Censored (step 1 → step 2)	131,570	58,245	33,444	98,126
Uncensored (step 2)	**3,113**	**2,389**	**1,902**	**1,211**
Wald test of indep. Eqns.	813.9	817.7	219.4	1,141.3
Prob > chi2	0.000	0.000	0.000	0.000

1.5.2. *Banks' regulation and foreign expansion with exclusive and mix business models*

From the specifications of the previous regressions, we run two additional Heckman sample-selection models in which the selection equation analyzes presence abroad with any kind of operations and the second stages consider all foreign organizational structures. We estimate the probability of operating in the host country exclusively with foreign subsidiaries instead of the mix of foreign branches only or both affiliate types. We also model the probability of operating in a host country exclusively with foreign branches only rather than with foreign subsidiaries only or both affiliate types. This enables us to account for all foreign affiliate strategies and to gain a better representativeness with the whole sample.

Table 1.13[21] reports the second stage of the Heckman which estimates the probability of operating with foreign branches exclusively or both affiliate types in the host country instead of foreign subsidiaries only. With these estimations, we aim to capture deeply the foreign structures banks build abroad relatively to the special case of the expansion with the exclusive

[21] The first-step of the Heckman is the same for both specifications and is reported in Appendix 1.D. The results of this estimation are similar to the Probit estimation of the likelihood for a bank to operate an affiliate in a foreign country *k* (Table 1.8).

business modem. Looking at the three income-group subsamples, we observe a complete absence of significance of bank regulation and supervision variables in developed countries where as in middle and low-income host countries, all effects become strongly significant. Relatively to the results reported in Table 1.9, stringent entry into banking requirements make more likely the foreign presence with subsidiaries only. Yet, when facing stronger capital rules and greater supervisory power in a host country, banks will rather build a presence with branches only or establish both subsidiaries and branches. Overall, the findings regarding bank regulation and supervision variables strengthen those previously obtained. We also find that foreign bank presence positively affects the likelihood to establish only foreign subsidiaries in developed countries and either branches only or both affiliate' forms in developing countries. Business opportunities and competitive advantage of the parent bank might explain this difference of strategies.

Table 1.13 – **Heckman** estimation of the likelihood for a bank *i* to operate foreign branches only or both affiliate types instead of foreign subsidiaries only in the host country *k*.

The table presents regression results of the **2nd step** of the Heckman two-step sample-selection estimation of the likelihood for a bank *i* from EU country *j* to operate in the host country $k \neq j$ with foreign branches only ($Affiliate_{i,j,k} = 1$) or with both organizational forms ($Affiliate_{i,j,k} = 2$) instead of with foreign subsidiaries only (base outcome $Affiliate_{i,j,k} = 0$), for the whole sample of countries and the three high-, middle-, and low-income-group. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

	Foreign Organizational Form choice: Only subsidiaries = 0 vs Only branches or both = 1			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	-0.019***	0.000	-0.074***	-0.239***
	(0.00)	(0.00)	(0.01)	(0.03)
Host_Bank Activity Restrictions	-0.003***	0.001	-0.004***	0.031***
	(0.00)	(0.00)	(0.00)	(0.01)
Host_Capital Regulatory index	0.004***	0.001	0.008***	0.043***
	(0.00)	(0.00)	(0.00)	(0.01)
Host_Official Supervisory Power	0.003***	0.002	0.016***	0.050***
	(0.00)	(0.00)	(0.00)	(0.01)
Host_Foreign Bank Share	-0.012**	-0.052***	0.073***	0.290***
	(0.01)	(0.01)	(0.01)	(0.06)
Host_GDP per Capita (log)	-0.013***			
	(0.00)			
Host_Size (log GDP)	-0.012***	-0.022***	-0.003*	-0.038***
	(0.00)	(0.00)	(0.00)	(0.01)
Specialization	0.008	0.009	0.100***	-0.005
	(0.01)	(0.01)	(0.01)	(0.03)

Cost to Income Ratio	0.011	0.016	-0.008	0.227***
	(0.01)	(0.01)	(0.02)	(0.06)
Equity / Total Assets	-0.103***	-0.984***	0.425***	-0.657***
	(0.02)	(0.05)	(0.04)	(0.13)
Net Interest Margin	0.017***	0.032***	0.004	-0.018*
	(0.00)	(0.00)	(0.00)	(0.01)
Non-Interest Income to Net Income	0.001	0.004***	-0.004*	0.000
	(0.00)	(0.00)	(0.00)	(0.01)
Bank size (logTA)	-0.017***	-0.024***	-0.004	-0.084***
	(0.00)	(0.00)	(0.00)	(0.01)
N° Observations (step 1)	**151,598**	**67,690**	**39,893**	**44,015**
N° foreign affiliates	20,850	10,134	9,010	1,706
N° Censored (step 1 → step 2)	131,570	58,245	30,980	42,345
Uncensored (step 2)	**20,028**	**9,445**	**8,913**	**1,670**
Wald test of indep. Eqns.	734.4	743.9	466.4	311.2
Prob > chi2	0.000	0.000	0.000	0.000

In the other second stage regression of the probability of operating in a host country with foreign subsidiaries only or both affiliate types rather than foreign branches only, the coefficients in Table 1.14 are globally opposite to the baseline Heckman estimations (Table 1.9). For instance, stringent capital regulation increases the likelihood to operate with branches exclusively instead of subsidiaries only or both forms in all host countries. Conversely, higher barriers to entry and greater supervisory power are positively associated to the foreign presence with subsidiaries only or both organizational forms in high and middle-income countries. On the whole, the country-level and bank-level characteristics portray the same pattern of opposite signs in line with the baseline model.

Table 1.14 – **Heckman** estimation of the likelihood for a bank *i* to operate foreign subsidiaries only or both affiliate types instead of foreign branches only in the host country *k*.

The table presents regression results of the **2nd step** of the Heckman two-step sample-selection estimation of the likelihood for a bank *i* from EU country *j* to operate in the host country $k \neq j$ with foreign subsidiaries only ($Affiliate_{i,j,k} = 0$) or with both organizational forms ($Affiliate_{i,j,k} = 2$) instead of with foreign branches only (base outcome $Affiliate_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income-group. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

	Foreign Organizational Form choice: Only branches = 0 vs Only subsidiaries or both = 1			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	0.091***	0.032***	0.213***	-0.026
	(0.01)	(0.01)	(0.01)	(0.03)

Host_Bank Activity Restrictions	0.007***	0.001	0.043***	-0.101***
	(0.00)	(0.00)	(0.00)	(0.01)
Host_Capital Regulatory index	-0.014***	-0.022***	-0.020***	-0.056***
	(0.00)	(0.00)	(0.00)	(0.01)
Host_Official Supervisory Power	0.020***	0.030***	0.023***	-0.139***
	(0.00)	(0.00)	(0.00)	(0.01)
Host_Foreign Bank Share	-0.042***	-0.276***	-0.166***	0.654***
	(0.01)	(0.02)	(0.01)	(0.06)
Host_GDP per Capita (log)	-0.053***			
	(0.00)			
Host_Size (log GDP)	0.038***	0.003	0.036***	0.067***
	(0.00)	(0.00)	(0.00)	(0.01)
Specialization	0.477***	0.437***	0.913***	-0.015
	(0.01)	(0.01)	(0.01)	(0.02)
Cost to Income Ratio	-0.212***	-0.282***	-0.313***	-0.020
	(0.02)	(0.02)	(0.02)	(0.04)
Equity / Total Assets	0.632***	0.873***	1.563***	0.794***
	(0.04)	(0.09)	(0.05)	(0.09)
Net Interest Margin	0.053***	0.055***	0.017***	-0.048***
	(0.00)	(0.00)	(0.00)	(0.01)
Non-Interest Income to Net Income	-0.002*	0.010***	-0.013***	0.026***
	(0.00)	(0.00)	(0.00)	(0.00)
Bank size (logTA)	0.043***	0.035***	-0.004	-0.049***
	(0.00)	(0.01)	(0.00)	(0.01)
N° Observations (step 1)	**151,598**	**67,690**	**39,893**	**44,015**
N° foreign affiliates	20,850	10,134	9,010	1,706
N° Censored (step 1 → step 2)	131,570	58,245	30,980	42,345
Uncensored (step 2)	**20,028**	**9,445**	**8,913**	**1,670**
Wald test of indep. Eqns.	9045.3	4339.1	7289.9	1983.3
Prob > chi2	0.000	0.000	0.000	0.000

1.5.3. *Additional robustness checks*

We test for the weight of foreign banks in the host country by replacing foreign bank share with the percentage of total banking assets held by foreign banks relatively to the total assets in the banking system (*ForeignTA_TotalTA*)[22] among the explanatory variables in Eq. (1) and Eq. (2). We estimate both Probit and Heckman sample selection models and our main findings globally remain unchanged[23] (see Appendixes 1. E, 1. F, 1. G).

[22] This variable was extracted from the Global Financial Development Database (2015) provided by the World Bank

[23] For this robustness check with ForeignTA_TotalTA, we report the global Probit estimation of the likelihood for a bank to operate an affiliate in a foreign country *k* in Appendix 1.E and the Heckman two-step sample selection specific estimation of the likelihood for a bank to have an exclusive foreign affiliate form in the host country *k* in Appendix 1.F (first step) and Appendix 1.G (second step).

Finally, we dissociate the economic freedom index to capture the effect of each composite on banks' internationalization[24]. More precisely, this check will allow us to determine the individual importance of the four pillars (Rule of Law, Limited Government, Regulatory Efficiency, and Market Openness) on the likelihood for a bank to operate an affiliate in a foreign country[25]. We report all Probit estimations of Eq. (1) and we only focus on the differences from the baseline results (Table 1.8) and across the income groups.

First, the Probit regressions reported in Table 1.15, indicate for all columns that banks are more likely to be present in host countries where Rule of Law is higher than at home. As the effects of property rights and freedom from corruption are similar to the global economic freedom score, this check supports the previous findings.

Second, we look at the influence of government in terms of the tax burden and expenditures relatively to the GDP and we observe an impact of Limited Government on the likelihood to expand abroad highly positive in developed economies, highly negative in middle-income countries, but an absence of significance in low-income host countries. The other coefficients of these regressions (see Table 1.16) are consistent with the baseline results (Table 1.8).

Third, we also find that an increase of the gap between the host and the home countries' Regulatory Efficiency has a positive impact on the selection of all host countries to establish foreign affiliates, regardless of the level of economic development. The results of this estimation, reported in Table 1.17, leave our previous findings unchanged.

Finally, when facing host countries with higher Market Openness score relatively to the home country, the bank incentive to establish a foreign affiliate abroad increases except in developing countries where it diminishes. As it was already the case for the previous categories, the rest of findings (see Table 1.18) again confirms the conclusions of Table 1.8 in Section 1.4.1.

[24] Rule of Law (property rights, freedom from corruption), Limited Government (fiscal freedom, government spending), Regulatory Efficiency (business freedom, labor freedom, monetary freedom), and Market Openness (trade freedom, investment freedom, financial freedom).

[25] For this robustness check on the four pillars of the Economic Freedom Index, we also run the Heckman two-step sample selection specific estimation of the likelihood for a bank to have an exclusive foreign affiliate form in the host country *k* and report both steps in Appendix 1.H to Appendix 1.O.

1.6. Conclusion

In this paper, we assemble a unique hand-collected database to capture the internationalization pattern of banks. Using 1,251 banks from the 28 European Union countries we empirically identify how home country bank regulation and host country regulation and level of development influence where and how banks expand abroad. More specifically, we look into whether they operate only with one type of affiliate (branches instead of subsidiaries) or with both organizational forms in the host country.

Globally, our results show that both home country and host country regulations matter but in different ways. Low-income countries with severe restrictions on bank activities are less likely to attract foreign entities; yet the likelihood increases when the barriers to entry are higher. Additionally, the incentives to go abroad decrease when the host country capital regulatory index, official supervisory power, and economic freedom scores are lower than at home. These findings suggest that in most host locations, rather than entering countries with lax regulation, banks prefer to expand in more stringent regulatory and supervisory environments. Moreover, banks' business models also matter as we find that retail-oriented banks are more likely to penetrate low-income countries than high-income countries. In less developed countries, banks apparently expand to build up traditional deposit-taking operations but in mature markets they rather expand when they are focused on wholesale banking services. Nevertheless, we also find that such retail-oriented banks operate either subsidiaries solely or both forms in high-income and middle-income host countries. Also, banks are more likely to run foreign branches than subsidiaries in both high-income and low-income countries that restrain banking activities, and establish both type of affiliates when they enter middle-income countries that limit their activities. Furthermore, strong entry restrictions are likely to favor subsidiary operations in all locations but branch activities are more common in middle-income and low-income countries with stringent capital requirements and greater supervisory power.

Our findings have important policy implications. Home country and host country regulatory requirements and prudential rules play an important role in banks' foreign expansion but differently for low-income and high-income countries. When facing strong supervisory power, banks expand by rather opening foreign branches than subsidiaries in middle-income and low-income countries but by mostly establishing subsidiaries in high-income countries. To monitor and manage bank stability, specifically in times of financial turmoil, supervisors should account for the structure of banking groups and the organizational

forms of their international expansion. Our results also show that highly capitalized banks mostly operate subsidiaries in both high and low-income countries. Internal capital markets through which parent banks can channel funds in both directions should therefore be given specific attention.

Table 1.15 – **Probit** estimation of the likelihood for a bank *i* to operate an affiliate in a foreign country *k*. **Economic Freedom – Rule of Law (property rights, freedom from corruption)**

The table presents regression results of the Probit estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to operate an affiliate in a host country $k \neq j$ (Presence $Foreign_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income groups. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	0.140***	0.163***	-0.284***	-0.182***
	(0.01)	(0.02)	(0.05)	(0.07)
Diff (Host-Home)_Bank Activity Restrictions	-0.004	0.053***	-0.021***	-0.101***
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Capital Regulatory index	-0.032***	-0.023***	-0.047***	0.013
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Official Supervisory Power	0.039***	-0.071***	0.150***	0.030*
	(0.00)	(0.01)	(0.01)	(0.02)
Host_Bank Concentration	-0.878***	-1.376***	-1.913***	-2.587***
	(0.04)	(0.06)	(0.16)	(0.21)
Host_Foreign Bank Share	1.130***	1.035***	0.398***	0.564***
	(0.03)	(0.05)	(0.10)	(0.17)
Host_Depth of Credit Information Index	0.281***	0.181***	0.513***	-0.081***
	(0.01)	(0.01)	(0.03)	(0.03)
Diff (Host-Home)_Rule of Law Score	0.011***	0.002***	0.029***	0.010***
	(0.00)	(0.00)	(0.00)	(0.00)
Host_GDP per Capita (log)	-0.428***			
	(0.01)			
Host_Size (log GDP)	0.223***	-0.018	0.694***	0.162***
	(0.01)	(0.01)	(0.03)	(0.04)
Specialization	0.640***	0.553***	0.698***	0.827***
	(0.02)	(0.03)	(0.05)	(0.09)
Cost to Income Ratio	-0.330***	-0.059	-1.091***	0.268**
	(0.04)	(0.05)	(0.10)	(0.12)
Loans / Total Assets	-0.762***	-0.509***	-1.725***	-1.312***
	(0.04)	(0.05)	(0.09)	(0.14)
Non-Interest Income to Net Income	-0.064***	-0.085***	-0.058***	-0.005
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.061***	0.174***	0.082***	0.050**
	(0.01)	(0.01)	(0.01)	(0.02)
Bank size (logTA)	0.649***	0.630***	0.748***	0.646***
	(0.01)	(0.01)	(0.01)	(0.02)
Common Official Language	0.424***	0.584***	1.380***	0.272**
	(0.02)	(0.03)	(0.06)	(0.11)

Distance between capitals	-0.387***	-0.204***	-1.573***	-1.355***
	(0.01)	(0.01)	(0.04)	(0.05)
Bilateral Trade ratio	0.129***	0.149***	0.021	0.380***
	(0.00)	(0.00)	(0.02)	(0.07)
N° Observations	**151,598**	**67,690**	**39,893**	**44,015**
Wald chi2	84,792.2	36,390.4	36,040.5	11,640.9
Prob > chi2	0.000	0.000	0.000	0.000
Pseudo R-squared	0.716	0.665	0.850	0.820

Table 1.16 – **Probit** estimation of the likelihood for a bank *i* to operate an affiliate in a foreign country *k*. **Economic Freedom – Limited Government (fiscal freedom, government spending)**

The table presents regression results of the Probit estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to operate an affiliate in a host country *k≠j* (Presence $Foreign_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income groups. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	0.174***	0.145***	-0.045	-0.201***
	(0.01)	(0.02)	(0.05)	(0.07)
Diff (Host-Home)_Bank Activity Restrictions	-0.010***	0.045***	-0.008	-0.097***
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Capital Regulatory index	-0.034***	-0.025***	-0.060***	0.016
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Official Supervisory Power	0.035***	-0.072***	0.174***	0.007
	(0.00)	(0.01)	(0.01)	(0.02)
Host_Bank Concentration	-0.667***	-1.234***	-0.488***	-2.606***
	(0.04)	(0.05)	(0.15)	(0.21)
Host_Foreign Bank Share	1.083***	1.007***	0.537***	0.562***
	(0.03)	(0.05)	(0.10)	(0.17)
Host_Depth of Credit Information Index	0.241***	0.131***	0.642***	-0.072**
	(0.01)	(0.02)	(0.03)	(0.03)
Diff (Host-Home)_Limited Government Score	0.000	0.007***	-0.018***	0.003
	(0.00)	(0.00)	(0.00)	(0.00)
Host_GDP per Capita (log)	-0.265***			
	(0.01)			
Host_Size (log GDP)	0.236***	0.024**	0.740***	0.139***
	(0.01)	(0.01)	(0.03)	(0.04)
Specialization	0.632***	0.529***	0.867***	0.823***
	(0.02)	(0.03)	(0.05)	(0.09)
Cost to Income Ratio	-0.360***	-0.071	-1.062***	0.221*
	(0.04)	(0.05)	(0.10)	(0.12)

Loans / Total Assets	-0.734***	-0.496***	-1.548***	-1.212***
	(0.04)	(0.05)	(0.09)	(0.14)
Non-Interest Income to Net Income	-0.071***	-0.086***	-0.050***	0.001
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.042***	0.173***	0.060***	0.026
	(0.01)	(0.01)	(0.01)	(0.02)
Bank size (logTA)	0.650***	0.634***	0.778***	0.649***
	(0.01)	(0.01)	(0.01)	(0.02)
Common Official Language	0.439***	0.598***	1.419***	0.200*
	(0.02)	(0.03)	(0.06)	(0.11)
Distance between capitals	-0.385***	-0.219***	-1.628***	-1.362***
	(0.01)	(0.01)	(0.04)	(0.06)
Bilateral Trade ratio	0.130***	0.155***	0.054***	0.474***
	(0.00)	(0.00)	(0.02)	(0.07)
N° Observations	**151,598**	**67,690**	**39,893**	**44,015**
Wald chi2	83,974.0	36,459.9	35,454.8	11,604.8
Prob > chi2	0.000	0.000	0.000	0.000
Pseudo R-squared	0.71	0.67	0.84	0.81

Table 1.17 – **Probit** estimation of the likelihood for a bank *i* to operate an affiliate in a foreign country *k*. **Economic Freedom – Regulatory Efficiency (business, labor, monetary)**

The table presents regression results of the Probit estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to operate an affiliate in a host country $k \neq j$ (Presence $Foreign_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income groups. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	0.174***	0.158***	0.081	-0.157**
	(0.01)	(0.02)	(0.05)	(0.07)
Diff (Host-Home)_Bank Activity Restrictions	-0.008***	0.054***	-0.003	-0.093***
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Capital Regulatory index	-0.031***	-0.022***	-0.037***	0.020**
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Official Supervisory Power	0.034***	-0.074***	0.224***	0.015
	(0.00)	(0.01)	(0.01)	(0.02)
Host_Bank Concentration	-0.691***	-1.357***	-2.260***	-2.775***
	(0.04)	(0.06)	(0.17)	(0.22)
Host_Foreign Bank Share	1.063***	1.003***	-0.048	0.588***
	(0.03)	(0.05)	(0.10)	(0.17)
Host_Depth of Credit Information Index	0.238***	0.173***	0.502***	-0.103***
	(0.01)	(0.01)	(0.03)	(0.03)

Diff (Host-Home)_Regulatory Efficiency Score	0.006***	0.005***	0.060***	0.018***
	(0.00)	(0.00)	(0.00)	(0.00)
Host_GDP per Capita (log)	-0.294***			
	(0.01)			
Host_Size (log GDP)	0.234***	-0.025*	0.930***	0.180***
	(0.01)	(0.01)	(0.03)	(0.04)
Specialization	0.636***	0.547***	0.871***	0.847***
	(0.02)	(0.03)	(0.05)	(0.09)
Cost to Income Ratio	-0.363***	-0.067	-1.177***	0.216*
	(0.04)	(0.05)	(0.10)	(0.12)
Loans / Total Assets	-0.739***	-0.509***	-1.731***	-1.239***
	(0.04)	(0.05)	(0.09)	(0.14)
Non-Interest Income to Net Income	-0.070***	-0.086***	-0.051***	-0.000
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.041***	0.174***	0.041***	0.028
	(0.01)	(0.01)	(0.01)	(0.02)
Bank size (logTA)	0.650***	0.631***	0.765***	0.643***
	(0.01)	(0.01)	(0.01)	(0.02)
Common Official Language	0.421***	0.591***	1.247***	0.268**
	(0.02)	(0.03)	(0.06)	(0.11)
Distance between capitals	-0.389***	-0.206***	-1.898***	-1.384***
	(0.01)	(0.01)	(0.04)	(0.05)
Bilateral Trade ratio	0.130***	0.152***	-0.037**	0.417***
	(0.00)	(0.00)	(0.02)	(0.07)
N° Observations	**151,598**	**67,690**	**39,893**	**44,015**
Wald chi2	84,017.802	36,388.205	35,797.359	11,623.8
Prob > chi2	0.000	0.000	0.000	0.000
Pseudo R-squared	0.710	0.665	0.845	0.82

Table 1.18 – **Probit** estimation of the likelihood for a bank *i* to operate an affiliate in a foreign country *k*. **Economic Freedom – Market Openness (trade, investment, financial)**

The table presents regression results of the Probit estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to operate an affiliate in a host country $k \neq j$ (Presence $Foreign_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income groups. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	0.168***	0.162***	0.044	-0.131**
	(0.01)	(0.02)	(0.05)	(0.07)
Diff (Host-Home)_Bank Activity Restrictions	-0.008***	0.047***	-0.051***	-0.097***
	(0.00)	(0.00)	(0.01)	(0.01)

Diff (Host-Home)_Capital Regulatory index	-0.032***	-0.025***	-0.063***	0.017*
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Official Supervisory Power	0.031***	-0.068***	0.086***	0.022
	(0.00)	(0.01)	(0.01)	(0.02)
Host_Bank Concentration	-0.760***	-1.199***	-2.853***	-3.042***
	(0.04)	(0.06)	(0.18)	(0.24)
Host_Foreign Bank Share	1.009***	1.106***	-0.988***	0.470***
	(0.03)	(0.05)	(0.11)	(0.17)
Host_Depth of Credit Information Index	0.006***	-0.003***	0.055***	0.021***
	(0.00)	(0.00)	(0.00)	(0.00)
Diff (Host-Home)_Market Openness Score	0.234***	0.165***	0.368***	-0.121***
	(0.01)	(0.01)	(0.03)	(0.03)
Host_GDP per Capita (log)	-0.311***			
	(0.01)			
Host_Size (log GDP)	0.235***	0.019	0.749***	0.175***
	(0.01)	(0.01)	(0.03)	(0.04)
Specialization	0.629***	0.536***	0.598***	0.852***
	(0.02)	(0.03)	(0.05)	(0.10)
Cost to Income Ratio	-0.365***	-0.056	-1.045***	0.221*
	(0.04)	(0.05)	(0.10)	(0.12)
Loans / Total Assets	-0.739***	-0.518***	-1.737***	-1.245***
	(0.04)	(0.05)	(0.09)	(0.14)
Non-Interest Income to Net Income	-0.069***	-0.089***	-0.053***	-0.001
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.043***	0.171***	0.038***	0.026
	(0.01)	(0.01)	(0.01)	(0.02)
Bank size (logTA)	0.648***	0.629***	0.736***	0.646***
	(0.01)	(0.01)	(0.01)	(0.02)
Common Official Language	0.428***	0.615***	1.396***	0.231**
	(0.02)	(0.03)	(0.06)	(0.11)
Distance between capitals	-0.380***	-0.209***	-1.699***	-1.391***
	(0.01)	(0.01)	(0.04)	(0.05)
Bilateral Trade ratio	0.128***	0.149***	0.011	0.441***
	(0.00)	(0.00)	(0.02)	(0.07)
N° Observations	**151,598**	**67,690**	**39,893**	**44,015**
Wald chi2	84,034.6	36,385.6	35,974.6	11,635.8
Prob > chi2	0.000	0.000	0.000	0.000
Pseudo R-squared	0.71	0.66	0.85	0.82

Appendix 1.A – Description of bank regulation and supervision indexes from the Barth et al. survey (updated 2012) BRSS.

Index	Description
Entry into Banking Requirements Binary "yes"=1 or "no"=0 answers Range from 0 (lower stringency) to 9 (greater stringency)	An index that accounts for all the documents that are legally required to be submitted before the issuance of the banking license in the country. Documents regarding: - Draft by laws - Intended organizational chart - Structure of Board (composition, committees, functions) - Market / business strategy - Financial projections for the first three years - Financial information on main potential shareholders - Background / experience of future Board directors - Background / experience of future senior managers - Source of funds to be used as capital
Bank Activity Restrictions Range from 0 (lower restrictiveness) to 16 (more restrictiveness)	An index that assesses the level of regulatory restrictiveness for bank participation in: - Securities activities (underwriting brokering and dealing in securities, and all aspects of mutual fund industry) - Insurance activities (insurance underwriting and selling) - Real estate activities (real estate investment, development, and management) - Nonfinancial businesses except those businesses that are auxiliary to banking business (ownership and control of nonfinancial firms) The level of regulatory restrictiveness is measured (weighted) as: - Unrestricted (=1) if full range of activities can be conducted directly in the bank or a bank may own 100 percent of the equity in any nonfinancial firm. - Permitted (=2) if full range of activities can be conducted, but some or all must be conducted in subsidiaries or a bank may own 100 percent of the equity in any nonfinancial firm, but ownership is limited based on bank's equity capital. - Restricted (=3) if less than full range of activities can be conducted in the bank or subsidiaries or a bank can only acquire less than 100 percent of the equity in any nonfinancial firm. - Prohibited (=4) if the activity cannot be conducted in either the bank or the subsidiaries or a bank may not acquire an of the equity investment in a nonfinancial firm.
Overall Capital Stringency	An index that assesses whether the capital requirement reflects information on certain risk elements and deducts certain market value losses from capital before the minimum capital adequacy is determined.
Initial Capital Stringency	An index that assesses whether certain funds may be used to initially capitalize a bank and whether they are officially verified.
Capital Regulatory Index Binary "yes"=1 or "no"=0 answers Range from 0 (lower stringency) to 18 (greater stringency)	The sum of the overall and initial capital stringency indexes.
Official Supervisory Power Binary "yes"=1 or "no"=0 answers Range from 0 (lower power) to 22 (greater power)	An index that evaluates whether supervisory authorities have the power to take specific preventive and corrective actions on the basis of auditing, internal/board/ownership rights structure, profits and losses and other balance sheets items.

Appendix 1.B – Heckman estimation of the likelihood for a bank *i* to have an exclusive foreign affiliate form in the host country *k*.

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	-0.018	-0.004	-0.217***	0.447***
	(0.02)	(0.02)	(0.08)	(0.13)
Diff (Host-Home)_Bank Activity Restrictions	0.010**	0.021***	0.031***	-0.062***
	(0.00)	(0.01)	(0.01)	(0.02)
Diff (Host-Home)_Capital Regulatory index	0.024***	0.033***	0.023***	0.030***
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Official Supervisory Power	0.019***	-0.005	0.058***	0.070***
	(0.01)	(0.01)	(0.02)	(0.02)
Host_Bank Concentration	-1.130***	-1.122***	-0.634**	-0.969***
	(0.06)	(0.09)	(0.26)	(0.23)
Host_Foreign Bank Share	0.637***	0.727***	0.272	-0.350*
	(0.05)	(0.07)	(0.17)	(0.18)
Host_Depth of Credit Information Index	0.135***	0.155***	0.308***	-0.123***
	(0.01)	(0.02)	(0.05)	(0.04)
Diff (Host-Home)_Economic Freedom Score	0.037***	0.032***	0.045***	0.013**
	(0.00)	(0.00)	(0.00)	(0.01)
Host_GDP per Capita (log)	-0.158***			
	(0.02)			
Host_Size (log GDP)	0.013	-0.018	0.209***	0.102**
	(0.01)	(0.02)	(0.04)	(0.04)
Specialization	-0.017	-0.046	-0.001	0.723***
	(0.03)	(0.03)	(0.07)	(0.13)
Cost to Income Ratio	0.322***	0.510***	-0.247*	0.423***
	(0.05)	(0.06)	(0.13)	(0.14)
Loans / Total Assets	-1.197***	-1.165***	-1.438***	-1.166***
	(0.05)	(0.06)	(0.13)	(0.18)
Non-Interest Income to Net Income	-0.062***	-0.080***	-0.026**	-0.013
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.101***	0.144***	0.031	0.185***
	(0.01)	(0.01)	(0.02)	(0.03)
Bank size (logTA)	0.475***	0.490***	0.525***	0.437***
	(0.01)	(0.01)	(0.02)	(0.03)
Common Official Language	0.074**	0.147***	0.518***	0.472***
	(0.04)	(0.04)	(0.11)	(0.11)
Distance between capitals	-0.302***	-0.221***	-1.017***	-0.509***
	(0.01)	(0.01)	(0.05)	(0.08)
Bilateral Trade ratio	0.148***	0.147***	0.164***	0.394***
	(0.01)	(0.01)	(0.03)	(0.14)
N° Observations	**134,683**	**60,634**	**31,523**	**42,526**

The table presents regression results of the **1st step** of the Heckman two-step sample-selection estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to have an exclusive foreign affiliate form in the host country $k \neq j$ (Presence $Foreign_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income groups. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01. The 2nd step is reported in Table 1.9.

Appendix 1.C – **Heckman** estimation of the likelihood for a bank *i* to have an exclusive foreign affiliate form in the host country *k*. **Host EU and non-EU countries.**

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) ALL	(2) Host_High-income	**(3) EU Host countries**	**(4) non-EU Host countries**
Host_Entry into Banking Requirements	-0.018	-0.004	-0.052*	-0.026
	(0.02)	(0.02)	(0.03)	(0.04)
Diff (Host-Home)_Bank Activity Restrictions	0.010**	0.021***	0.054***	0.002
	(0.00)	(0.01)	(0.01)	(0.01)
Diff (Host-Home)_Capital Regulatory index	0.024***	0.033***	0.049***	0.007
	(0.00)	(0.00)	(0.00)	(0.00)
Diff (Host-Home)_Official Supervisory Power	0.019***	-0.005	0.017*	0.068***
	(0.01)	(0.01)	(0.01)	(0.01)
Host_Bank Concentration	-1.130***	-1.122***	-0.600***	-0.844***
	(0.06)	(0.09)	(0.11)	(0.11)
Host_Foreign Bank Share	0.637***	0.727***	0.669***	0.495***
	(0.05)	(0.07)	(0.10)	(0.09)
Host_Depth of Credit Information Index	0.135***	0.155***	-0.043	0.023
	(0.01)	(0.02)	(0.03)	(0.02)
Diff (Host-Home)_Economic Freedom Score	0.037***	0.032***	0.040***	0.035***
	(0.00)	(0.00)	(0.00)	(0.00)
Host_GDP per Capita (log)	-0.158***		-0.529***	-0.245***
	(0.02)		(0.04)	(0.03)
Host_Size (log GDP)	0.013	-0.018	0.186***	0.274***
	(0.01)	(0.02)	(0.03)	(0.02)
Specialization	-0.017	-0.046	0.117***	0.010
	(0.03)	(0.03)	(0.04)	(0.04)
Cost to Income Ratio	0.322***	0.510***	0.441***	0.131*
	(0.05)	(0.06)	(0.07)	(0.08)
Loans / Total Assets	-1.197***	-1.165***	-0.927***	-1.408***
	(0.05)	(0.06)	(0.07)	(0.08)
Non-Interest Income to Net Income	-0.062***	-0.080***	-0.038***	-0.059***
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.101***	0.144***	0.098***	0.111***
	(0.01)	(0.01)	(0.01)	(0.01)
Bank size (logTA)	0.475***	0.490***	0.497***	0.449***
	(0.01)	(0.01)	(0.01)	(0.01)
Common Official Language	0.074**	0.147***	0.251***	0.187***
	(0.04)	(0.04)	(0.06)	(0.05)
Distance between capitals	-0.302***	-0.221***	-0.059***	-0.818***
	(0.01)	(0.01)	(0.02)	(0.03)
Bilateral Trade ratio	0.148***	0.147***	0.162***	-0.015
	(0.01)	(0.01)	(0.01)	(0.01)
N° Observations	**134,683**	**60,634**	**35,346**	**99,337**

The table presents regression results of the **1st step** of the Heckman two-step sample-selection estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to have an exclusive foreign affiliate form in the host country $k \neq j$ (Presence $Foreign_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income groups. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01. The 2nd step is reported in Table 1.12.

Appendix 1.D – **Heckman** estimation of the likelihood for a bank *i* to operate with least one foreign affiliate abroad.

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	0.153***	0.159***	-0.088*	-0.129*
	(0.01)	(0.02)	(0.05)	(0.07)
Diff (Host-Home)_Bank Activity Restrictions	-0.006***	0.054***	-0.038***	-0.100***
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Capital Regulatory index	-0.030***	-0.023***	-0.043***	0.014
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Official Supervisory Power	0.030***	-0.074***	0.144***	0.028
	(0.00)	(0.01)	(0.01)	(0.02)
Host_Bank Concentration	-0.864***	-1.395***	-2.958***	-2.945***
	(0.04)	(0.06)	(0.18)	(0.22)
Host_Foreign Bank Share	1.009***	0.990***	-0.388***	0.603***
	(0.03)	(0.05)	(0.10)	(0.17)
Host_Depth of Credit Information Index	0.230***	0.172***	0.384***	-0.113***
	(0.01)	(0.01)	(0.03)	(0.03)
Diff (Host-Home)_Economic Freedom Score	0.018***	0.005***	0.072***	0.030***
	(0.00)	(0.00)	(0.00)	(0.00)
Host_GDP per Capita (log)	-0.363***			
	(0.01)			
Host_Size (log GDP)	0.235***	-0.023*	0.811***	0.201***
	(0.01)	(0.01)	(0.03)	(0.04)
Specialization	0.631***	0.551***	0.682***	0.841***
	(0.02)	(0.03)	(0.05)	(0.09)
Cost to Income Ratio	-0.376***	-0.067	-1.197***	0.251**
	(0.04)	(0.05)	(0.10)	(0.12)
Loans / Total Assets	-0.749***	-0.504***	-1.770***	-1.298***
	(0.04)	(0.05)	(0.09)	(0.14)
Non-Interest Income to Net Income	-0.065***	-0.085***	-0.058***	-0.004
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.049***	0.175***	0.053***	0.041*
	(0.01)	(0.01)	(0.01)	(0.02)
Bank size (logTA)	0.652***	0.632***	0.747***	0.641***
	(0.01)	(0.01)	(0.01)	(0.02)
Common Official Language	0.398***	0.582***	1.333***	0.271**
	(0.02)	(0.03)	(0.06)	(0.11)
Distance between capitals	-0.396***	-0.204***	-1.755***	-1.462***
	(0.01)	(0.01)	(0.04)	(0.06)
Bilateral Trade ratio	0.131***	0.151***	-0.036**	0.343***
	(0.00)	(0.00)	(0.02)	(0.07)
N° Observations	**151,958**	**67,690**	**39,893**	**44,015**

The table presents regression results of the **1st step** of the Heckman two-step sample-selection estimation of the likelihood for a bank *i* from EU country *j* to have a foreign activity in the host country *k≠j*, for the whole sample of countries and the three high-, middle-, and low-income-group. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01. The 2nd step is reported in both the Table 1.13 and the Table 1.14.

Appendix 1.E – **Probit** estimation of the likelihood for a bank *i* to operate an affiliate in a foreign country *k*. **Foreign Assets to Total Assets**

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	0.324***	0.371***	-0.098**	-0.154**
	(0.02)	(0.03)	(0.05)	(0.07)
Diff (Host-Home)_Bank Activity Restrictions	-0.022***	0.036***	-0.048***	-0.102***
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Capital Regulatory index	-0.022***	0.013***	-0.044***	0.008
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Official Supervisory Power	0.040***	-0.100***	0.159***	0.021
	(0.00)	(0.01)	(0.01)	(0.02)
Host_Bank Concentration	-1.059***	-1.689***	-3.437***	-3.156***
	(0.04)	(0.07)	(0.18)	(0.23)
Host_ForeignTA_TotalTA	0.473***	0.435***	-0.872***	0.198
	(0.04)	(0.06)	(0.11)	(0.16)
Host_Depth of Credit Information Index	0.225***	0.135***	0.427***	-0.136***
	(0.01)	(0.02)	(0.03)	(0.03)
Diff (Host-Home)_Economic Freedom Score	0.020***	0.009***	0.075***	0.027***
	(0.00)	(0.00)	(0.00)	(0.00)
Host_GDP per Capita (log)	-0.361***			
	(0.01)			
Host_Size (log GDP)	0.180***	-0.099***	0.789***	0.186***
	(0.01)	(0.01)	(0.03)	(0.04)
Specialization	0.610***	0.465***	0.684***	0.783***
	(0.02)	(0.03)	(0.05)	(0.09)
Cost to Income Ratio	-0.426***	-0.052	-1.169***	0.236*
	(0.04)	(0.06)	(0.10)	(0.12)
Loans / Total Assets	-0.956***	-0.894***	-1.776***	-1.441***
	(0.04)	(0.05)	(0.09)	(0.14)
Non-Interest Income to Net Income	-0.062***	-0.082***	-0.056***	-0.004
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.050***	0.197***	0.052***	0.034
	(0.01)	(0.01)	(0.01)	(0.02)
Bank size (logTA)	0.668***	0.655***	0.751***	0.641***
	(0.01)	(0.01)	(0.01)	(0.02)
Common Official Language	0.442***	0.617***	1.365***	0.227*
	(0.02)	(0.03)	(0.06)	(0.12)
Distance between capitals	-0.379***	-0.139***	-1.817***	-1.480***
	(0.01)	(0.01)	(0.04)	(0.06)
Bilateral Trade ratio	0.126***	0.137***	-0.051***	0.367***
	(0.00)	(0.00)	(0.02)	(0.08)
N° Observations	**133,380**	**54,468**	**39,893**	**44,015**
Wald chi2	79,063.0	32,954.9	36,057.8	11,226.7
Prob > chi2	0.000	0.000	0.000	0.000
Pseudo R-squared	0.72	0.69	0.85	0.81

The table presents regression results of the Probit estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to operate an affiliate in a host country $k \neq j$ (Presence $Foreign_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income groups. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

Appendix 1.F – **Heckman** estimation of the likelihood for a bank *i* to have an exclusive foreign affiliate form in the host country *k*. **Foreign Assets to Total Assets**

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	-0.106***	-0.135***	-0.195***	0.367***
	(0.03)	(0.04)	(0.08)	(0.11)
Diff (Host-Home)_Bank Activity Restrictions	0.001	0.008	0.033***	-0.042***
	(0.00)	(0.01)	(0.01)	(0.02)
Diff (Host-Home)_Capital Regulatory index	0.045***	0.063***	0.027***	0.013
	(0.00)	(0.01)	(0.01)	(0.01)
Diff (Host-Home)_Official Supervisory Power	0.001	-0.031***	0.050***	0.057***
	(0.01)	(0.01)	(0.02)	(0.02)
Host_Bank Concentration	-1.453***	-1.771***	-0.621**	-0.854***
	(0.07)	(0.10)	(0.26)	(0.23)
Host_ForeignTA_TotalTA	0.520***	0.520***	0.313	-0.621***
	(0.05)	(0.07)	(0.19)	(0.18)
Host_Depth of Credit Information Index	0.136***	0.187***	0.298***	-0.114***
	(0.01)	(0.02)	(0.05)	(0.04)
Diff (Host-Home)_Economic Freedom Score	0.034***	0.031***	0.044***	0.008
	(0.00)	(0.00)	(0.00)	(0.01)
Host_GDP per Capita (log)	-0.115***			
	(0.02)			
Host_Size (log GDP)	-0.038***	-0.132***	0.207***	0.063
	(0.01)	(0.02)	(0.04)	(0.04)
Specialization	-0.016	-0.054	-0.002	0.642***
	(0.03)	(0.03)	(0.07)	(0.12)
Cost to Income Ratio	0.323***	0.536***	-0.244*	0.367**
	(0.05)	(0.07)	(0.13)	(0.14)
Loans / Total Assets	-1.259***	-1.243***	-1.441***	-1.275***
	(0.05)	(0.07)	(0.13)	(0.18)
Non-Interest Income to Net Income	-0.062***	-0.082***	-0.026**	-0.013
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.102***	0.150***	0.032*	0.174***
	(0.01)	(0.01)	(0.02)	(0.03)
Bank size (logTA)	0.473***	0.491***	0.526***	0.418***
	(0.01)	(0.01)	(0.02)	(0.02)
Common Official Language	0.092**	0.178***	0.524***	0.417***
	(0.04)	(0.05)	(0.11)	(0.12)
Distance between capitals	-0.295***	-0.208***	-1.007***	-0.414***
	(0.01)	(0.01)	(0.05)	(0.08)
Bilateral Trade ratio	0.145***	0.151***	0.167***	0.402***
	(0.01)	(0.01)	(0.03)	(0.14)
N° Observations	**117,175**	**48,125**	**31,523**	**37,527**

The table presents regression results of the **1st step** of the Heckman two-step sample-selection estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to have an exclusive foreign affiliate form in the host country $k \neq j$ (Presence $Foreign_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income groups. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

Appendix 1.G – **Heckman** estimation of the likelihood for a bank *i* to operate foreign branches only and no subsidiary in the host country *k*. **Foreign Assets to Total Assets**

	Foreign Organizational Form choice: Only subsidiaries = 0 vs Only branches = 1			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	-0.115***	-0.154***	-0.089**	0.117
	(0.02)	(0.02)	(0.04)	(0.10)
Host_Bank Activity Restrictions	-0.007**	0.004	-0.011	0.098***
	(0.00)	(0.00)	(0.01)	(0.01)
Host_Capital Regulatory index	0.006*	-0.042***	0.021***	0.033**
	(0.00)	(0.01)	(0.01)	(0.02)
Host_Official Supervisory Power	-0.053***	-0.057***	0.027**	0.081***
	(0.01)	(0.01)	(0.01)	(0.03)
Host_ForeignTA_TotalTA	0.036	0.122**	-0.019	-0.477***
	(0.04)	(0.05)	(0.09)	(0.13)
Host_GDP per Capita (log)	-0.047***			
	(0.01)			
Host_Size (log GDP)	-0.067***	-0.067***	-0.050***	-0.090***
	(0.01)	(0.01)	(0.02)	(0.02)
Specialization	-0.113***	-0.093***	-0.087**	0.253*
	(0.02)	(0.02)	(0.04)	(0.15)
Cost to Income Ratio	0.170***	0.061	0.604***	0.659***
	(0.04)	(0.04)	(0.09)	(0.16)
Equity / Total Assets	-1.218***	-1.663***	0.739***	-0.093
	(0.11)	(0.14)	(0.22)	(0.42)
Net Interest Margin	-0.009	-0.002	-0.031**	-0.006
	(0.01)	(0.01)	(0.01)	(0.02)
Non-Interest Income to Net Income	0.009***	-0.001	-0.001	-0.020*
	(0.00)	(0.00)	(0.01)	(0.01)
Bank size (logTA)	-0.092***	-0.057***	-0.059***	-0.011
	(0.01)	(0.01)	(0.01)	(0.04)
N° Observations (step 1)	**117,175**	**48,125**	**31,523**	**37,527**
N° foreign affiliates	20,850	10,134	9,010	1,706
N° Censored (step 1 → step 2)	114,220	45,890	30,980	37,350
Uncensored (step 2)	**2,995**	**2,235**	**543**	**177**
Wald test of indep. Eqns.	822.0	890.1	153.3	153.4
Prob > chi2	0.000	0.000	0.000	0.000

The table presents regression results of the **2nd step** of the Heckman two-step sample-selection estimation of Eq. (2): the likelihood for a bank *i* from EU country *j* to operate with foreign branches only in the host country $k \neq j$ (Only branches $Affiliate_{i,j,k} = 1$) instead of with foreign subsidiaries only in the host country $k \neq j$ (Only subsidiaries $Affiliate_{i,j,k} = 0$), for the whole sample of countries and the three high-, middle-, and low-income-group. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix 1.H – **Heckman** estimation of the likelihood for a bank *i* to have an exclusive foreign affiliate form in the host country *k*. **Economic Freedom – Rule of Law (property rights, freedom from corruption)**

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	0.017	0.039*	-0.203***	0.444***
	(0.02)	(0.02)	(0.08)	(0.13)
Diff (Host-Home)_Bank Activity Restrictions	0.004	0.016***	0.023**	-0.063***
	(0.00)	(0.01)	(0.01)	(0.02)
Diff (Host-Home)_Capital Regulatory index	0.017***	0.028***	0.019**	0.028**
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Official Supervisory Power	0.034***	0.006	0.077***	0.072***
	(0.01)	(0.01)	(0.01)	(0.02)
Host_Bank Concentration	-1.040***	-1.002***	-0.213	-0.841***
	(0.06)	(0.08)	(0.25)	(0.22)
Host_Foreign Bank Share	0.798***	0.901***	0.554***	-0.330*
	(0.05)	(0.07)	(0.16)	(0.18)
Host_Depth of Credit Information Index	0.202***	0.204***	0.386***	-0.116***
	(0.01)	(0.02)	(0.05)	(0.04)
Diff (Host-Home)_Rule of Law Score	0.012***	0.010***	0.015***	0.005*
	(0.00)	(0.00)	(0.00)	(0.00)
Host_GDP per Capita (log)	-0.146***			
	(0.02)			
Host_Size (log GDP)	-0.003	-0.001	0.147***	0.101**
	(0.01)	(0.02)	(0.04)	(0.04)
Specialization	-0.005	-0.036	0.005	0.722***
	(0.03)	(0.03)	(0.07)	(0.13)
Cost to Income Ratio	0.343***	0.527***	-0.227*	0.428***
	(0.05)	(0.06)	(0.13)	(0.14)
Loans / Total Assets	-1.185***	-1.144***	-1.471***	-1.181***
	(0.05)	(0.06)	(0.13)	(0.18)
Non-Interest Income to Net Income	-0.064***	-0.083***	-0.026**	-0.014
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.106***	0.149***	0.031	0.187***
	(0.01)	(0.01)	(0.02)	(0.03)
Bank size (logTA)	0.474***	0.487***	0.526***	0.439***
	(0.01)	(0.01)	(0.02)	(0.03)
Common Official Language	0.157***	0.240***	0.466***	0.478***
	(0.03)	(0.04)	(0.11)	(0.11)
Distance between capitals	-0.277***	-0.199***	-0.944***	-0.475***
	(0.01)	(0.01)	(0.05)	(0.07)
Bilateral Trade ratio	0.136***	0.131***	0.201***	0.389***
	(0.00)	(0.01)	(0.03)	(0.14)
N° Observations	**134,683**	**60,634**	**31,523**	**42,526**

The table presents regression results of the **1st step** of the Heckman two-step sample-selection estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to have an exclusive foreign affiliate form in the host country $k \neq j$ (Presence $Foreign_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income groups. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

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Appendix 1.I – **Heckman** estimation of the likelihood for a bank *i* to operate foreign branches only and no subsidiary in the host country *k*. **Economic Freedom – Rule of Law (property rights, freedom from corruption)**

	Foreign Organizational Form choice: Only subsidiaries = 0 vs Only branches = 1			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	-0.097***	-0.060***	-0.093**	0.082
	(0.01)	(0.02)	(0.04)	(0.10)
Host_Bank Activity Restrictions	-0.001	0.008**	-0.010	0.102***
	(0.00)	(0.00)	(0.01)	(0.01)
Host_Capital Regulatory index	0.003	-0.002	0.024***	0.047***
	(0.00)	(0.00)	(0.01)	(0.02)
Host_Official Supervisory Power	-0.053***	-0.077***	0.027**	0.095***
	(0.00)	(0.01)	(0.01)	(0.03)
Host_Foreign Bank Share	-0.039	-0.103**	-0.098	-0.404***
	(0.03)	(0.05)	(0.08)	(0.14)
Host_GDP per Capita (log)	-0.035***			
	(0.01)			
Host_Size (log GDP)	-0.083***	-0.115***	-0.061***	-0.091***
	(0.01)	(0.01)	(0.02)	(0.02)
Specialization	-0.071***	-0.035*	-0.094**	0.198
	(0.02)	(0.02)	(0.04)	(0.16)
Cost to Income Ratio	0.150***	0.069*	0.610***	0.631***
	(0.04)	(0.04)	(0.09)	(0.16)
Equity / Total Assets	-1.192***	-1.551***	0.701***	-0.377
	(0.10)	(0.13)	(0.23)	(0.41)
Net Interest Margin	-0.005	0.000	-0.031**	-0.010
	(0.01)	(0.01)	(0.01)	(0.03)
Non-Interest Income to Net Income	0.009***	0.004*	0.001	-0.012
	(0.00)	(0.00)	(0.01)	(0.01)
Bank size (logTA)	-0.103***	-0.069***	-0.064***	-0.033
	(0.01)	(0.01)	(0.01)	(0.04)
N° Observations (step 1)	**134,683**	**60,634**	**31,523**	**42,526**
N° foreign affiliates	20,850	10,134	9,010	1,706
N° Censored (step 1 → step 2)	131,570	58,245	30,980	42,345
Uncensored (step 2)	**3,113**	**2,389**	**543**	**181**
Wald test of indep. Eqns.	850.3	836.8	154.3	159.1
Prob > chi2	0.000	0.000	0.000	0.000

The table presents regression results of the **2nd step** of the Heckman two-step sample-selection estimation of Eq. (2): the likelihood for a bank *i* from EU country *j* to operate with foreign branches only in the host country $k \neq j$ (Only branches $Affiliate_{i,j,k} = 1$) instead of with foreign subsidiaries only in the host country $k \neq j$ (Only subsidiaries $Affiliate_{i,j,k} = 0$), for the whole sample of countries and the three high-, middle-, and low-income-group. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix 1.J – **Heckman** estimation of the likelihood for a bank *i* to have an exclusive foreign affiliate form in the host country *k*. **Economic Freedom – Limited Government (fiscal freedom, government spending)**

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	0.016	0.050**	-0.222***	0.437***
	(0.02)	(0.02)	(0.08)	(0.13)
Diff (Host-Home)_Bank Activity Restrictions	-0.006	-0.003	0.019*	-0.060***
	(0.00)	(0.00)	(0.01)	(0.02)
Diff (Host-Home)_Capital Regulatory index	0.013***	0.022***	0.017*	0.029**
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Official Supervisory Power	0.018***	-0.007	0.070***	0.063***
	(0.01)	(0.01)	(0.01)	(0.02)
Host_Bank Concentration	-0.898***	-0.724***	0.068	-0.854***
	(0.06)	(0.08)	(0.25)	(0.22)
Host_Foreign Bank Share	0.722***	0.835***	0.808***	-0.311*
	(0.05)	(0.07)	(0.16)	(0.18)
Host_Depth of Credit Information Index	0.143***	0.136***	0.337***	-0.108***
	(0.01)	(0.02)	(0.05)	(0.04)
Diff (Host-Home)_Limited Government Score	0.006***	0.003***	0.016***	0.001
	(0.00)	(0.00)	(0.00)	(0.00)
Host_GDP per Capita (log)	0.068***			
	(0.01)			
Host_Size (log GDP)	0.007	0.064***	0.211***	0.098**
	(0.01)	(0.02)	(0.04)	(0.04)
Specialization	-0.050*	-0.102***	0.054	0.716***
	(0.03)	(0.03)	(0.07)	(0.13)
Cost to Income Ratio	0.349***	0.536***	-0.194	0.415***
	(0.05)	(0.06)	(0.12)	(0.14)
Loans / Total Assets	-1.130***	-1.111***	-1.305***	-1.143***
	(0.05)	(0.06)	(0.13)	(0.18)
Non-Interest Income to Net Income	-0.071***	-0.090***	-0.026**	-0.013
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.094***	0.142***	0.013	0.185***
	(0.01)	(0.01)	(0.02)	(0.03)
Bank size (logTA)	0.473***	0.486***	0.514***	0.437***
	(0.01)	(0.01)	(0.02)	(0.03)
Common Official Language	0.195***	0.372***	0.502***	0.460***
	(0.03)	(0.04)	(0.11)	(0.11)
Distance between capitals	-0.284***	-0.189***	-1.020***	-0.487***
	(0.01)	(0.01)	(0.05)	(0.08)
Bilateral Trade ratio	0.147***	0.132***	0.180***	0.404***
	(0.01)	(0.01)	(0.03)	(0.14)
N° Observations	**134,683**	**60,634**	**31,523**	**42,526**

The table presents regression results of the **1st step** of the Heckman two-step sample-selection estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to have an exclusive foreign affiliate form in the host country $k \neq j$ (Presence $Foreign_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income groups. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

Appendix 1.K – **Heckman** estimation of the likelihood for a bank *i* to operate foreign branches only and no subsidiary in the host country *k*. **Economic Freedom – Limited Government (fiscal freedom, government spending)**

	Foreign Organizational Form choice: Only subsidiaries = 0 vs Only branches = 1			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	-0.095***	-0.059***	-0.103**	0.094
	(0.02)	(0.02)	(0.04)	(0.11)
Host_Bank Activity Restrictions	-0.002	0.007**	-0.009	0.104***
	(0.00)	(0.00)	(0.01)	(0.01)
Host_Capital Regulatory index	0.005*	-0.001	0.029***	0.049***
	(0.00)	(0.00)	(0.01)	(0.02)
Host_Official Supervisory Power	-0.050***	-0.074***	0.034***	0.097***
	(0.01)	(0.01)	(0.01)	(0.03)
Host_Foreign Bank Share	-0.007	-0.105**	-0.093	-0.408***
	(0.04)	(0.05)	(0.08)	(0.14)
Host_GDP per Capita (log)	-0.030***			
	(0.01)			
Host_Size (log GDP)	-0.076***	-0.115***	-0.060***	-0.090***
	(0.01)	(0.01)	(0.02)	(0.02)
Specialization	-0.099***	-0.050**	-0.051	0.207
	(0.02)	(0.02)	(0.05)	(0.16)
Cost to Income Ratio	0.203***	0.087**	0.703***	0.620***
	(0.04)	(0.04)	(0.09)	(0.16)
Equity / Total Assets	-1.253***	-1.603***	1.015***	-0.313
	(0.11)	(0.13)	(0.24)	(0.41)
Net Interest Margin	0.010	0.007	-0.026*	-0.007
	(0.01)	(0.01)	(0.01)	(0.03)
Non-Interest Income to Net Income	0.007***	0.004*	0.002	-0.011
	(0.00)	(0.00)	(0.01)	(0.01)
Bank size (logTA)	-0.086***	-0.067***	-0.059***	-0.013
	(0.01)	(0.01)	(0.01)	(0.04)
N° Observations (step 1)	**134,683**	**60,634**	**31,523**	**42,526**
N° foreign affiliates	20,850	10,134	9,010	1,706
N° Censored (step 1 → step 2)	131,570	58,245	30,980	42,345
Uncensored (step 2)	**3,113**	**2,389**	**543**	**181**
Wald test of indep. Eqns.	797.3	828.4	175.3	162.4
Prob > chi2	0.000	0.000	0.000	0.000

The table presents regression results of the **2nd step** of the Heckman two-step sample-selection estimation of Eq. (2): the likelihood for a bank *i* from EU country *j* to operate with foreign branches only in the host country $k \neq j$ (Only branches $Affiliate_{i,j,k} = 1$) instead of with foreign subsidiaries only in the host country $k \neq j$ (Only subsidiaries $Affiliate_{i,j,k} = 0$), for the whole sample of countries and the three high-, middle-, and low-income-group. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

Appendix 1.L – **Heckman** estimation of the likelihood for a bank *i* to have an exclusive foreign affiliate form in the host country *k*. **Economic Freedom – Regulatory Efficiency (business freedom, labor freedom, monetary freedom)**

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	0.020	0.037*	-0.163**	0.436***
	(0.02)	(0.02)	(0.08)	(0.13)
Diff (Host-Home)_Bank Activity Restrictions	0.006	0.012**	0.036***	-0.059***
	(0.00)	(0.01)	(0.01)	(0.02)
Diff (Host-Home)_Capital Regulatory index	0.023***	0.030***	0.025***	0.029**
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Official Supervisory Power	0.017***	-0.011	0.089***	0.065***
	(0.01)	(0.01)	(0.01)	(0.02)
Host_Bank Concentration	-0.959***	-0.906***	-0.239	-0.852***
	(0.06)	(0.08)	(0.26)	(0.23)
Host_Foreign Bank Share	0.693***	0.761***	0.531***	-0.314*
	(0.05)	(0.07)	(0.16)	(0.18)
Host_Depth of Credit Information Index	0.158***	0.170***	0.395***	-0.108***
	(0.01)	(0.02)	(0.05)	(0.04)
Diff (Host-Home)_Regulatory	0.018***	0.017***	0.023***	0.001
	(0.00)	(0.00)	(0.00)	(0.00)
Host_GDP per Capita (log)	-0.032**			
	(0.01)			
Host_Size (log GDP)	-0.007	-0.007	0.215***	0.100**
	(0.01)	(0.02)	(0.04)	(0.04)
Specialization	-0.022	-0.071**	0.082	0.720***
	(0.03)	(0.03)	(0.07)	(0.13)
Cost to Income Ratio	0.339***	0.527***	-0.232*	0.413***
	(0.05)	(0.06)	(0.13)	(0.14)
Loans / Total Assets	-1.134***	-1.124***	-1.327***	-1.146***
	(0.05)	(0.06)	(0.13)	(0.18)
Non-Interest Income to Net Income	-0.068***	-0.086***	-0.022**	-0.013
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.096***	0.143***	0.011	0.185***
	(0.01)	(0.01)	(0.02)	(0.03)
Bank size (logTA)	0.471***	0.487***	0.516***	0.437***
	(0.01)	(0.01)	(0.02)	(0.03)
Common Official Language	0.185***	0.289***	0.536***	0.465***
	(0.03)	(0.04)	(0.11)	(0.11)
Distance between capitals	-0.278***	-0.202***	-1.012***	-0.476***
	(0.01)	(0.01)	(0.05)	(0.07)
Bilateral Trade ratio	0.142***	0.138***	0.178***	0.399***
	(0.00)	(0.01)	(0.03)	(0.14)
N° Observations	**134,683**	**60,634**	**31,523**	**42,526**

The table presents regression results of the **1st step** of the Heckman two-step sample-selection estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to have an exclusive foreign affiliate form in the host country $k \neq j$ (Presence $Foreign_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income groups. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

Appendix 1.M – **Heckman** estimation of the likelihood for a bank *i* to operate foreign branches only and no subsidiary in the host country *k*. **Economic Freedom – Regulatory Efficiency (business freedom, labor freedom, monetary freedom)**

	Foreign Organizational Form choice: Only subsidiaries = 0 vs Only branches = 1			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	-0.098***	-0.059***	-0.106***	0.090
	(0.02)	(0.02)	(0.04)	(0.10)
Host_Bank Activity Restrictions	-0.002	0.007*	-0.009	0.104***
	(0.00)	(0.00)	(0.01)	(0.01)
Host_Capital Regulatory index	0.005**	-0.001	0.028***	0.048***
	(0.00)	(0.00)	(0.01)	(0.02)
Host_Official Supervisory Power	-0.051***	-0.076***	0.037***	0.097***
	(0.01)	(0.01)	(0.01)	(0.03)
Host_Foreign Bank Share	-0.024	-0.095*	-0.090	-0.405***
	(0.04)	(0.05)	(0.08)	(0.14)
Host_GDP per Capita (log)	-0.034***			
	(0.01)			
Host_Size (log GDP)	-0.079***	-0.113***	-0.062***	-0.090***
	(0.01)	(0.01)	(0.02)	(0.02)
Specialization	-0.090***	-0.048**	-0.061	0.205
	(0.02)	(0.02)	(0.05)	(0.16)
Cost to Income Ratio	0.193***	0.083**	0.672***	0.624***
	(0.04)	(0.04)	(0.09)	(0.16)
Equity / Total Assets	-1.234***	-1.573***	0.929***	-0.332
	(0.11)	(0.13)	(0.23)	(0.41)
Net Interest Margin	0.003	0.002	-0.028**	-0.007
	(0.01)	(0.01)	(0.01)	(0.03)
Non-Interest Income to Net Income	0.008***	0.004*	0.000	-0.011
	(0.00)	(0.00)	(0.01)	(0.01)
Bank size (logTA)	-0.094***	-0.064***	-0.061***	-0.020
	(0.01)	(0.01)	(0.01)	(0.04)
N° Observations (step 1)	**134,683**	**60,634**	**31,523**	**42,526**
N° foreign affiliates	20,850	10,134	9,010	1,706
N° Censored (step 1 → step 2)	131,570	58,245	30,980	42,345
Uncensored (step 2)	**3,113**	**2,389**	**543**	**181**
Wald test of indep. Eqns.	818.2	829.0	176.4	161.0
Prob > chi2	0.000	0.000	0.000	0.000

The table presents regression results of the **2nd step** of the Heckman two-step sample-selection estimation of Eq. (2): the likelihood for a bank *i* from EU country *j* to operate with foreign branches only in the host country $k \neq j$ (Only branches $Affiliate_{i,j,k} = 1$) instead of with foreign subsidiaries only in the host country $k \neq j$ (Only subsidiaries $Affiliate_{i,j,k} = 0$), for the whole sample of countries and the three high-, middle-, and low-income-group. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

Appendix 1.N – Heckman estimation of the likelihood for a bank *i* to have an exclusive foreign affiliate form in the host country *k*. **Economic Freedom – Market Openness (trade freedom, investment freedom, financial freedom)**

	Foreign Host Country choice: Presence = 1 ; Absence = 0			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	0.011	0.020	-0.130*	0.462***
	(0.02)	(0.02)	(0.08)	(0.12)
Diff (Host-Home)_Bank Activity Restrictions	0.006	0.021***	0.011	-0.056***
	(0.00)	(0.01)	(0.01)	(0.02)
Diff (Host-Home)_Capital Regulatory index	0.022***	0.033***	0.015*	0.034***
	(0.00)	(0.00)	(0.01)	(0.01)
Diff (Host-Home)_Official Supervisory Power	0.018***	-0.008	0.056***	0.073***
	(0.01)	(0.01)	(0.02)	(0.02)
Host_Bank Concentration	-1.015***	-1.040***	-0.192	-1.074***
	(0.06)	(0.08)	(0.26)	(0.24)
Host_Foreign Bank Share	0.509***	0.620***	0.155	-0.422**
	(0.05)	(0.07)	(0.19)	(0.18)
Host_Depth of Credit Information Index	0.138***	0.157***	0.337***	-0.151***
	(0.01)	(0.02)	(0.05)	(0.04)
Diff (Host-Home)_Market Openness Score	0.023***	0.024***	0.017***	0.016***
	(0.00)	(0.00)	(0.00)	(0.00)
Host_GDP per Capita (log)	-0.132***			
	(0.02)			
Host_Size (log GDP)	0.022*	0.000	0.155***	0.113**
	(0.01)	(0.02)	(0.04)	(0.05)
Specialization	-0.022	-0.057*	0.025	0.732***
	(0.03)	(0.03)	(0.07)	(0.13)
Cost to Income Ratio	0.315***	0.498***	-0.229*	0.413***
	(0.05)	(0.06)	(0.12)	(0.14)
Loans / Total Assets	-1.139***	-1.137***	-1.344***	-1.155***
	(0.05)	(0.06)	(0.13)	(0.18)
Non-Interest Income to Net Income	-0.066***	-0.084***	-0.022**	-0.013
	(0.00)	(0.00)	(0.01)	(0.01)
ROAA	0.091***	0.140***	0.012	0.183***
	(0.01)	(0.01)	(0.02)	(0.03)
Bank size (logTA)	0.468***	0.484***	0.519***	0.435***
	(0.01)	(0.01)	(0.02)	(0.03)
Common Official Language	0.200***	0.290***	0.440***	0.452***
	(0.03)	(0.04)	(0.11)	(0.11)
Distance between capitals	-0.250***	-0.164***	-0.954***	-0.488***
	(0.01)	(0.01)	(0.05)	(0.07)
Bilateral Trade ratio	0.134***	0.133***	0.211***	0.410***
	(0.01)	(0.01)	(0.03)	(0.14)
N° Observations	**134,683**	**60,634**	**31,523**	**42,526**

The table presents regression results of the **1st step** of the Heckman two-step sample-selection estimation of Eq. (1): the likelihood for a bank *i* from EU country *j* to have an exclusive foreign affiliate form in the host country $k \neq j$ (Presence $Foreign_{i,j,k} = 1$), for the whole sample of countries and the three high-, middle-, and low-income groups. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * p < 0.1, ** p < 0.05, *** p < 0.01.

Appendix 1.O – **Heckman** estimation of the likelihood for a bank *i* to operate foreign branches only and no subsidiary in the host country *k*. **Economic Freedom – Market Openness (trade freedom, investment freedom, financial freedom)**

	Foreign Organizational Form choice: Only subsidiaries = 0 vs Only branches = 1			
	(1) Host_All countries	(2) Host_High Income	(3) Host_Middle Income	(4) Host_Low Income
Host_Entry into Banking Requirements	-0.094***	-0.060***	-0.087**	0.081
	(0.01)	(0.02)	(0.04)	(0.10)
Host_Bank Activity Restrictions	-0.002	0.008**	-0.008	0.102***
	(0.00)	(0.00)	(0.01)	(0.01)
Host_Capital Regulatory index	0.003	-0.003	0.024***	0.046***
	(0.00)	(0.00)	(0.01)	(0.02)
Host_Official Supervisory Power	-0.050***	-0.075***	0.025**	0.096***
	(0.01)	(0.01)	(0.01)	(0.03)
Host_Foreign Bank Share	-0.034	-0.105**	-0.091	-0.392***
	(0.03)	(0.05)	(0.08)	(0.14)
Host_GDP per Capita (log)	-0.037***			
	(0.01)			
Host_Size (log GDP)	-0.081***	-0.115***	-0.056***	-0.088***
	(0.01)	(0.01)	(0.02)	(0.02)
Specialization	-0.081***	-0.045**	-0.067	0.211
	(0.02)	(0.02)	(0.05)	(0.16)
Cost to Income Ratio	0.184***	0.071*	0.681***	0.638***
	(0.04)	(0.04)	(0.09)	(0.16)
Equity / Total Assets	-1.240***	-1.555***	0.847***	-0.338
	(0.10)	(0.13)	(0.23)	(0.40)
Net Interest Margin	0.006	0.002	-0.024*	-0.009
	(0.01)	(0.01)	(0.01)	(0.03)
Non-Interest Income to Net Income	0.009***	0.005**	0.002	-0.012
	(0.00)	(0.00)	(0.01)	(0.01)
Bank size (logTA)	-0.101***	-0.070***	-0.068***	-0.033
	(0.01)	(0.01)	(0.01)	(0.03)
N° Observations (step 1)	**134,683**	**60,634**	**31,523**	**42,526**
N° foreign affiliates	20,850	10,134	9,010	1,706
N° Censored (step 1 → step 2)	131,570	58,245	30,980	42,345
Uncensored (step 2)	**3,113**	**2,389**	**543**	**181**
Wald test of indep. Eqns.	847.1	834.9	159.7	156.0
Prob > chi2	0.000	0.000	0.000	0.000

The table presents regression results of the **2nd step** of the Heckman two-step sample-selection estimation of Eq. (2): the likelihood for a bank *i* from EU country *j* to operate with foreign branches only in the host country $k \neq j$ (Only branches $Affiliate_{i,j,k} = 1$) instead of with foreign subsidiaries only in the host country $k \neq j$ (Only subsidiaries $Affiliate_{i,j,k} = 0$), for the whole sample of countries and the three high-, middle-, and low-income-group. A constant is estimated but not reported. All the variables have been defined in Section 1. 3 and the descriptive statistics can be found in Table 1.4-a (Country-level Bank regulation and supervision), Table 1.5 (Country-level Institutional) and Table 1.6 (Individual bank-specific characteristics). This table reports the standard errors in parentheses and the significance of p-value by * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

CHAPTER 2

Bank Foreign Presence, Organizational and Geographic Complexity: Implications for Bank Risk and Profitability

This chapter draws from the working paper "Bank Foreign Presence, Organizational and Geographic Complexity: Implications for Bank Risk and Profitability" co-authored with Alain Sauviat and Amine Tarazi.

2.1. 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 Santomerro (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"[26]. 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)[27], 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

[26] 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.

[27] 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 2.2 presents related literature and our research focus. Section 2.3 describes the sample and provides details on the data. In Section 2.4 we present the econometric methodology and Section 2.5 discusses the empirical findings and further investigations of our main results. In Section 2.6 we perform some robustness checks and Section 2.7 concludes the paper.

2.2. Related literature and research focus

2.2.1. *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[28] 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.

[28] 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.

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. (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.

2.3. Data, variables and summary statistics

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

2.3.1. *Sample*

To construct the sample, we consider banks established in the 28 European Union countries[29] 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

[29] 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.

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, 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[30] 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.

2.3.2. *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

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

branches only (at least one foreign branch and no foreign subsidiary) and zero otherwise, and $Bank\_BS_i$ takes the value one when the bank has a foreign network with both foreign subsidiaries and branches, and zero if not.

Table 2.1 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.

Table 2.1 – 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	

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[31]: 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:

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

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)[32].

Table 2.2 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

[31] 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.

32 In Appendix 2.A we present the detailed list of host countries that constitute each of the eight regions. Figure 2. 1 maps the seven world regions by the World Bank sub-division.

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.

Table 2.2 – 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 2.3. "." 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

2.3.3. *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[33] 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 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[34]. 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[35] to respectively measure bank portfolio risk and leverage risk:

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

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

[34] 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).

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

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[36].

2.3.4. *Control variables*

2.3.4.1. 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 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.

[36] 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.

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 more risky [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.

We present in Table 2.3 the descriptive statistics and sources of all individual bank-level variables used in our empirical work.

Table 2.3 – Bank 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 2.3. 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
Dependent 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 control variables								
TA	Total assets (millions USD)	Bankscope	2176	23565.77	77784.06	3190.33	15.77	580117
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, and zero otherwise		2176	0.26	0.44	0	0	1
Savg	Dummy equal to one if the bank has a "Savings" banking specialization, and zero otherwise		2176	0.22	0.41	0	0	1

2.3.4.2. 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 2.4 we show the distribution of banks by country with the descriptive statistics and sources of all macroeconomic and institutional variables.

Table 2.4 – 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 2.3. *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; *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. 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. All variables were winsorized at 1% and 99% levels to limit the influence of outliers.

Country (28 EU)	Number of banks	Restrictions [1 – 16]	RegulCapital [0 – 18]	Supervision [0 – 22]	GDP growth (%)	Legal Strength [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*

2.4. 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 2.3.

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 2.5 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.

Table 2.5 – 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 2.3 and their descriptive statistics are presented in the three previous tables.

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
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
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
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
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
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
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
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
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
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
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
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
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

	13	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
13	1											
14	0.12	1										
15	0.09	0.03	1									
16	0.06	0.05	0.79	1								
17	0.10	0.02	1.00	0.77	1							
18	-0.07	-0.15	-0.46	-0.35	-0.45	1						
19	-0.03	-0.12	-0.27	0.10	-0.28	0.62	1					
20	0.15	0.12	-0.09	0.02	-0.10	0.01	0.12	1				
21	-0.05	-0.08	0.13	0.10	0.13	-0.04	-0.09	-0.18	1			
22	0.07	0.10	-0.17	-0.14	-0.17	0.05	0.02	0.29	0.09	1		
23	-0.04	-0.05	0.06	0.11	0.05	0.03	0.07	-0.13	0.07	-0.32	1	
24	-0.06	-0.13	-0.02	-0.06	-0.02	0.04	0.01	-0.23	-0.09	-0.43	0.38	1

2.5. 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.

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

We report in Table 2.6 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.

Table 2.6 – Influence of foreign banks' presence on bank risk and profitability

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 ; *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 * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	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

From the estimations of Eq. (2) reported in Table 2.7 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

Table 2.7 – Influence of bank foreign organizational complexity on bank risk and profitability

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 ; *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; *LegamlStrength* 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 * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	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***	-0.735***
											(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	-0.524***
	(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***	-0.328***
	(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***	-0.371***
	(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	-0.168***
	(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-value	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

Looking at the control variables in Table 2.6 and Table 2.7, 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 2.6) 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 2.6), either an exclusive form or a mix structure (Table 2.7), 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.

2.5.2. *Impact of geographic complexity on risk and profitability*

We report in Table 2.8 the estimations of Eq. (3)[37] 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

[37] 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.

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 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 2.6 and Table 2.7. 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).

Table 2.8 – Influence of bank geographic complexity (All affiliates / Subsidiaries / Branches) on bank risk and bank profitability

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 * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	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)
Strength	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

2.5.3. *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.

2.5.3.1. Bank size

We hypothesize that as banks usually gain advanced management skills and economies of scale and scope from their size[38], 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[39] 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)[40]. 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 2.3) 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,

[38] 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.

[39] 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).

[40] 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).

Table 2.9[41] 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 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* [42] 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 2.9 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.

[41] We report only the results obtained for the variables of interest. The rest of detailed results are available from the authors.
[42] 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.

Table 2.9 – Effect of bank foreign presence and foreign organizational complexity on bank risk and bank profitability

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 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 * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	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

2.5.3.2. 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, we build the dummy *Sov11*[43] 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 2.11 the estimated coefficients[44] 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,

[43] 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.

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

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 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).

Table 2.10 – Effect of bank foreign presence and foreign organizational complexity on bank risk and bank profitability _ **Sovereign debt crisis**

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 ; *BankSB*: 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.

	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
GeoComplex (β_1)	0.051**	-0.749	0.090**	0.129***	0.058**
	(0.02)	(0.89)	(0.04)	(0.04)	(0.03)
Sov11*GeoComplex (β'_1)	-0.241*	-1.157	-0.191*	0.067**	-0.166
	(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 (β'_1)	-0.275	-1.157	-0.227*	0.175***	-0.101*
	(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 (β'_1)	1.065***	1.000**	1.074***	-0.141	-0.127*
	(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

2.6. Robustness checks

We conduct additional regressions to analyze the sensitivity of our main results obtained in Section 2.5.

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 2.7) and the indexes of geographic complexity (Table 2.8) 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[45], 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.

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

2.7. 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.

Table 2.11 – 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-value	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 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_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 $IncomeDivers = 1 - \left|\frac{Net\ Interest\ Income - Other\ Operating\ Income}{Total\ Operationg\ Income}\right|$; *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 2.12 – Effect of bank foreign presence and foreign organizational complexity on bank risk and bank profitability _ **Listed banks**

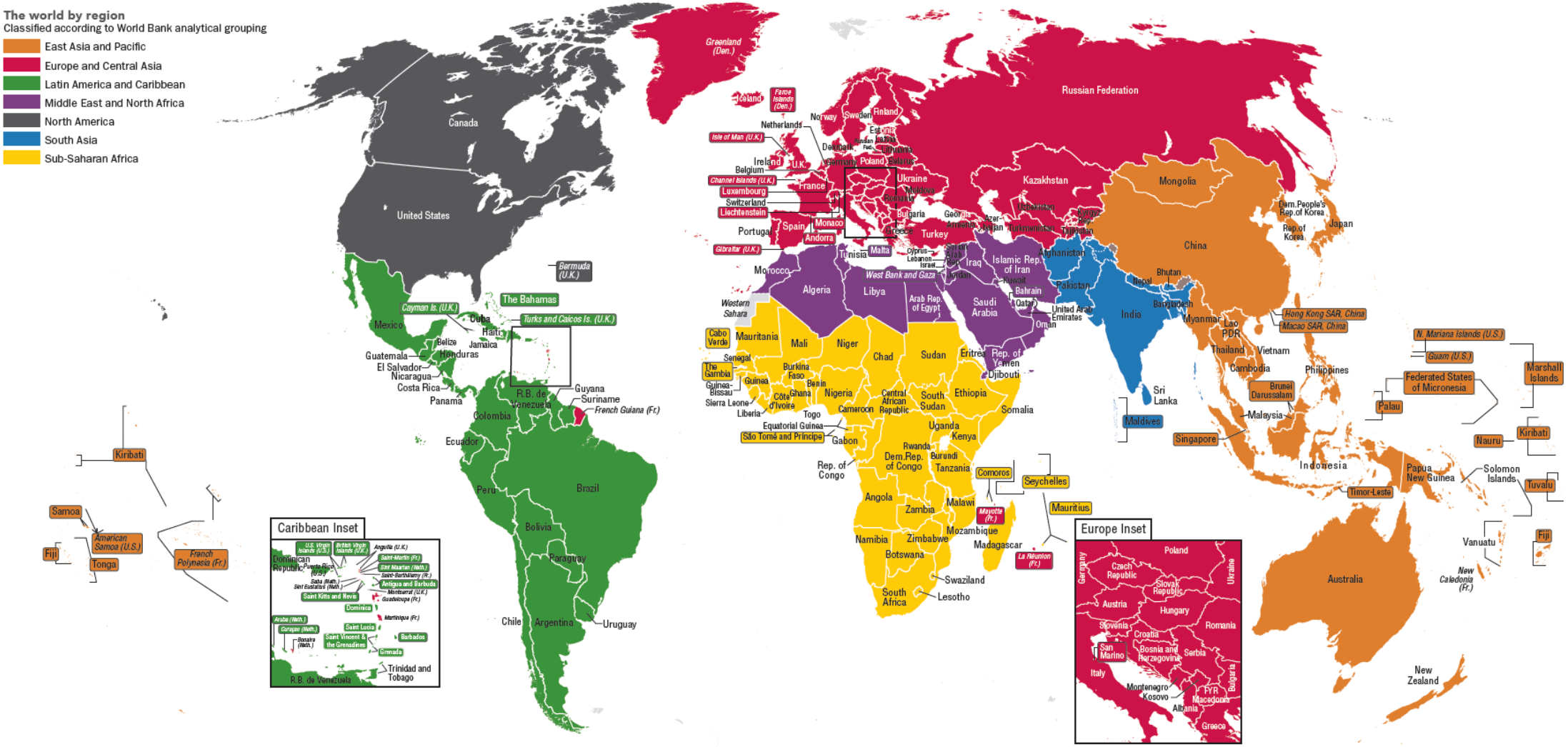
	Zscore	**Zscore1**	**Zscore2**	**SDROA**	**ROA**
Foreign	0.171*	0.025	0.196*	0.050*	0.174**
	(0.10)	(0.66)	(0.11)	(0.03)	(0.08)
Size (logTA)	-0.357	-0.284	-0.365	0.076***	-0.116
	(0.27)	(0.29)	(0.27)	(0.03)	(0.08)
No. Obs.	256	256	256	256	256
No. of clusters	102	102	102	102	102
Hausman test p-value	0.582	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 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 * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix 2.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 2. 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 2.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 2.3.

	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	154437.7	174724.7	55502.1	40002.2	580117	1088	46016.5	105340.1	13576.4	3194.35	580117
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

CHAPTER 3

Internationalization and Systemic Risk: Evidence from a sample of European Listed Banks

This chapter draws from the working paper "Internationalization and Systemic Risk: Evidence from a sample of European Listed Banks" co-authored with Yassine Bakkar.

3.1. Introduction

Deregulation and financial innovation have prompted a particularly important degree of globalization among large financial institutions [Claessens and van Horen (2012), Frame and White (2015)]. These profound and rapid changes have transformed the scale and the scope of global banking institutions and increased their size and their complexity over the past two decades. The broader networks of banking institutions' affiliates, geographically spread global banks and interconnected banking legal entities both at home and abroad and the issues of too-big- and too-complex-to-fail entities and Global Systemically Important Banks (G-SIBs) have received renewed attention in recent years [Gropp et al. (2010),Goetz et al. (2016)]. Consequently, how global financial institutions manage their complexity and the potential influence on different financial systems has surged to the top position on policy agenda and academic debate. And, the global financial crisis followed by the European sovereign debt crisis have even more increased the concern about the interconnectedness of complex institutions and the contagion of risk to different sectors of the economy as well as to different economies. Our paper investigates the impact of bank internationalization (through foreign subsidiaries) on the systemic risk of European listed banks and whether such impact in normal times changes in times of financial turmoil.

The issue of systemically important financial institutions and the effect on financial fragility have caught more attention of researchers and policy makers. The Financial Stability Board [FSB (2011)] has published an integrated set of policy measures to address the systemic and moral hazard risks associated with systemically important financial institutions (SIFIs). The FSB uses the notion of "complexity" as one important factor affecting systemic risk and the identification of G-SIBs. Besides, the G-SIBs designation methodology is also based on four distinguishing aspects: interconnectedness, substitutability within the financial institution infrastructure and cross-jurisdictional activity in addition to size. Thus, the Basel Committee for Banking Supervision [BCBS (2011)] has proposed capital surcharges and liquidity requirements on large and systemically important banks to contain systemic risk, and also measures to reduce their involvement in market-based activities and their organizational complexity. Also, the Dodd–Frank Act (the Volcker Rule) in the U.S., the Liikanen Report (2012), and the Vickers Report (2013) proposals in Europe have supported restrictions on risky bank activities. Other authors have advocated outright limits on the individual size of banks including capping of size, breakup and separation of the institution along business lines

and organizational restructuring to limit the cross-border dimension of complexity. However, the literature has not yet offered any evidence on the effect of complexity, through the affiliates' types and the worldwide geographic dispersion of counterparts, on bank systemic risk.

There is a growing consensus that banking complexity and geographic expansion are relevant factors that lower banks' risk if it involves adding assets whose returns are imperfectly correlated with existing assets [Gropp et al. (2010), Goetz et al. (2016)]. Dell'Ariccia and Marquez (2010) analyze the choice between branches and subsidiaries in banking in a theoretical framework. Carmassi and Herring (2016) investigate how different aspects of complexity may enhance systemic risk. They also refer to a number of possible reasons for becoming too-complex such as economies of scale and scope, regulation and tax rules [see also Gropp, et al. (2010)]. An extensive literature reviews bank holding companies and their complex organization and geographic expansion around the world as well as their potential implication for standalone risk [Akhigbe and Whyte (2003), Deng and Elyasiani (2008), Goetz et al. (2016)], diversification and financial fragility [Calomiris (2000), Barth and Wihlborg (2016), Carmassi and Herring (2016)], risk monitoring and adverse effects on asset quality [Brickley et al. (2003), Berger et al. (2005)], loan quality and bank fragility [Berger and Ofek (1995), Servaes (1996), Denis et al. (1997)], and capital and loans [Demsetz and Strahan (1997), Acharya et al. (2006)], Nevertheless, the existing literature focusses on analyzing bank complexity implications on only individual aspects of bank risk [Goetz et al. (2016)], not the exposure of banks to systemic risk, the contagion risk or the magnitude of systemic shocks. Apart from Carmassi and Herring (2016) who show that the organizational complexity of 29 G-SIBs (8 from U.S.) has increased in pre-crisis times, and slightly decreased in the aftermath of the crisis, and the large mergers and acquisitions being the main drivers of this effect, there is still no academic consensus on whether internationalization and foreign complexity has led to greater bank systemic risk.

In this paper we seek to link these two strands of literatures and address the following questions: Are internationalization, affiliates structures, and geographic expansion of activities adding to the instability of the financial system? And to what extent these aspects of organizational and geographic complexity might affect banks' systemic risk during sound and stress periods (of accumulations of systemic risk)? Hence, the acute time of the global financial crisis in 2008–2009, followed by the 2010–2011European sovereign debt crisis provides a natural environment that allows us to investigate the effect of bank complexity on

systemic risk during financial distress. Accordingly, we turn our attention to European financial institutions that conduct operations by establishing foreign subsidiaries around the world and to European financial institutions that do not.

The objective of this paper is to investigate the relation between bank organizational forms in foreign markets and geographic complexity and bank systemic risk. This paper takes a narrower approach to explain the potential systemic risk repercussions of internationalization and foreign complexity. It seeks to explain how the organizational choice, i.e. separately incorporated subsidiaries, and geographic complexity, i.e. geographical diversity in terms of affiliate locations, might contribute to systemic disruption. It also asks whether the choice to expand counterparts abroad and geographical complexity –that might potentially maximize the benefits and reduce default cost and the possibility of a state bailout– make banks systemically riskier than in the absence of such foreign complexity. Therefore, we follow the insights from Anginer et al. (2013), Bertay et al. (2013) and Barth and Schnabel (2013), and we distinguish five measures of systemic banks, to metric systemic risk exposures (Marginal Expected Shortfall (MES) and SRisk its expected capital shortfall), systemic risk contributions (delta Conditional Value-at-Risk (ΔCoVaR)), systemic default risk (Merton's probability-of-default measure (PD) and sensitivity to extreme systemic shock (Tail-beta)).

To the best of our knowledge, this is the first paper on European listed banks that seeks to examine the relationships between bank internationalization and foreign complexity and bank systemic risk and that investigates possible changes over the 2005–2013 period covering the peak of the global financial crisis (2008–2009), the height of European sovereign debt crisis (2010–2011), and the aftermath stages of these financial crises (2012–2013). Our findings reveal that internationalization and foreign complexity appear to be an important driver of bank systemic risk, specifically over both crisis and post-crisis periods. However, the effect is either reversed or non-important during sound period (2005–2007). Moreover, our results suggest that complex banks might be less reluctant to build capital shortfall buffers during sound period –risk accumulating period– that can be drawn down in the event of a systemic shock. Our findings contribute to the bank complexity literature and carry various policy implications, especially for too-complex and systemically important financial institutions.

In the remainder of the paper, Section 3.2 presents the sample and the empirical methodology. Section 3.3 describes the data and variables and reports some univariate

analysis. Section 3.4 presents the results and discusses additional analyses, and Section 3.5 provides robustness tests. Section 3.6 concludes our study.

3.2. Sample and model specification

In this section, before presenting the empirical methodology we describe the procedures we follow to construct our sample.

3.2.1. *Sample*

To address the effect of foreign presence and complexity on systemic risk, which requires market-based data, we focus exclusively on banks that have publicly traded equity. We consider listed banks that specialized in commercial, cooperative and savings activities and are established in Europe. Our study spans the 2005–2013[46] period. From Bloomberg we retrieve bank stock price information and other market data which we combine with accounting and structural data from various sources. We extract unconsolidated bank-level annual accounting data from the Bureau Van Djik (BvD) Bankscope and Thomsen-Reuters Advanced Analytics (TRAA) databases. Bloomberg is a well-known proprietary database collecting market data across publicly listed companies, while TRAA and Bankscope are databases collecting balance sheet statements across a large sample of countries. All the banks in our sample report annual financial statements following an accounting period running from January 1 to December 31. To obtain a homogenized sample, we apply several selection criteria and make some restrictions. First, we drop banks with infrequently traded stocks and low variability in stock prices. Then, we restrict the subsample to banks with continuously traded stocks. More specifically, we disregard a stock if daily returns are zero over five rolling consecutive days. Third, we consider bank stocks with more than 70% of the daily returns over the period that are non-zero returns. Finally, for each year we eliminate outliers and extreme values of all variables. Moreover, to map the level of internationalization of banks around the world, we collect the number and locations of their foreign subsidiaries from Bankscope. For each bank and its affiliates we go through bank annual reports and websites to match the collected data and, in cases of discrepancies, we extract and add complementary data. Finally, considering the full availability of accounting, market, and international data

[46] We end the sample period in 2013 in order to avoid interference with the implementation of the Basel III regulations in Europe (starting from 2013) that among other things introduced measures for large banks to reduce their involvement in market-based activities and their organizational complexity. In doing so, we can study how complex banks potentially affect systemic risk. Then, we are able to investigate the change in this relationship before the global financial crisis (GFC), during the acute financial crisis and at the later stage of financial crisis years.

each year, we end up with a sample of 105 banks[47] from 15 European countries[48] publicly traded on financial markets: Austria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Poland, Portugal, Slovakia, Spain, and Sweden. From all the filtering procedures, we build a panel of 945 bank-year observations.

3.2.2. *Model specification and empirical methodology*

This paper investigates the effect of the internationalization and complexity of 105 listed banks that are headquartered in Europe and operate foreign subsidiaries around the world on the individual bank risk of systemic disruptions. More precisely we study how this effect differs according to the state and soundness of the banking industry. Indeed our period of study that spans on 2005–2013 covers two main events, namely the global financial crisis and the European sovereign debt crisis, which might have affected both the bank presence abroad and bank systemic risk differently. To capture the state and soundness of all countries banking systems, we define a large timeline to include both the global financial and the sovereign debt crises. The dummy variable *Crisis08_11* takes the value of one if the year is 2008, 2009, 2010, and 2011[49], and zero otherwise. In another analysis we decompose *Crisis08_11* into two other dummies *Fin08_09* and S*ov10_11* to capture more precisely the individual effect of the acute years of the global financial crisis and the sovereign debt crisis, respectively. As the dummy *Crisis08_11* encompasses both crises, we decompose the years left into a relatively calm period prior to the crises (2005–2007) and an aftermath period (2012–2013). *Post12_13* is a dummy equal to one for the years 2012 and 2013, and zero otherwise. With regards to these three states of financial systems stability, to determine the impact of internationalization and foreign complexity on bank individual systemic risk over the 2005–2013 period, we estimate the following model:

$$Risk_{i,j,t} = \alpha_0 + (\alpha_1 + \beta_1 Crisis08\_11 + \beta_2 Post12\_13) * International_{i,t} + \varphi Financial_{i,t-1} + \omega_j + \varepsilon_{ij,t} \quad (1)$$

[47] See Table 3.1 in section 3.3 for a thorough description of the sample of European listed banks.

[48] We focus of European countries for reasons of data availability and cross-countries consistency.

[49] Crossing different timelines given by the BIS (2010) and the Banque de France (2010, 2012), the financial crisis started in July 2007 in the USA, intensified after the collapse of Lehman Brothers in September 2008, 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 (e.g. Greece, Ireland, Portugal and Spain) and had profoundly affected all European economies in 2011. In 2012, the agreement of the EU to bailout Greece on February 21st and the adoption of an EU fiscal compact treaty on March 2nd mark the beginning of strong interventionist measures in order to stop the contagion of the crisis and provide stability for all countries. Hence, we define the crises over the 2008–2011 period.

Where $Risk_{i,j,t}$ contains the different measures of systemic risk of the publicly traded bank *i* in country *j* over the year *t*. In one specification of our study, we successively examine three measures of bank individual systemic risk over the period 2005 to 2013: MES, SRISK, and ΔCoVaR and in another, we successively analyze two other measures of risk: PD (probability of default) and Tail-beta. $International_{i,t}$ comprises different measures of bank internationalization: presence abroad (with subsidiaries), number of host countries, number of subsidiaries, and geographic dispersion and complexity of the foreign affiliates. The parameters α_1, $(\alpha_1+\beta_1)$, and $(\alpha_1+\beta_2)$ capture the effect of the bank foreign presence and foreign complexity on bank individual systemic risk during the pre-financial crisis period (2005–2007), the acute years of both financial (2008–2009) and sovereign debt crises (2010–2011), and during the post-crisis time (2012–2013), respectively. $Financial_{i,t-1}$ is a vector of bank characteristics computed at time $t-1$ which are presented in section 3.3.3, ω_j is a country fixed effect, and $\varepsilon_{ij,t}$ is the error term. In all regressions, we include country fixed effects ω_j and the standard errors are clustered at the country level.

We use Ordinary Least Squares (OLS) to estimate the model with all dependent variables resulting from previous estimation methodologies. In the presence of a lagged control variables, we build on the insights of Laeven et al. (2015) and use ordinary least squares (OLS) estimation.

In what follow we turn to the definitions of our variables of interest (foreign presence and complexity), our dependent variables measuring bank systemic risk and the different control variables include in the regressions.

3.3. Data and variables

In this section, we define the internationalization criteria and present the foreign complexity indicators and the measures of systemic risk at the bank-level. We also present all the bank financial characteristics we use in the empirical framework.

3.3.1. *Building of foreign presence and complexity variables*

Our paper aims to investigate whether the internationalization and foreign complexity of publicly traded banks affect systemic risk and whether the effect in normal times differs from times of financial distress. We evaluate the internationalization of a bank in terms of its presence abroad or not and the widespread of such presence in multiple countries. And, to

determine the foreign complexity, we consider the penetration of foreign markets with subsidiaries; an entity with 50% or more of its shares owned by another company that competes directly and deeply on the local market, abides the laws of that country, owns its full accounting statements, and is a total independent entity from the parent bank.

From Bankscope we identify banks that have at least one foreign subsidiary and collect data as of the end of 2007, 2010, and 2013. Taking into account the legal procedures and costs related to the closing of foreign affiliates, we assume that the speed of change of the presence abroad should not be faster over few years. Henceforth, the measures of the internationalization constructed for the year 2007, 2010, and 2013 are assumed to be the same for 2006 and 2005, 2009 and 2008, and 2011 and 2012, respectively. Using these data we create the dummy variable $Foreign_i$ that takes the value one when the listed bank *i* from home country *j* owns at least one subsidiary abroad, and zero otherwise (either the bank is not present abroad or operates another type of foreign affiliate or does not conduct foreign operations through subsidiary). Another variable included in the regressions is the continuous variable Nb_Host_i that measures the wide presence of each bank around the world through the number of host countries where there is a foreign affiliate. Given the (economic, political, social, cultural) differences between all host countries, the two previous variables do not represent all the potential channels of transmission of multinational banks' impact on systemic risk. Hence, we deepen the analysis with a focus on the complexity of the foreign structure and locations of multinational banks. Following prior studies [Carmassi and Herring (2013, 2016), Laeven et al. (2015), Barth and Wihlborg (2016)] we introduce the (natural logarithm of the) number of subsidiaries $Nb\_Subsidiaries_i$ as an indicator of foreign complexity.

Additionally, regarding the locations of the international banks, we consider another measure of the concept of foreign complexity: the geographic dispersion of the different regions where banks operate their foreign subsidiaries. On the basis of the World Bank regional division of countries around the world, we defined the following eight regions[50]: 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-

[50] The World Bank (WB) regional division of countries consists of seven groups with Europe and Central Asia (ECA) representing a unique group. 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.

Saharan Africa (SSA). For each listed bank *i* we include the continuous variable $NbRegions\_Sub_i$ that accounts for the number of regions where the foreign subsidiaries are located. And 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). By construction of *GeoComplex**S***, the lowest complexity also indicates a presence in a unique region and the highest complexity describes a presence in all regions with the same number of subsidiaries. We use the previously defined regions *r*[51] to build an index for each one of the banks that have established subsidiaries abroad:

$$GeoComplexS_i = \frac{R}{R-1}\left(1 - \sum_{r=1}^{R}\left(\frac{NbSubsidiaries_{i,r}}{NbSubsidiaries_i}\right)^2\right) \quad (2)$$

Where *R* is the total number of regions *r* around the world (i.e. 8); $Nb\_Subsidiaries_{i,r}$ is the number of subsidiaries of bank *i* in region *r*; and $Nb\_Subsidiaries_i$ is the total number of subsidiaries of bank *i*.

Finally, for each aforementioned indicator we introduce interacted terms that capture the specific effect of bank internationalization and foreign complexity during times of financial instability in Eq. (1).

Table 3.1 reports the distribution of the 105 listed banks by European countries and global foreign activities over the three periods of 2005–2007, 2008–2010, and 2011–2013.

Our dataset indicates that while most of the banks publicly traded on financial markets are from Denmark (21.90%), France (17.14%), and Italy (16.19%), Czech Republic (0.95%), Hungary (0.95%), and Ireland (0.95%) have the fewest representatives in the whole sample.

We observe that, on average, 50 banks in the sample owned foreign subsidiaries around the world. Through the whole period, French banks globally have the wider international presence in terms of host countries [and number of regions] with subsidiaries located in 63 [8] (2005–2007), then 57 [8] (2008–2010), and 47 [8] (2011–2013) host countries [world regions]. Moreover, comparing the number of subsidiaries, we find that while during 2005–2007 French, German, and Italian banks operate most of the foreign subsidiaries with respectively 586, 431, and 350 affiliates, the representativeness is different in 2011–2013 as

[51] See Figure 2.1(in Chapter 2) of the map of World countries into seven regions as defined by the World Bank.

Spanish (72) and Swedish (68) banks now hold the second and third position, respectively[52]. Considering the geographic complexity of foreign subsidiaries, the average value of the index for the whole sample decreases from 0.33 (2005–2007) to 0.31 (2008–2010) and increases back to 0.34 in 2011–2013. Among all banks that operate foreign subsidiaries, Portuguese banks (0.69, 0.71, and 0.82) are the ones with the most regionally diversified affiliates.

Table 3.1 – Distribution of listed banks

The table shows the breakdown of the 105 listed banks by country, and the indicator of geographic complexity for foreign subsidiaries (*GeoComplex**S***), (the detailed method of calculation can be found in Section 3.3.1) for the three sets of extraction of international observations from Bankscope [(2005–2007) ; (2008–2010) ; (2011–2013)]. Delta measures the variation in percentage between (2008–2010) and (2005–2007) and between (2011–2013) and (2008–2010) for the variable in column at the left side. We extract most of the information on banks, and number and locations of foreign from Bankscope and we complete them with data from annual reports and bank's website. "." indicates unavailable or unknown data.

	Listed banks	Banks with a foreign activity	Number of foreign subsidiaries	Delta %	Number of host countries	Delta %	Number of world regions	GeoComplex**S** **[Mean]**
				2011–2013				
Austria	6	6	15	-75	6	-64.71	2	0.05
Czech Republic	1	1	1	0	1	0	1	.
Denmark	23	4	38	-35.59	20	-13.04	7	0.35
Finland	2	.	.	.	.	.	.	.
France	18	6	140	-67.74	47	-17.54	8	0.48
Germany	7	4	43	-87.68	24	-48.94	6	0.43
Greece	6	4	23	-43.90	7	-22.22	2	0.06
Hungary	1	1	6	-57.14	5	-58.33	2	0.51
Ireland	1	.	.	.	.	.	.	.
Italy	17	10	62	-61.96	20	-25.93	7	0.20
Poland	10	2	2	-33.33	2	100	1	0
Portugal	2	2	14	-56.25	8	-27.27	5	0.82
Slovakia	2	.	.	.	.	.	.	.
Spain	6	6	72	-36.84	28	7.69	6	0.45
Sweden	3	3	68	-55.56	26	0	8	0.82
Obs.	**105**	**49**	**484**	**-66.13**				**0.34**

[52] The drop of the number of foreign subsidiaries (French and German banks more specifically) observed between the extraction at end of 2010 and the one at end of 2013 might have different causes. First, according to Chapter 2 of the Global Financial Stability Report (GFSR) by the IMF (April 2015), the pre-crisis level of cross-border operations reflected a temporary unsustainable boom. Hence, one implication of the recent global financial crisis on banks' organizational network was a shift away from international activities to more local lending through domestic branches and subsidiaries. Consequently, between 2008 and 2013, international banks have significantly reduced their number of foreign affiliates in order to refocus on core markets, rebalance their business models away from capital-intensive activities to more fee-based businesses, refocus their geographical presence on fast-growing markets (Claessens and van Horen 2014), and limit their risk exposures and contagion among entities. The GFSR explains this decline of cross-border lending by a combination of regulatory and supervisory changes, weaknesses in banks balance sheets, and some macroeconomic factors. Second, in case the drop might come from databases' issues, we conduct additional checks of our sample. Going through all filtering procedures, controlling and comparing them with other extractions, we were not able to find any discrepancies. However, since Bankscope do not give exhaustive information and/or do not report details about what might explain the changes, were there any problems with the information initially collected and/or reported in the database, we are not able to expose them.

				2008–2010				
Austria	6	5	60	275	17	70	3	0.048
Czech Republic	1	1	1	0	1	0	1	0
Denmark	23	4	59	-30.59	23	-4.17	6	0.26
Finland	2	1	5	0	4	0	2	0.54
France	18	6	434	-25.94	57	-9.52	8	0.47
Germany	7	4	349	-19.03	47	-17.54	8	0.53
Greece	6	5	41	-16.33	9	0	3	0.08
Hungary	1	1	14	0	12	0	2	0.28
Ireland	1	1	1	-80	1	-75	1	0
Italy	17	10	163	-53.43	27	-50	8	0.20
Poland	10	3	3	50	1	0	1	0
Portugal	2	2	32	-3.03	11	0	6	0.71
Slovakia	2	.	0	.	.	.	.	.
Spain	6	4	114	-9.52	26	-18.75	6	0.65
Sweden	3	3	153	13.33	26	4	7	0.60
Obs.	**105**	**50**	**1429**	**-22.25**				**0.31**
				2005–2007				
Austria	6	4	16		10		1	0
Czech Republic	1	1	1		1		1	0
Denmark	23	3	85		24		6	0.31
Finland	2	1	5		4		2	0.36
France	18	6	586		63		8	0.56
Germany	7	4	431		57		8	0.47
Greece	6	5	49		9		3	0.15
Hungary	1	1	14		12		2	0.28
Ireland	1	1	5		4		2	0.36
Italy	17	12	350		54		8	0.25
Poland	10	2	2		1		1	0
Portugal	2	2	33		11		6	0.69
Slovakia	2	.	0		.		.	.
Spain	6	5	126		32		7	0.66
Sweden	3	3	135		25		6	0.45
Obs.	**105**	**50**	**1838**					**0.33**

Table 3.2 shows the dispersion of foreign bank subsidiaries owned by listed European banks in different world regions. Regardless of the region, the total number of subsidiaries has significantly decreased throughout the period of study; from 1838 to 1429 (-22.25%) and then to 484 (-66.13%). Going through the downfall of the financial and sovereign debt crises, banks have faced numerous losses which might have forced them to close some of their counterparts abroad. As we could have imagined, most of the foreign subsidiaries are located in Europe (1001, 753, and then 202) and North America (372, 297, and 78).

Table 3.2 – Distribution of foreign subsidiaries over regions

The table shows the distribution of the foreign subsidiaries in eight world regions: East Asia & Pacific (EAP) ; Central Asia (CA) ; Europe (EUR) ; Latin America & Caribbean (LAC) ; Middle East & North Africa (MENA) ; North America (NA) ; South Asia (SA) ; Sub-Saharan Africa (SSA). "." indicates unavailable or unknown data.

2011–2013	Total	EAP	EUR	CA	LAC	MENA	NA	SA	SSA
Austria	15	0	14	1	0	0	0	0	0
Czech Republic	1	0	1	0	0	0	0	0	0
Denmark	38	9	20	2	1	0	1	2	3
Finland	.	.	.	.	.	.	.	.	.
France	140	23	58	7	10	11	15	1	15
Germany	43	9	16	3	5	0	9	0	1
Greece	23	0	22	0	0	1	0	0	0
Hungary	6	0	4	2	0	0	0	0	0
Ireland	.	.	.	.	.	.	.	.	.
Italy	62	5	21	1	0	2	27	3	3
Poland	2	0	2	0	0	0	0	0	0
Portugal	14	1	4	0	4	1	0	0	4
Slovakia	.	.	.	.	.	.	.	.	.
Spain	72	2	16	0	39	2	12	0	1
Sweden	68	13	25	4	5	1	14	2	4
Obs.	484	62	202	20	64	18	78	8	31
2008–2010	Total	EAP	EUR	CA	LAC	MENA	NA	SA	SSA
Austria	60	1	55	4	0	0	0	0	0
Czech Republic	1	0	1	0	0	0	0	0	0
Denmark	59	4	45	2	2	0	2	0	4
Finland	5	0	2	3	0	0	0	0	0
France	434	55	224	11	23	20	57	25	19
Germany	349	29	103	5	12	4	176	11	9
Greece	41	0	39	0	0	1	1	0	0
Hungary	14	0	12	2	0	0	0	0	0
Ireland	1	0	1	0	0	0	0	0	0
Italy	163	15	106	5	1	4	27	4	1
Poland	3	0	3	0	0	0	0	0	0
Portugal	32	1	17	0	3	1	3	0	7
Slovakia	.	.	.	.	.	.	.	.	.
Spain	114	5	43	0	44	3	17	0	2
Sweden	153	12	102	14	3	0	14	7	1
Obs.	1429	122	753	46	88	33	297	47	43
2005–2007	Total	EAP	EUR	CA	LAC	MENA	NA	SA	SSA
Austria	16	0	16	0	0	0	0	0	0
Czech Republic	1	0	1	0	0	0	0	0	0
Denmark	85	3	76	3	1	0	1	0	1
Finland	5	0	4	1	0	0	0	0	0
France	586	59	299	20	19	36	119	8	26
Germany	431	45	160	7	14	6	184	12	3
Greece	49	0	43	0	0	4	1	0	1
Hungary	14	0	12	2	0	0	0	0	0

Ireland	5	0	4	0	0	0	1	0	0
Italy	350	77	209	9	8	5	39	1	2
Poland	2	0	2	0	0	0	0	0	0
Portugal	33	1	20	0	4	2	3	0	3
Slovakia	.	.	.	.	.	.	.	.	.
Spain	126	4	48	2	52	1	17	0	2
Sweden	135	6	107	11	3	0	7	1	0
Obs.	1838	195	1001	55	101	54	372	22	38

3.3.2. *Bank-level systemic risk measures*

We compute in this section the main dependent variables reflecting individual bank systemic risk in order to investigate the systemic dimension of bank risk and capture the bank' sensitivity to system-wide distress. This differs from the individual dimension of bank risk as it also encompasses different aspects such as interconnectedness in the banking industry, correlation in returns between the bank and the financial system, and the economic context. We define and measure market-based measures of systemic importance, approach base on market data. We devote attention to, the systemic risk exposures and vulnerability to system wide distress (the Marginal Expected Shortfall (*MES*)), the expected capital shortfall during a period of system distress (*SRisk*), the contribution to system wide risk of an individual bank (the delta Conditional Value-at-Risk ($\Delta CoVaR$)), systemic default risk (the Merton's probability-of-default measure (*PD*)) and sensitivity to extreme systemic shock (quantile Tail-beta (*Tail-beta*)).

We follow common practice and use the opposite of returns in the computation, such that losses are expressed with a positive sign. Systemic risk measures will typically be positive and higher values correspond to larger systemic risk exposures, contributions, default and sensitivity. All measures are constructed by estimating the return model using daily data over the period January 2005 to December 2013. Then we compute annual systemic risk values using the average of the predicted values over each year.

Hypothesizing that some publicly traded banks with critical market power or large amount of total assets might generate a risk that, due to the importance of the bank in the system, will turn out systemic and shaken the whole banking system, and others on the contrary rather suffer from systemic risk, we separate the five risk measures into two categories: systemic risk–maker (*MES*, *SRisk*, and $\Delta CoVaR$) and systemic risk–taker (*PD* and *Tail-beta*).

3.3.2.1. MES, SRisk, and ΔCoVaR

The Marginal expected shortfall (MES) is introduced as a risk measure in Acharya et al. (2010). We follow Engle (2002), Zhou and Tarashev (2013), and Brownlees and Engle (2015, 2017), among other and define MES as the expected return (tail expectation) of a bank's stock return conditional on a market return (i.e. the market index) being in its lower tail[53]. The market-based systemic risk measure MES thus assesses the extent to which distress at a bank contributes to system-wide stress. Here, the MES is defined as:

$$MES_{i,t}^{q=5\%} \equiv E\left(R_{i,t} | R_{M,t} \leq VaR_{R_{M,t}}^{q}\right) \quad (3)$$

Where $R_{i,t}$ is the daily stock return for bank *i*, $R_{M,t}$ is the daily market return[54], *q*-percent is a pre-specified extreme quantile enabling us to look at systemic events. $VaR_{R_{M,t}}^{q}$ stands for Value-at-Risk, which is a critical threshold value that measures the worst expected market loss over a specific time period at a given confidence level. Herewith, we follow the common practice and set q at 5-percent, the term $R_{M,t} \leq \mathrm{VaR}_{\mathrm{R_{M,t}}}^{\mathrm{q}}$ reflects the set of days when the market return is at or below the 5-percent tail outcomes in that given year.

An extension of the MES, called SRisk, was proposed by Acharya et al. (2012). It is determined by bank's total asset, and bank's equity. It metrics the expected capital shortfall of an individual bank *i* when the financial system is undercapitalized. Therefore, an individual bank is considered systemically risky if it is faced to a capital shortfall when the system is under distress. Formally, Acharya et al. (2012) and Laeven et al. (2015) measure SRisk's as following[55]:

$$SRisk_{i,t} = E_{t-1} * (Capital\ Shortfall_i | Crisis) =$$

$$\left(k * D_{i,t}\right) - VE_{i,t} * \left(1-k\right) * \left(1-LRMES_{i,t}\right) \quad (4)$$

Where *k* is the prudential capital ratio equal to 8 percent, VE_i is market value of equity, D_i is book value of debts (total liabilities) and $LRMES_{i,t}$ (Long Run MES, $LRMES_{i,t} =$

[53] Economically, the term "marginal" means that each unit increase or decrease in the equity value MES implies the variation in the bank's capital shortfall.

[54] To estimate risk measures, we either use the financial sector index or the broad market index.

[55] Unlike Acharya et al. (2012) methodology, we do not limit SRisk from below to zero. Acharya et al. (2012) are interested in estimating capital shortages, which theoretically cannot take on negative values. Here, we allow SRisk to take on negative values, with a view that highly capitalized banks with large buffers can easily absorb systemic shocks and subtract systemic risk from the financial system.

$(1-k)exp^{(-18\,MES_i)}$) is tail expectation of the bank's return conditional on a market decline[56].

Adrian and Brunnermeier (2011) introduce another concept of systemic risk, computed at the bank-level, called ΔCoVaR, similar to the value-at-risk (VaR). The market-based systemic risk measure CoVaR corresponds to the VaR of the entire financial market (i.e. of the market index, R_M), conditional on a certain bank *i* being in distress (at its lower tail). Specifically, the distress of bank *i* is captured by that bank being at its own individual ($\mathrm{VaR}^{q}_{\mathrm{R_{i,t}}}$), that is when bank *i*'s stock return ($R_{i,t}$) is beyond a critical threshold *q* probability level. Here, we set *q* at 1-percent. As in Adrian and Brunnermeier (2009), we compute a time series CoVaR measure for each of the banks in our sample using quantile regressions. $CoVaR^{q}_{R_{M|i,t}}$ is the *q*-percent quantile of this conditional probability distribution and can be written as[57]:

$$Prob_{t-1}\left(R_{M,t} \leq CoVaR^{q}_{R_{M|i,t}} \mid R_{i,t} = VaR^{q}_{R_{i,t}}\right) = q \qquad (5)$$

Thus, explicitly, Adrian and Brunnermeier (2011) define bank $\Delta\mathrm{CoVaR_i}$ as the VaR of the financial market when bank *i* is in distress (i.e. when bank stock return is at its bottom 1-percent level), minus the VaR of the market when bank *i* is at its median value (i.e. when this bank *i* is on its median return). Additionally, this relation is allowed to depend on additional estimated covariates [Adrian and Brunnermeier (2014), Hautsch et al. (2014), Mayordomo et al. (2014)]. It catches the externality a bank causes to the entire financial system. ΔCoVaR of individual bank *i* is expressed as[58]:

$$\Delta CoVaR^{q=1\%}_{R_{M|i,t}} = CoVaR^{q=1\%}_{R_{M|i,t}} - CoVaR^{median}_{R_{M|i,t}} \qquad (6)$$

[56] An approximation of equity values falls in the crisis scenarios when the market goes down below a given threshold, 40% over 180 days [Acharya et al. (2012), Laeven et al. (2015), among other].

[57] Quantile regressions estimate the functional relationship among variables at different quantiles [Koenker and Hallock (2001)] and allow the risk co-dependence during stress periods by taking into account nonlinear relationships when there is a large negative shock.

[58] As MES, ΔCoVaR computed at time t given information available at time t–1 based on the financial system Expected Shortfall.

3.3.2.2. PD and Tail-beta

We compute the two additional measures of bank risk that capture another dimension of systemic risk to identify banks more likely to be strongly affected by a sharp system downturn.

Following Hillegeist et al. (2004) and Campbell et al. (2008) methodology, we model and compute the Merton's distance-to default (DD) measure for each of the banks in our sample. Formally, DD at the end of year t is expressed as:

$$DD_{it} = \frac{log\left(\frac{VA_{i,t}}{D_{i,t}}\right) + \left(r_f - 0.5 * (\sigma_{i,t}^{A})^2\right) * T}{\sigma_{i,t}^{A}\sqrt{T}} \quad (7)$$

Where $VA_{i,t}$ is the market value of the bank's assets at the end of the fiscal year t; $D_{i,t}$ is the book value of total liabilities maturing at time T (as a proxy for the face value of debt); r_f is the risk-free rate (10-year government bond obtained for each country from the Bloomberg), and $\sigma_{A,i,t}$ is the volatility of the bank's assets at t (based on equity returns in a given year).

However, the distance to default cannot be measured directly. $DD_{i,t}$ requires estimates of $VA_{i,t}$ and $\sigma_{A,i,t}$ neither of which are directly observable. Following the option pricing model of Black and Scholes (1973), equity can be modeled as a call option on the underlying bank's assets. Therefore, the market value of equity and volatility are estimated from observed stock prices ($VE_{i,t}$) and their volatility ($\sigma_{i,t}^{E}$), by solving simultaneously the following system of nonlinear equations:

$$VE_{i,t} = VA_{i,t}N(d_1) - X_t e^{-r_f T} N(d_2) \qquad \sigma_{i,t}^{E} = \left(\frac{VA_{i,t}}{VE_{i,t}}\right) * N(d_1) * \sigma_{i,t}^{A} \quad (8)$$

Where $VA_{i,t} = VE_{i,t} + D_{i,t}$ and N is the cumulative normal distribution function and d_1 and d_2 are given by:

$$d_1 = \frac{\log\left(\frac{VA_{i,t}}{D_{i,t}}\right) + \left(r_f + 0.5 \times \left(\sigma_{i,t}^{A}\right)^2\right) \times T}{\sigma_{A,it}\sqrt{T}} \qquad d_2 = d_1 - \sigma_{A,it}\sqrt{T} \quad (9)$$

Since the bank's total liabilities is on an annual basis (an accounting data), we quadratically interpolate the values of debt for all dates over the period, using beginning and end of year values for total liabilities. The interpolation method has the advantage of

producing a smooth implied liabilities value process and avoids jumps in the implied default probabilities at year end [Anginer et al.(2015)].

In this paper, we focus specifically on the default probability defined as the normal transformation of the Merton's distance-to-default measure, computed as: $PD_{i,t} = F(-DD_{i,t})$, where F is the cumulative distribution function of a standard normal distribution. The $DD_{i,t}$ model is suitable indicators of bank distress during the crisis time and bank fragility. Thus, according to this model, default happens when the market value of assets $VA_{i,t}$ falls below the book value of the debt $D_{i,t}$. Hence, the larger the $DD_{i,t}$, the greater is the distance of a bank from the default point, and the lower is the probability of default.

Following Engle and Manganelli (2004) and De Jonghe (2010), we compute Tail-beta (quantile-Tail-beta) for each of the banks in our sample using a quantile regression model at the q-specified quantile. Tail-beta captures bank's sensitivity to extreme movements. We conduct a 1-percent quantile regression. We estimate Tail betas of each bank *i* by regressing daily bank stock return $R_{i,t}$ on daily market return $R_{M,t}$ (as in Eq. (7)). Thus, Tail-beta (spillover coefficient) measures the risk sensitivity of bank at the 1% quantile. The larger is the spillover effect, the more vulnerable is bank to a financial downturn.

3.3.3. *Control variables*

In examining the relationship between bank internationalization and systemic risk, we include in our estimations a vector of control variables which are expected to affect our bank individual systemic risk measures. We follow previous studies in the literature [Beck et al. (2013), Anginer et al. (2014), Weiß et al. (2014), Laeven et al. (2015), among others] and calculate for each bank, each year, a set of controls. We use Size, which is defined as the natural logarithm of a bank's total assets to control for bank absolute size and -Leverage, measured as the ratio of equity to total assets to account for bank capitalization. We also consider Diversification for the reliance on non-interest income activities (noninterest income over total income), Deposits to capture a bank's involvement in market-based activities (deposits to total assets) and Loans funding (net loans over total assets), Efficiency (cost income ratio, non-interest expense over total income) and ROA return on assets ratio (net income to total assets).

3.4. Empirical results

In this section, we first present univariate mean analyses of the main bank financial characteristics we use in the empirical framework, and examine presence abroad across three periods: 2005–2007, 2008–2011, and 2012–2013. Then, we estimate regressions to examine the effect and the changes of internationalization and organization complexity on bank systemic risk depending on the state and soundness of the banking industry using the same periods: before the GFC, during the acute financial crises years and at the later stage of the financial crises.

3.4.1. *Descriptive statistics and univariate analysis*

We report in Table 3.3[59] the descriptive statistics of the variables used in this study and compares bank financial characteristics throughout the 2005–2007, 2008–2011, and 2012–2013 periods. We observe that on average our two main measures of systemic risk (i.e. the MES and SRisk) were at the lowest levels (resp. 1.17 and 4.83) during the years 2005–2007 prior to both crises. And, the already extremely high levels (resp. 3.30 and 12.43) consequently during economic distress from 2008–2011 are even higher (resp. 3.32 and 13.32) in the 2012–2013 post crisis period. Looking at the standard deviation and maximum values, the previous pattern stands. Moreover, while the evolution of the ΔCoVaR, probability of default, and Tail-beta globally follow the same track, we point out that maximum levels of ΔCoVaR (6.84) and probability of default (0.57) were reached during the crisis period. Considering the control variables, while the values of some variables have increased (decreased) during the distress period and the tendency had continued in the aftermath, other variables have seen the levels almost coming back in 2012–2013 to the state of 2005–2007. For instance, the downfall of average and maximum bank capitalization (total equity to total assets ratio) observed in 2008–2013 (from 9.09% to 8.68% and from 44.82% to 35.68%) have continued in 2012–2013 (from 8.68% to 8.01% and from 35.68% to 30.35%). Throughout the three periods, the average and maximum returns on assets of listed banks were also lower (from 1.17% to 0.35% and from 5.85% to 3.61%) during the 2008–2011 crisis and even lowest the years after (from 0.35% to 0.06% and from 3.61% to 3.24%). However, Deposits and cost-to-income (Efficiency) which were on average higher in 2012-2013 (49.58% and 45.20%) than in 2008-2011 (49.36% and 42.33%) and 2005–2007 (48.52% and 40.08%). In

[59] Appendix 3.A contents the definitions of all variables, the sources, and the summary statistics over the global 2005–2013 period.

contrary, Diversification (and Loans) that measure the bank degree of reliance on nontraditional activities (and traditional activities), have declined (increased) during the crisis but, have almost regain the pre-crisis levels. In contrary, Diversification has declined and Loans has increased during the crisis (from 29.82% to 26.10% and from 69.19% to 72.61%, respectively) but, have almost regained the pre-crisis levels in the post-crisis period (from 26.10% to 28.80% and from 72.61% to 69.23%, respectively).

Table 3.3 – Bank descriptive statistics, across the 2005–2007, 2008–2011 and 2012–2013 periods

MES = Marginal Expected Shortfall, marginal participation of a bank to the Expected Shortfall (ES) of the financial system, a measure of bank equity sensitivity to market crashes ; SRisk = Systemic risk, expected capital shortfall ; ΔCoVaR = Conditional Value-at-Risk of a bank to an entire financial system or benchmark/reference market conditional on an extreme event leading to the fall of a bank stock return beyond its critical threshold level ; PD = Probability of default ; Tail-beta = quantile-beta, a measure of the sensitivity to extreme movements of beta. *Foreign* = a dummy that takes the value one when the listed bank owns at least one subsidiary abroad ; *Nb_Host* = continuous variable that accounts the number of host countries of the foreign subsidiaries ; *Nb_Subsidiaries* = continuous variable that accounts the exact number of foreign subsidiaries a listed bank operate abroad ; *NbRegions_Sub* = the number of regions where all foreign subsidiaries are located ; *GeoComplexS* = the geographic complexity indicator of the dispersion of all subsidiaries in different world regions. *Size (log TA)* = natural logarithm of the total assets; *Leverage (%)* = ratio of total equity to total assets ; *Deposits (%)* = ratio of customer deposits to total assets ; *Diversification (%)* = ratio of noninterest income to total income ; *Loans (%)* = ratio of net loans to total assets ; *Efficiency (%)* = cost to income ratio defined as non-interest expense divided by total income ; *ROA (%)* = return on assets is the ratio of net income to total assets.

	Pre-Crisis 2005–2007					Crisis 2008–2011					Post Crisis 2012–2013				
	Obs.	Mean	Std. Dev.	Min	Max	Obs.	Mean	Std. Dev.	Min	Max	Obs.	Mean	Std. Dev.	Min	Max
MES	315	1.17	1.30	-1.21	5.74	420	3.30	2.26	-1.64	9.63	210	3.32	2.32	-1.56	9.17
SRisk	315	4.83	17.57	-6.12	165.21	420	12.43	34.03	-6.21	223.80	210	13.32	35.84	-5.02	202.98
ΔCoVaR	315	1.12	1.11	-2.80	4.08	420	2.61	1.46	-2.01	6.85	210	2.02	1.50	-1.57	6.16
PD	312	0	0.01	0	0.21	416	0.03	0.07	0	0.57	208	0.06	0.10	0	0.53
Tail-beta	315	0.69	0.81	-1.46	3.05	420	1.01	0.77	-1.57	3.07	210	1.02	0.92	-1.41	3.17
Foreign	315	0.47	0.50	0	1	420	0.48	0.50	0	1	210	0.49	0.50	0	1
Nb_Host	149	13.21	16.38	1	63	201	10.75	13.36	1	57	102	9.55	13.05	1	54
Nb_Subsidiaries	149	37.21	70.39	1	378	201	23.78	49.30	0	289	102	9.47	13.49	0	60
NbRegions_Sub	149	3.06	2.36	1	8	197	2.84	2.27	1	8	94	2.79	2.23	1	8
GeoComplex**S**	149	0.34	0.31	0	0.87	197	0.31	0.34	0	0.95	94	0.34	0.37	0	0.95
Size (log TA)	315	-3.69	2.14	-8.18	0.16	420	-3.40	2.12	-7.99	0.16	210	-3.32	2.12	-7.97	0.16
Leverage (%)	315	9.09	5.80	0.78	44.82	420	8.68	5.05	0.78	35.68	210	8.01	4.79	0.78	30.35
Deposits (%)	309	48.52	19.66	5.69	88.91	412	49.36	18.91	5.69	88.68	206	49.58	20.78	5.69	91.43
Diversification (%)	309	29.82	10.95	1.06	66.54	412	26.10	12.16	1.06	66.54	206	28.80	12.37	1.06	66.54
Loans (%)	294	69.19	16.66	13.02	96.28	392	72.61	15.30	23.37	100	196	69.23	17.12	13.02	100
Efficiency (%)	294	40.08	12.73	14.87	79.52	392	42.33	13.77	14.87	89.93	196	45.20	13.44	14.87	84.41
ROA (%)	315	1.17	0.92	-2.09	5.85	420	0.35	1.06	-4.58	3.61	210	0.06	1.32	-4.58	3.24

In a univariate analysis that tests the significance of the descriptive statistics, we compare the financial characteristics and risk measures of banks that operate foreign subsidiaries and those who do not over the full period of study and then across 2005–2007, 2008–2011, and 2012–2013. Table 3.4 indicates that irrespective of the period, the exposure to systemic risk for banks with foreign subsidiaries is always significantly higher than other banks. From the values of the t-statistics, the difference is greater during the crises' years, than during the years after, and even before. The cost-to-income ratio (Efficiency) for listed banks with and without international affiliates is not different. Overall regardless of the period, the data show that multinational banks are larger (higher TA), less capitalized (lower equity to total asset ratio), rely less on deposits and loans, and are less profitable (lower return on assets).

Table 3.4 – Bank characteristics by foreign presence across the 2005–2007, 2008–2011 and 2012–2013 periods

This table compares the characteristics of banks that operate at least one subsidiary abroad and banks that do not across the 2005-2007, 2008-2011, and 2012-2013 periods. T-statistics test the null hypothesis: "bank characteristics are not different between international and non-international banks during the 2005–2007, the 2008–2011, and the 2012–2013 periods." * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ indicate the significance of p-value for a bilateral test. *MES* = Marginal Expected Shortfall, marginal participation of a bank to the Expected Shortfall (ES) of the financial system, a measure of bank equity sensitivity to market crashes ; *SRisk* = Systemic risk, expected capital shortfall ; Δ*CoVaR* = Conditional Value-at-Risk of a bank to an entire financial system or benchmark/reference market conditional on an extreme event leading to the fall of a bank stock return beyond its critical threshold level ; *PD* = Probability of default ; *Tail-beta* = quantile-beta, a measure of the sensitivity to extreme movements of beta. *Foreign* = a dummy that takes the value one when the listed bank owns at least one subsidiary abroad ; *TA* = the bank total assets ; *Size (log TA)* = natural logarithm of the total assets ; *Leverage (%)* = ratio of total equity to total assets ; *Deposits (%)* = ratio of customer deposits to total assets ; *Diversification (%)* = ratio of noninterest income to total income ; *Loans (%)* = ratio of net loans to total assets ; *Efficiency (%)* = cost to income ratio defined as non-interest expense divided by total income ; *ROA (%)* = return on assets is the ratio of net income to total assets.

	All 2005-2013			Pre-Crisis 2005-2007			Crisis 2008-2011			Post-Crisis 2012-2013		
	Foreign = 0	Foreign = 1	t-statistics	Foreign = 0	Foreign = 1	t-statistics	Foreign = 0	Foreign = 1	t-statistics	Foreign = 0	Foreign = 1	t-statistics
MES	1.75	3.51	-13.05***	0.77	1.62	-6.15***	2.27	4.41	-11.01***	2.22	4.48	-8.09***
SRisk	0.59	20.46	-10.67***	0.43	9.73	-4.86***	0.75	25.15	-7.85***	0.51	26.88	-5.72***
ΔCoVaR	1.5	2.51	-10.78***	0.85	1.42	-4.7***	2.11	3.16	-7.86***	1.28	2.8	-8.54***
PD	0.02	0.04	-2.79***	0	0	1.20	0.03	0.04	-2.79***	0.05	0.07	-1.49*
Tail-beta	0.61	1.22	-12.08***	0.45	0.95	-5.70***	0.71	1.33	-9.09***	0.66	1.4	-6.32***
TA	1.70E+08	2.90E+08	-1.19	2.01E+04	1.40E+08	-2.13**	2.25E+04	4E+05	-8.34***	7.70E+08	1.10E+09	-0.70
Size (log TA)	-4.82	-2.01	-26.95***	-5.02	-2.2	-15.49***	-4.81	-1.85	-19.89***	-4.54	-2.04	-10.56***
Leverage (%)	11.06	6.06	16.54***	11.83	6.04	10.20***	10.91	6.24	10.64***	10.17	5.72	7.57***
Deposits (%)	54.59	43.38	9.08***	54.1	42.29	5.52***	54.46	44.3	5.65***	55.61	43.18	4.49***
Diversification (%)	27.4	28.53	-1.44*	29.19	30.51	-1.06	26.56	25.6	0.80	26.35	31.41	-2.99***
Loans (%)	74.21	67.25	6.51***	73.52	64.8	4.64***	75.91	69.35	4.34***	71.81	66.71	2.11**
Efficiency (%)	42.62	41.81	0.89	40.79	39.36	0.96	42.81	41.85	0.69	45.06	45.33	-0.14
ROA (%)	0.73	0.37	4.73***	1.44	0.86	5.80***	0.5	0.19	3***	0.11	0.02	0.50

We display in Table 3.5 the correlation matrix for all variables on the whole 2005–2013 period. However, because the variables of internationalization are observable only for bank with a presence abroad, the correlation test indicates a strong collinearity between *Nb_Host*, *Nb_Subsidiaries*, *NbRegions_Sub*, and *GeoComplex**S*** and the dummy variable *Foreign*. We hence omit Foreign. The correlation matrix suggests that there is a structural reason why some banks become large, with lower capital, more non-interest activities, and more systemic risk at the same time. Yet, from the test statistics and variance inflation factor (VIF), we find no additional collinearity issues that would prevent us from using all the variables simultaneously in the regressions.

Table 3.5 – Correlation Matrix

	Nb_Host	**Nb_Subsidiaries**	**NbRegions_Sub**	**GeoComplexS**	MES	SRisk	ΔCoVaR	PD	Tail-beta
Nb_Host	1								
Nb_Subsidiaries	0.82	1							
NbRegions_Sub	0.86	0.69	1						
GeoComplexS	0.64	0.43	0.87	1					
MES	0.16	0.04	0.19	0.22	1				
SRisk	0.71	0.58	0.65	0.50	0.35	1			
ΔCoVaR	0.05	-0.01	0.05	0.06	0.65	0.17	1		
PD	0.04	-0.01	-0.01	-0.02	0.48	0.16	0.36	1	
Tail-beta	0.26	0.10	0.26	0.28	0.67	0.25	0.43	0.39	1
Crisis08_11	-0.04	-0.03	-0.02	-0.03	0.36	0.10	0.45	0.12	0.14
Size (log TA)	0.59	0.40	0.61	0.57	0.40	0.47	0.30	0.23	0.38
Leverage (%)	-0.30	-0.24	-0.29	-0.23	-0.04	-0.24	0.05	-0.20	-0.08
Deposits (%)	-0.37	-0.28	-0.40	-0.33	-0.01	-0.30	0.10	-0.08	-0.05
Diversification	0.30	0.23	0.30	0.24	0.03	0.27	-0.15	0.01	0.06
Loans (%)	-0.50	-0.45	-0.47	-0.39	-0.02	-0.42	0.09	-0.01	-0.11
Efficiency (%)	0.06	0.01	0.04	0.01	0.13	0.22	-0.08	-0.04	0.04
ROA (%)	0.02	0.03	0.05	0.06	-0.31	-0.11	-0.11	-0.35	-0.18

	Crisis 08_11	Size (log TA)	Leverage (%)	Deposits (%)	Diversification (%)	Loans (%)	Efficiency (%)	ROA (%)
Crisis08_11	1							
Size (log TA)	0.08	1						
Leverage (%)	0.06	-0.30	1.00					
Deposits (%)	0.06	-0.30	0.46	1				
Diversification	0.04	-0.21	0.10	-0.18	1			
Loans (%)	-0.21	-0.01	0.33	0.52	-0.28	1		
Efficiency (%)	0.12	-0.18	0.10	0.03	0.55	-0.20	1	
ROA (%)	0.01	-0.31	0.52	0.19	0.23	-0.01	-0.15	1

3.4.2. *Regression results*

We first examine the effect of five international and foreign complexity indicators on the estimated measures of systemic risk of listed European banks depending on the state and soundness of the banking industry after controlling for bank-level characteristics[60]. Specifically, we determine whether the relationship between bank international activities and systemic risk is different during the financial and sovereign debt crises and at the later stage of the financial crises. We also investigate the effect of other measures of foreign organizational strategies on listed banks systemic risk over the 2011–2013 period.

3.4.2.1 Effect of bank internationalization and complexity on systemic risk

In Table 3.6, we examine for a sample of listed European banks over 2005-2013 period the effects of five foreign complexity measures: presence abroad with subsidiaries (Foreign), number of host countries around the world (Nb_Host), number of subsidiaries (Nb_Subsidiaries), number of regions where the foreign subsidiaries are located (NbRegions_Sub), and geographical complexity index (GeoComplex**S**) on the bank risk measures that generate systemic effect: MES (columns (1a)–(5a)), SRisk (columns (1b)–(5b)), and ΔCoVaR (columns (1c)–(5c)).

Before the crisis (2005–2007), banks with a foreign presence have a significantly lower systemic risk (MES (1a), SRisk (1b), and ΔCoVaR (1c)). These results are consistent with the arguments that geographic expansion lowers risk by reducing exposure to idiosyncratic local risks (Goetz et al. (2016), Carmassi and Herring (2016), Gropp, et al. (2010)). Moreover, while banks operating a network of foreign subsidiaries in many host countries around the world appear slightly less vulnerable to systemic event (MES (2a)), they display a higher and significant exposure to common shocks that affect the whole financial system (SRisk (2b)). Yet, given the absence of significance on ΔCoVaR (2c), the value of the stocks of such banks is not affected probably because the banks are not under distress. Then, looking at the affiliates dispersion, our results indicate that the growth of the number of subsidiaries and the widespread in different world regions are positively and slightly significantly (at a 10% level) associated with SRisk only (columns (3b) and (4b)) and bear zero impact on the other measures. The coefficients accounting for the influence of the Herfindhal index of geographic

[60] Our study provides an analysis of the effect of foreign bank affiliates and international complexity on the European banking industry systemic risk. Although we picture great changes in cross-border operations through the data collected, we do not analyze the drivers of those changes. In a further research, we aim to go beyond the scope of what we did and question the different factors likely to explain the transformation of multinational banks' organizational networks.

complexity and diversity of the bank's subsidiaries around the different world regions indicate no significance on all three risk measures. Globally, these findings imply that during the normal times before the crisis, the internationalization of banks either decrease the contribution of a bank to the system-wide stress or increase a bank capital expected shortfall when domestic and foreign markets are financially stable. We also investigate the previous relationships in times of financial distress and in the aftermath. Our results reveal that relatively to the pre-crisis (2005–2007) period, the effect of bank internationalization and foreign complexity on listed banks systemic risk are either reversed or amplified during the global financial crisis and sovereign debt crisis years (2008–2011). When significant, the Wald test indicates that while the effect of internationalization and complexity on MES and ΔCoVaR are reversed during the 2008–2011 crisis ($\alpha_1+\beta_1$ carries the same positive sign as β_1 and opposite to α_1), the effect on SRisk is aggravated ($\alpha_1+\beta_1$ carries the same positive sign as α_1 and β_1). Looking at the post-crisis period (2012–2013), the effects observed during the crises continue to stand and are globally greater in intensity and significance. For the three risk measures, all Wald tests ($\alpha_1+\beta_2$) are positive and significant (from a 10% level to a 1% level) and display a similar pattern of signs as ($\alpha_1+\beta_1$).

Comparing both sets of Wald tests on a statistical axis, the extent of the effect is more sizable in the post-crisis years (2012–2013). The "normal" and expected increase of the bank systemic risk due to financial distress is long-lived. Probably, during the post-crisis years, banks, central banks, and banking regulators are in the process of changing their behavior, are recovering from the losses of the previous years, and are subject to various macroeconomic policies (fiscal, monetary, and Basel, among others). Hence, the continued increase of the systemic risk and downfall of the financial system.

Regardless of the periods, the economic relevance of the result of listed banks internationalization and complexity is considerable. A bank growing its structure from not operating foreign subsidiaries (*Foreign = 0*) to having a presence abroad with subsidiaries (*Foreign = 1*) decreases the MES by 49% of its mean. Before the financial turmoil, a one standard deviation increase in the number of host countries around the world (i.e., a 1.40 unit increase in *Nb_Host*) would increase the SRisk by 95% of its mean.

On the whole, internationalization and foreign complexity appear to be an important driver of bank systemic risk, specifically over the crisis times and the post-crisis period. However, our results show that across the calm period, bank foreign complexity contributed

to increase the capital shortfall capacity against a systemic risk event, without increasing the bank systemic risk exposure.

Regarding the control variables, most of them carry the signs obtained in previous studies. Not surprisingly, the coefficients of both the acute crises dummy and the post-crises dummy show an increase in the MES. Bank size has a positive and statistically significant effect on the MES. It is a factor that drives systemic risk exposure and not the capital shortfall. With respect to share of loans in total assets, coefficient shows that the MES is negatively associated with loans/assets ratio, while the coefficient related to the share of noninterest income in total income shows a significant increase in the MES. Return on assets has a negative and significant effect on both systemic risks, indicating that higher bank profitability is associated with less systemic risk.

Table 3.6 – Effect of the internationalization of bank on systemic risk

This table displays the results of the estimation of Eq. (1) regarding the effects of bank internationalization on listed banks systemic risk over the 2005–2013 period. *MES* = Marginal Expected Shortfall, marginal participation of a bank to the Expected Shortfall (ES) of the financial system, a measure of bank equity sensitivity to market crashes; *SRisk* = Systemic risk, expected capital shortfall; Δ*CoVaR* = Conditional Value-at-Risk of a bank to an entire financial system or benchmark/reference market conditional on an extreme event leading to the fall of a bank stock return beyond its critical threshold level. *Foreign* = a dummy that takes the value one when the listed bank owns at least one subsidiary abroad ; *Nb_Host* = continuous variable that accounts the number of host countries of the foreign subsidiaries ; *Nb_Subsidiaries* = natural logarithm of the continuous variable that accounts the exact number of foreign subsidiaries a listed bank operate abroad ; *NbRegions_Sub* = the number of regions where all foreign subsidiaries are located ; *GeoComplex**S*** = the geographic complexity indicator of the dispersion of all subsidiaries in different world regions ; Crisis08_10 is a dummy equal to one if the year is 2008, 2009,2010, or 2011, and zero otherwise ; Post12_13 is a dummy equal to one if the year is 2012 or 2013, and zero otherwise ; *Size (log TA)* = natural logarithm of the total assets ; *Leverage (%)* = ratio of total equity to total assets ; *Deposits (%)* = ratio of customer deposits to total assets ; *Diversification (%)* = ratio of noninterest income to total income ; *Loans (%)* = ratio of net loans to total assets ; *Efficiency (%)* = cost to income ratio defined as non-interest expense divided by total income ; *ROA (%)* = return on assets is the ratio of net income to total assets. We use the Ordinary Least Square (OLS) model and the robust adjusted standard error are reported in parentheses. Variables were winsorized at 1% and 99% levels to limit the influence of extreme values. *** , **, and * indicate significance of the p-value respectively at the 1%, 5%, and 10% levels.

	MES	SRisk	Δ CoVaR	MES	SRisk	Δ CoVaR	MES	SRisk	Δ CoVaR	MES	SRisk	Δ CoVaR	MES	SRisk	Δ CoVaR
	(1a)	**(1b)**	**(1c)**	**(2a)**	**(2b)**	**(2c)**	**(3a)**	**(3b)**	**(3c)**	**(4a)**	**(4b)**	**(4c)**	**(5a)**	**(5b)**	**(5c)**
Foreign (α_1)	-0.969***	-10.06*	-0.462***												
	(-3.82)	(-1.79)	(-3.06)												
Foreign*Crisis08_11 (β_1)	1.476***	15***	0.386*												
	(6.78)	(3.48)	(1.84)												
Foreign*Post12_13 (β_2)	1.592***	17.16***	0.834**												
	(5.80)	(3.60)	(2.69)												
Nb_Host (α_1)				-0.017*	0.678***	0.004									
				(-2.02)	(3.27)	(0.31)									
Nb_Host*Crisis08_11 (β_1)				0.034**	1.543***	0.005									
				(2.81)	(8.15)	(0.63)									
Nb_Host*Post12_13 (β_2)				0.056***	1.415**	0.019									
				(5.93)	(2.82)	(1.34)									
Nb_Subsidiaries (α_1)							-0.038	8.050*	0.165						
							(-0.37)	(2.05)	(1.44)						
Nb_Subsidiaries*Crisis08_11 (β_1)							0.379***	10.50***	0.069						
							(3.91)	(3.70)	(0.90)						
Nb_Subsidiaries*Post12_13 (β_2)							0.497**	15.11***	0.334***						
							(2.38)	(4.26)	(3.18)						
NbRegions_Sub (α_1)										-0.035	4.190*	0.066			
										(-0.48)	(2.11)	(0.94)			
NbRegions_Sub*Crisis08_11 (β_1)										0.192*	7.879***	0.010			
										(2.13)	(3.93)	(0.17)			
NbRegions_Sub*Post12_13 (β_2)										0.343***	8.086***	0.098			
										(3.91)	(3.09)	(1.35)			
GeoComplexS (α_1)													0.118	0.326	0.466
													(0.20)	(0.05)	(1.13)
GeoComplexS*Crisis08_11 (β_1)													0.911	36.56**	0.049
													(1.20)	(2.72)	(0.12)
GeoComplexS*Post12_13 (β_2)													1.780**	39.17***	0.120
													(2.19)	(3.31)	(0.28)
Crisis08_11	1.152***	-1.563	1.131***	1.980***	-2.580	1.367***	1.708***	-3.768	1.411***	1.850***	-9.515*	1.439***	2.114***	-0.189	1.442***
	(5.62)	(-0.99)	(4.87)	(5.96)	(-0.84)	(7.87)	(4.55)	(-0.82)	(7.14)	(3.85)	(-1.98)	(6.84)	(4.55)	(-0.05)	(6.72)
Post12_13	1.034***	-5.369***	0.484**	1.695***	1.855	1.035***	1.680**	-1.838	0.875**	1.414**	-8.111*	0.937**	1.784**	-2.090	1.153***

	(4.51)	(-3.31)	(2.47)	(3.72)	(0.46)	(4.42)	(2.69)	(-0.38)	(2.99)	(2.69)	(-1.87)	(2.94)	(2.99)	(-0.49)	(3.73)
Size	0.422***	9.985***	0.237***	0.526***	4.570	0.223***	0.401***	2.059	0.073	0.468***	5.605**	0.195***	0.487***	11.23***	0.228***
	(3.87)	(3.81)	(6.12)	(4.87)	(1.64)	(5.36)	(3.51)	(1.15)	(1.22)	(5.09)	(2.32)	(5.74)	(7.44)	(3.06)	(9.86)
Leverage	-1.918	42.44	-1.496	-0.427	22.88	-6.558	0.547	91.93	-6.311	-0.265	32.48	-6.556*	-0.754	45.26	-6.196
	(-0.92)	(1.29)	(-1.49)	(-0.10)	(0.28)	(-1.66)	(0.14)	(0.84)	(-1.67)	(-0.06)	(0.29)	(-1.79)	(-0.20)	(0.35)	(-1.58)
Deposit	0.148	14.19	0.259	-0.597	-7.826	-0.254	-0.295	-5.457	0.120	-0.250	-4.335	0.028	-0.352	-8.557	0.003
	(0.25)	(1.02)	(0.76)	(-0.54)	(-0.48)	(-0.34)	(-0.28)	(-0.36)	(0.16)	(-0.23)	(-0.27)	(0.04)	(-0.31)	(-0.35)	(0.00)
Diversification	2.464**	20.36	0.432	0.675	-17.48	-0.617	0.172	-16.76	-0.575	0.121	-23.15	-0.651	-0.085	-15.92	-0.709
	(2.64)	(0.84)	(0.61)	(0.49)	(-0.54)	(-0.55)	(0.13)	(-0.59)	(-0.51)	(0.09)	(-0.81)	(-0.54)	(-0.06)	(-0.49)	(-0.60)
Loans	-0.798**	-32.49***	-0.507	-0.123	-0.550	0.464	0.217	02	0.770	0.176	-3.163	0.588	0.297	-15.24	0.490
	(-2.20)	(-4.28)	(-1.37)	(-0.24)	(-0.02)	(0.64)	(0.45)	(0.00)	(1.45)	(0.37)	(-0.10)	(0.89)	(0.60)	(-0.38)	(0.69)
Effeciency	-0.268	36.45	-0.843	0.751	34.88	-0.380	1.379	49.63	-0.316	1.338	46.60	-0.027	1.688	68.39	0.154
	(-0.22)	(1.63)	(-0.97)	(0.46)	(1.09)	(-0.29)	(0.86)	(1.39)	(-0.23)	(0.97)	(1.62)	(-0.02)	(1.26)	(1.68)	(0.12)
ROA	-11.40	-135.6	21.63*	-28.37**	-13.64	18.80	-29.61*	-190.6	8.680	-31.59*	-102.2	10.16	-28.32*	-16.29	11.67
	(-1.54)	(-1.71)	(1.94)	(-2.55)	(-0.06)	(0.85)	(-1.79)	(-1.03)	(0.50)	(-2.14)	(-0.50)	(0.58)	(-2.08)	(-0.08)	(0.65)
Constant	-3.780**	-100.0**	0742	-5.486***	-58.03	-0.320	-4.892***	-53.52	0.452	-5.315***	-68.93	-0.472	-5.701***	-118.3*	-0.750
	(-2.72)	(-2.55)	(0.01)	(-3.51)	(-1.55)	(-0.57)	(-3.15)	(-1.47)	(0.81)	(-3.97)	(-1.72)	(-0.81)	(-5.07)	(-1.93)	(-1.10)
N	784	784	784	394	394	394	382	382	382	382	382	382	382	382	382
R-squared	0.652	0.549	0.464	0.658	0.786	0.448	0.671	0.751	0.496	0.668	0.758	0.473	0.667	0.678	0.468
Adjusted R-squared	0.640	0.534	0.445	0.635	0.772	0.410	0.647	0.734	0.461	0.645	0.741	0.436	0.644	0.656	0.431
Wald tests: $\alpha_1 + \beta_1$	0.51*	4.94	-0.08	0.02**	2.22***	0.01	0.34**	18.55***	0.24**	0.16*	12.07***	0.085	1.03	36.89**	0.52**
$\alpha_1 + \beta_2$	0.62*	7.10*	0.37*	0.04***	2.09***	0.02*	0.46*	23.16***	0.50***	0.3**	12.28***	0.16***	1.90**	39.50***	0.59***

3.4.2.2. Exploration of alternative systemic risk measures

For deeper insights, we investigate the effect of bank internationalization and how the large period marked by both the global financial crisis and the sovereign debt crises might have affected the different relationships. For simplicity and a better readability of Table 3.7, we regroup and comment the results by our different variables of interest instead by the risk measures. While banks present abroad with subsidiaries face lower probability of default (PD) before the period of crisis (negative α_1), the relation is reversed during the crisis (positive β_1) and this effect is statistically worsened in the aftermath of the crisis (positive and higher β_2). In these years after the crises, the impact on the Tail-beta also becomes significant (positive β_2). For this set of regressions, the Wald tests ($\alpha_1+\beta_1$) only indicate an increase of the sensitivity to extreme movements (Tail-beta) whereas ($\alpha_1+\beta_2$) points to an increase of both PD and Tail-beta. Regarding the four other indicators of bank internationalization and foreign complexity (*Nb_Host*, *NbSubsidiairies*, *NbRegions_Sub*, and *GeoComplex**S***), we only observe lower risk (PD) before the crisis (2005–2007) for banks in many host countries and a slightly significant (at a 10% level) increase of the sensitivity of geographic complex banks to the extreme movements of the financial markets (Tail-beta). Also, for all variables, our findings globally signal higher financial instability during both crises (2008–2011) and post-crises (2012–2013) periods. All significant Wald tests ($\alpha_1+\beta_1$ and $\alpha_1+\beta_2$) point to higher bank risk and thus, greater banking fragility. Regarding the bank financial characteristics, we observe in all estimation highly profitable banks are the less risky ones. Albeit a lost in the significance of most coefficients, the rest of control variables globally portray the same impact as what can be seen in Table 3.6.

Table 3.7 – Effect of the internationalization of banks on alternative systemic risk measures

This table displays the results of the estimation of Eq. (1) regarding the effects of bank internationalization on listed banks systemic risk over the 2005–2013 period. *PD* = Probability of default; *Tail-beta* = quantile-beta, a measure of the sensitivity to extreme movements of beta. *Foreign* = a dummy that takes the value one when the listed bank owns at least one subsidiary abroad ; *Nb_Host* = continuous variable that accounts the number of host countries of the foreign subsidiaries ; *Nb_Subsidiaries* = natural logarithm of the continuous variable that accounts the exact number of foreign subsidiaries a listed bank operate abroad ; *NbRegions_Sub* = the number of regions where all foreign subsidiaries are located ; *GeoComplex**S*** = the geographic complexity indicator of the dispersion of all subsidiaries in different world regions ; *Crisis08_10* is a dummy equal to one if the year is 2008, 2009,2010, or 2011, and zero otherwise ; *Post12_13* is a dummy equal to one if the year is 2012 or 2013, and zero otherwise ; *Size (log TA)* = natural logarithm of the total assets ; *Leverage (%)* = ratio of total equity to total assets ; *Deposits (%)* = ratio of customer deposits to total assets ; *Diversification (%)* = ratio of noninterest income to total income ; *Loans (%)* = ratio of net loans to total assets ; *Efficiency (%)* = cost to income ratio defined as non-interest expense divided by total income ; *ROA (%)* = return on assets is the ratio of net income to total assets. We use the Ordinary Least Square (OLS) model and the robust adjusted standard error are reported in parentheses. Variables were winsorized at 1% and 99% levels to limit the influence of extreme values. ***, **, and * indicate significance of the p-value respectively at the 1%, 5%, and 10% levels.

	PD (1d)	Tail- (1e)	PD (2d)	Tail- (2e)	PD (3d)	Tail- (3e)	PD (4d)	Tail- (4e)	PD (5d)	Tail- (5e)
Foreign (α_1)	-2.378**	0.108								
	(-2.83)	(0.88)								
Foreign*Crisis08_11 (β_1)	3.174***	0.167								
	(3.92)	(1.56)								
Foreign*Post12_13 (β_2)	4.312***	0.355**								
	(3.25)	(2.27)								
Nb_Host (α_1)			-0.041**	05						
			(-2.40)	(1.25)						
Nb_Host*Crisis08_11 (β_1)			0.122***	02						
			(3.99)	(0.51)						
Nb_Host*Post12_13 (β_2)			0.129***	0.013**						
			(4.51)	(2.47)						
Nb_Subsidiaries (α_1)					-0.149	0.046				
					(-0.57)	(1.67)				
Nb_Subsidiaries*Crisis 08_11 (β_1)					1.188***	0.018				
					(5.86)	(0.36)				
Nb_Subsidiaries*Post1 2_13 (β_2)					1.169**	0.086**				
					(2.93)	(2.41)				
NbRegions_Sub (α_1)							-0.208	0.036		
							(-1.38)	(1.39)		
NbRegions_Sub*Crisis 08_11 (β_1)							0.578***	07		
							(3.18)	(0.31)		
NbRegions_Sub*Post1 2_13 (β_2)							0.290	0.049		
							(0.65)	(1.12)		
GeoComplex**S** (α_1)									-0.802	0.377*
									(-0.58)	(1.78)
GeoComplex**S***Crisis08 _11 (β_1)									2.865	0.086
									(1.66)	(0.48)
GeoComplex**S*** Post12_13 (β_2)									0.452	0.290
									(0.15)	(0.91)
Crisis08_11	-0.041	0.078	1.155	0.180**	0.400	0.168	0.914	0.166	1.667	0.160*
	(-0.09)	(0.88)	(1.44)	(2.11)	(0.55)	(1.28)	(0.83)	(1.59)	(1.54)	(1.68)
Post12_13	-0.049	-0.061	1.779	0.0625	1.680	0.086	2.539	0.042	3.237	0.076
	(-0.09)	(-0.52)	(1.11)	(0.50)	(1.03)	(0.70)	(1.01)	(0.27)	(1.43)	(0.57)
Size	0.051	0.124***	0.167	0.123***	-0.0954	0.119**	0.329	0.129***	0.406*	0.123***
	(0.25)	(4.06)	(0.69)	(2.75)	(-0.39)	(2.86)	(1.52)	(3.22)	(2.00)	(3.81)
Leverage	-2.640	0.629	-28.38	1.448	-33.15	1.890	-29.06	1.588	-26.81	1.349
	(-0.54)	(0.92)	(-1.35)	(0.97)	(-1.60)	(1.04)	(-1.43)	(1.12)	(-1.36)	(1.00)
Deposit	-2.225	-0.114	-1.788	-0.404	-1.571	-0.373	-1.735	-0.377	-1.905	-0.361
	(-1.20)	(-0.53)	(-0.58)	(-1.22)	(-0.52)	(-0.93)	(-0.54)	(-1.11)	(-0.60)	(-1.11)
Diversification	5.517	0.679**	4.402	0.546	3.535	0.519	3.255	0.474	31	0.416
	(1.61)	(2.38)	(0.66)	(1.63)	(0.55)	(1.28)	(0.51)	(1.34)	(0.46)	(1.19)
Loans	-1.509	-0.402**	-0.641	-0.155	0.224	-0.158	-0.620	-0.145	-0.696	-0.126
	(-0.97)	(-2.14)	(-0.55)	(-0.59)	(0.16)	(-0.55)	(-0.50)	(-0.58)	(-0.50)	(-0.55)
Efficiency	-6.154	-0.119	-7.717	0.0256	-6.281	0.164	-5.309	0.154	-4.707	0.164
	(-1.69)	(-0.39)	(-1.39)	(0.07)	(-1.19)	(0.39)	(-1.12)	(0.42)	(-0.95)	(0.47)
ROA	-229.6***	-5.772	-329.2***	-16.40**	-308.0***	-18.09***	-301.0***	-18.15**	-297.6***	-17.89**
	(-3.06)	(-1.54)	(-5.41)	(-2.32)	(-5.04)	(-3.61)	(-5.13)	(-2.66)	(-5.03)	(-2.63)
Constant	5.461**	-0.837**	5.475*	-0.799*	7.069***	-0.856	3.265	-0.898**	1.937	-0.805**
	(2.58)	(-2.45)	(2.11)	(-1.84)	(3.22)	(-1.64)	(1.75)	(-2.27)	(1.01)	(-2.24)

N		776	784	390	394	378	382	378	382	378	382
R-squared		0.431	0.463	0.499	0.475	0.483	0.463	0.469	0.466	0.466	0.478
Adjusted R-squared		0.411	0.445	0.464	0.439	0.446	0.425	0.431	0.428	0.428	0.442
Wald tests:	$\alpha_1+\beta_1$	0.80	0.28***	1.18**	0.01	1.73***	0.06	0.37**	0.04	2.06	0.46***
	$\alpha_1+\beta_2$	1.94**	0.46***	1.25**	0.02***	1.02**	0.13***	0.08	0.09**	-0.35	0.67***

3.4.2.3. Deeper investigation: impact of foreign organizational complexity on systemic risk

To conduct an additional analysis, we focus on the 2011–2013 window and, instead of using the number of subsidiaries as a measure of complexity, we build three dummies that more precisely map more precisely the different foreign affiliates' strategies banks have established abroad on that period of study. In fact, because of the limited availability of data on branches we were only able to hand-collect such data from the SNL database[61] as of end of 2013. Following the same logic, we did for foreign subsidiaries; we apply the information of the year 2013 to 2012 and 2011. Considering our global sample of listed 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 operates a network of foreign branches only (at least one foreign branch and no foreign subsidiary) and zero otherwise, and $Bank\_BS_i$ takes the value one when the bank has a foreign network with both foreign subsidiary and branch, and zero if not. Note that a branch is an extension of the parent bank which undergoes the parent home country supervision and all its activities are accounted for by the parent bank.

In Table 3.8, we present this complementary aspect of complexity as we look more closely at the impact of the foreign organizational choice of affiliates on the listed bank systemic risk.. We replace the three dummy variables in the vector of variables of interest $International_{i,t}$ in Eq. (1) and we estimate the new model:

$$Risk_{i,j,t} = \alpha_0 + International_{i,t} + \varphi Financial_{i,t-1} + \omega_j + \varepsilon_{ij,t} \quad (11)$$

Where $Risk_{i,j,t}$ represents systemic risk measures MES and SRisk of the publicly traded bank i in country j over the year t. $International_{i,t}$ corresponds to the three dummies representing penetration strategies: $Bank\_S_i$, $Bank\_B_i$, and $Bank\_BS_i$. We include the same set of bank control variables as in Eq. (1).

[61] SNL only provides data on branches for the latest accounting exercise. Unfortunately, since we lost our access to the database in 2014 and were not able to find additional as detailed data elsewhere, the sample of branches is limited to the year 2013.

The results show that while on the whole establishing a network of branches exclusively is significantly negatively associated with the marginal expected shortfall of multinational listed bank, there is no impact on SRisk. In contrast, owning foreign subsidiaries produce an opposite effect as it is ineffective on the bank MES and slightly negatively affects SRisk (at a 10% level of significance). However, we do not find any impact on the systemic risk of banks that set up the more complex foreign organizational model of both subsidiaries and branches.

Table 3.8 – Effect of foreign organizational complexity (branches and subsidiaries) on listed banks systemic risk – 2011–2013

This table displays the results of the estimation of Eq. (11) regarding the effects of bank internationalization and organizational complexity on listed banks systemic risk over the 2011-2013 period. *MES* = Marginal Expected Shortfall, marginal participation of a bank to the Expected Shortfall (ES) of the financial system, a measure of bank equity sensitivity to market crashes; *SRisk* = Systemic risk, expected capital shortfall. *Foreign* = a dummy that takes the value one when the listed bank owns at least one subsidiary abroad ; *Nb_Host* = continuous variable that accounts the number of host countries of the foreign subsidiaries ; *Nb_Subsidiaries* = natural logarithm of the continuous variable that accounts the exact number of foreign subsidiaries a listed bank operate abroad ; *NbRegions_Sub* = the number of regions where all foreign subsidiaries are located ; *GeoComplex**S*** = the geographic complexity indicator of the dispersion of all subsidiaries in different world regions ; *Crisis08_10* is a dummy equal to one if the year is 2008, 2009,2010, or 2011, and zero otherwise ; *Post12_13* is a dummy equal to one if the year is 2012 or 2013, and zero otherwise ; *Size (log TA)* = natural logarithm of the total assets ; *Leverage (%)* = ratio of total equity to total assets ; *Deposits (%)* = ratio of customer deposits to total assets ; *Diversification (%)* = ratio of noninterest income to total income ; *Loans (%)* = ratio of net loans to total assets ; *Efficiency (%)* = cost to income ratio defined as non-interest expense divided by total income ; *ROA (%)* = return on assets is the ratio of net income to total assets. We use the Ordinary Least Square (OLS) model and the robust adjusted standard error are reported in parentheses. Variables were winsorized at 1% and 99% levels to limit the influence of extreme values. ***, **, and * indicate significance of the p-value respectively at the 1%, 5%, and 10% levels.

	MES			SRisk		
	(1a)	**(2a)**	**(3a)**	**(1b)**	**(2b)**	**(3b)**
Bank_S	0.192			-8.740*		
	(0.56)			(-1.95)		
Bank_B		-1.260**			0.753	
		(-2.72)			(0.18)	
Bank_BS			-0.233			11.84
			(-0.49)			(1.32)
Size (logTA)	0.580***	0.585***	0.615***	13.68***	13.63***	11.90***
	(4.48)	(4.54)	(3.90)	(4.23)	(4.32)	(5.04)
Leverage	0.679	0.361	0.412	97.44	109.7	109.6
	(0.19)	(0.11)	(0.12)	(1.55)	(1.72)	(1.71)
Deposits	1.139	1.297*	1.162	33.61	34.77*	32.29
	(1.61)	(1.84)	(1.64)	(1.60)	(1.78)	(1.71)
Diversification	3.228**	3.096**	3.153**	29	30.01	32.70
	(2.39)	(2.25)	(2.36)	(0.66)	(0.73)	(0.80)
Loans	-1.358*	-1.247*	-1.439**	-19.25	-22.44	-14.78
	(-2.03)	(-1.98)	(-2.32)	(-1.36)	(-1.66)	(-1.28)
Efficiency (CIR)	-0.716	-0.582	-0.692	68.26**	68.02**	67.05**
	(-0.58)	(-0.51)	(-0.56)	(2.41)	(2.23)	(2.45)
ROA	-27.33***	-26.13***	-26.48***	-346.8***	-384.0***	-385.6***
	(-3.75)	(-3.86)	(-3.87)	(-4.31)	(-4.47)	(-4.50)

Constant	-4.515**	-4.453**	-4.609**	-174.1***	-175.7***	-169.1***
	(-2.56)	(-2.66)	(-2.56)	(-3.33)	(-3.31)	(-3.40)
N	294	294	294	294	294	294
R-squared	0.720	0.724	0.720	0.620	0.613	0.620
Adjusted R-squared	0.698	0.701	0.697	0.589	0.581	0.589

3.5. Robustness checks

In this section, we perform additional regressions to check for the robustness and the validity of our main results obtained in Section 3.4.2.

First, we decompose the timeline dummy of crisis that covers the 2008 to 2011 large period of global economic instability into two other dummies Fin08_09 and Sov10_11 to capture more precisely the individual effect of the acute years of the global financial crisis and the sovereign debt crisis, respectively. We introduce both dummy variables in the regressions (by augmenting Eq.(1) by these two binary variables) and analyze the influence on the individual bank systemic risk. With the exception of the negative relationship between *Sov10_11* and *SRisk* in the regression where the variable of interest assesses the presence abroad with subsidiaries or not i.e. Foreign, the effects of *Fin08_09* and *Sov10_11* mirror *Crisis08_11* in sign and significance. Also, considering all interacted terms, the results of Wald tests align with the baseline. Globally, regardless of the definition or type or timeline of the crisis, shocks increase the systemic risk of publicly trade banks with international operations and geographic complex structure. The rest of results are consistent with the main findings.

Second, as the sovereign debt crisis strongly affected the Euro Area[62], we only consider listed banks from each of the Euro Area countries and run the regression on that sub-sample. Overall, our main results remain unchanged.

Third to make sure that using lagged variables did not affect our results, we consider each control variables at time *t* and the estimated coefficients from these regressions are consistent with the previous findings.

[62] 11 of the 15 countries in the whole sample are part of the Euro Area. We keep banks from Austria (6), Finland (2), France (18), Germany (7), Greece (6), Ireland (1), Italy (17), Portugal (2), Slovakia (2), and Spain (6).

3.6. Conclusion

The objective of this study is to empirically investigate whether the internationalization and geographic complexity of listed banks affect the systemic risk and how both the global financial crisis and the European sovereign debt crisis might have modified the existing relationship. For this purpose, we construct a data set on banks' network of foreign affiliates and systemic risk measures of 105 publicly traded banks headquartered in 15 European countries from 2005 to 2013. Specifically, we question the impact of owning foreign subsidiaries, having a wide presence in many host countries and different world regions, and the geographic dispersion of all the subsidiaries around all the regions on bank stability in periods prior (2005–2007), during (2008–2013), and post (2012–2013) the aforementioned crises.

On the whole, our findings show that while operating a subsidiary abroad is associated with lower systemic risk in normal times, the impact is totally reversed when the banking system undergoes global shocks. Indeed, our results point to an increase in the fragility of international publicly traded banks during years of distress. A closer look at the period after both global financial and European sovereign debt crises indicates that just like during the crisis, the effect of the presence of a bank abroad was long lived with an even worse contribution to bank systemic risk. Moreover, we find that the relationship stands when we examine the impact of owning many subsidiaries, and spreading the foreign presence in different host countries and multiple world regions. These findings suggest that bank internationalization appears as a source of greater stability in calm periods but turns out to increase instability during the 2008–2011 crises. As listed banks are more affected by the changes on financial markets, expanding different affiliates in other markets increase the sensitivity of banks to multiple shocks relatively to banks that conduct domestic operations only.

Table 3.9 – Effect of bank internationalization on listed banks systemic risk – **Global Financial Crisis Fin08_09 and European Sovereign Debt Crisis Sov10_11**

	MES	SRisk	MES	SRisk	MES	SRisk	MES	SRisk	MES	SRisk
	(1a)	**(1b)**	**(2a)**	**(2b)**	**(3a)**	**(3b)**	**(4a)**	**(4b)**	**(5a)**	**(5b)**
Foreign (α_1)	-0.965***	-9.994*								
	(-3.80)	(-1.77)								
Foreign*Fin08_09 (β_1)	1.432***	16.22***								
	(4.10)	(3.02)								
Foreign*Sov10_11 (β_2)	1.543***	14***								
	(5.42)	(4.01)								
Foreign*Post12_13 (β_3)	1.578***	17.01***								
	(5.48)	(3.67)								
Nb_Host (α1)			-0.020**	0.676***						
			(-2.37)	(3.33)						
Nb_Host*Fin08_09 (β_1)			0.044**	1.734***						
			(2.59)	(13.09)						
Nb_Host*Sov10_11 (β_2)			0.018	1.329***						
			(1.25)	(4.10)						
Nb_Host*Post12_13 (β_3)			0.054***	1.404**						
			(5.27)	(2.71)						
ln(Nb_Subsidiaries) (α_1)					-0.076	8.107*				
					(-0.82)	(2.09)				
ln(Nb_Subsidiaries)*Fin08_09 (β_1)					0.454***	10.92***				
					(4.43)	(3.38)				
ln(Nb_Subsidiaries)*Sov10_11 (β_2)					0.223	10.08***				
					(1.52)	(3.76)				
ln(Nb_Subsidiaries)*Post12_13 (β_3)					0.461**	15.15***				
					(2.28)	(4.20)				
NbRegion_Sub (α1)							-0.053	4.097*		
							(-0.76)	(2.12)		
NbRegion_Sub*Fin08_09 (β_1)							0.283***	8.568***		
							(3.06)	(4.28)		
NbRegion_Sub*Sov10_11 (β_2)							0.073	7.023***		
							(0.63)	(3.35)		
NbRegion_Sub*Post12_13 (β_3)							0.330***	8.010***		
							(3.77)	(3.03)		
GeoComplex**S** (α_1)									0.100	-0.310
									(0.17)	(-0.05)
GeoComplex**S***Fin08_09 (β_1)									1.675**	38.28**
									(2.17)	(2.51)
GeoComplex**S***Sov10_11 (β_2)									0.135	34.09**
									(0.15)	(2.81)
GeoComplex**S***Post12_13 (β_3)									1.688*	38.40***
									(2.07)	(3.24)
Fin08_09	1.511***	1.047	2.207***	-3.939	1.809***	-4.945	1.915***	-9.786	2.209***	3.188
	(6.33)	(0.46)	(7.51)	(-1.30)	(5.22)	(-0.86)	(4.40)	(-1.72)	(5.28)	(0.68)
Sov10_11	0.762**	-4.404***	1.772***	-1.130	1.644***	-2.603	1.827***	-8.938*	1.997***	-3.841
	(2.31)	(-3.56)	(3.94)	(-0.35)	(3.43)	(-0.66)	(3.13)	(-2.11)	(3.60)	(-1.02)
Post12_13	0.976***	-5.894***	1.593***	1.773	1.583**	-1.710	1.333**	-8.479*	1.706**	-3.246
	(3.57)	(-3.47)	(3.12)	(0.46)	(2.37)	(-0.35)	(2.31)	(-1.91)	(2.69)	(-0.67)
Size (logTA)	0.438***	10.13***	0.568***	4.659	0.466***	1.986	0.511***	5.830**	0.515***	11.58**
	(4.16)	(3.81)	(5.24)	(1.61)	(4.59)	(1.15)	(5.39)	(2.24)	(7.68)	(2.99)

Leverage	-1.185	49.76	2.782	26.61	3.562	87.85	3.101	49.30	3.331	90.50
	(-0.65)	(1.57)	(0.56)	(0.29)	(0.82)	(0.77)	(0.66)	(0.39)	(0.82)	(0.60)
Deposits	0.182	14.38	-0.565	-8.056	-0.292	-5.402	-0.246	-4.335	-0.350	-8.388
	(0.28)	(1.06)	(-0.53)	(-0.49)	(-0.28)	(-0.35)	(-0.24)	(-0.27)	(-0.33)	(-0.35)
Diversification	2.841**	24.23	1.213	-16.38	0.579	-17.32	0.699	-19.96	0.433	-10.10
	(2.87)	(0.96)	(0.89)	(-0.50)	(0.48)	(-0.61)	(0.54)	(-0.68)	(0.32)	(-0.32)
Loans	-0.573	-30.18***	-0.135	0.495	0.135	0.234	0.154	-3.134	0.230	-15.92
	(-1.66)	(-3.93)	(-0.26)	(0.02)	(0.29)	(0.01)	(0.32)	(-0.10)	(0.44)	(-0.39)
Efficiency (CIR)	0.101	40.23	1.290	37.05	1.880	49.27	1.854	49.39	2.096	73.45
	(0.08)	(1.66)	(0.76)	(1.09)	(1.15)	(1.34)	(1.27)	(1.59)	(1.51)	(1.70)
ROA	-16.49**	-182.6*	-37.65**	-19.88	-38.36*	-180.7	-40.92**	-147.9	-38.53**	-143.5
	(-2.52)	(-2.02)	(-2.79)	(-0.08)	(-1.99)	(-0.93)	(-2.26)	(-0.60)	(-2.24)	(-0.62)
Constant	-4.355***	-105.7**	-6.340***	-60.89	-5.811***	-52.67	-6.175***	-73.61	-6.380***	-126.4*
	(-3.26)	(-2.50)	(-4.07)	(-1.52)	(-4.21)	(-1.44)	(-4.66)	(-1.69)	(-5.91)	(-1.92)
N	784	784	394	394	382	382	382	382	382	382
R-squared	0.663	0.554	0.671	0.789	0.681	0.751	0.683	0.759	0.683	0.682
Adjusted R-squared	0.651	0.538	0.647	0.773	0.656	0.732	0.658	0.741	0.659	0.658
Wald tests: $\alpha_1 + \beta_1$	0.47	6.23	0.02*	2.41***	0.38***	19.03***	0.23**	12.67***	1.78**	37.97**
$\alpha_1 + \beta_2$	0.58*	4.01	-0.00	0.03***	0.15	18.19***	0.00	11.12***	0.23	33.78**
$\alpha_1 + \beta_3$	0.61*	7.02*	0.03***	2.00***	0.39*	23.26***	0.28**	12.11***	1.79**	38.09***

Appendix 3.A – Definition of variables, Sources and summary statistics over 2005–2013

This table reports the descriptive of variables used in the paper for our sample of publicly traded banks over the whole period 2005-2013.

Variable Name	Definitions	Sources	Obs.	Mean	Std. Dev.	Min	Max
MES	Marginal Expected Shortfall, marginal participation of a bank to the Expected Shortfall (ES) of the financial system, a measure of bank equity sensitivity to market crashes (Equation 3).	Bloomberg	945	2.59	2.24	-1.64	9.63
SRisk	Systemic risk, expected capital shortfall (Equation 4).		945	10.09	30.25	-6.21	223.8
ΔCoVaR	Conditional Value-at-Risk of a bank to an entire financial system or benchmark/reference market conditional on an extreme event leading to the fall of a bank stock return beyond its critical threshold level (Equation 6).		945	1.98	1.51	-2.80	6.85
PD	Merton's probability of default (Equation 7)		936	0.03	0.07	0	0.57
Tail-beta	Measure of the sensitivity to extreme movements of beta, quantile-beta.		945	0.90	0.83	-1.57	3.17
Foreign	Dummy equal to one when the bank owns at least one foreign subsidiary, and zero if not	Bankscope	945	0.48	0.50	0	1
Nb_Host	Number of foreign countries where a bank has a foreign presence with subsidiary		452	11.29	14.40	1	63
Nb_Subsidiaries	Number of foreign subsidiaries per bank		452	24.98	53.38	0	378
NbRegions_Sub	Number of world regions where a bank has established its foreign subsidiaries, among eight world regions	World Bank	440	2.90	2.29	1	8
GeoComplex**S**	Indicator of the geographic dispersion of a bank foreign subsidiaries in different world regions.	Bankscope – World Bank	440	0.33	0.33	0	0.95
Size (log TA)	Natural logarithm of total assets (USD billion).	TRAA	945	-3.48	2.13	-8.18	0.16
Leverage (%)	Ratio of total equity to total assets, measure of leverage/bank capitalization	Bloomberg	945	8.67	5.27	0.78	44.82
Deposits (%)	Ratio of customer deposits to total assets	Bankscope – TRAA	927	49.23	19.58	5.69	91.43
Diversification (%)	Ratio of noninterest income to total income		927	27.94	11.93	1.06	66.54
Loans (%)	Ratio of net loans to total assets (%)		882	70.72	16.25	13.02	100
Efficiency (%)	Cost to income ratio = non-interest expense divided by total income		882	42.22	13.48	14.87	89.93
ROA (%)	Return on assets = ratio of net income to total assets		945	0.56	1.17	-4.58	5.85

GENERAL CONCLUSION

Over the last decades, the liberalization, deregulation, and globalization of financial systems have affected banking industries and European banks among the others. As financial systems are changing, the importance and role of banks in economies of different levels of economic development have risen and questioned the behavior and interconnectedness of all institutions. These processes call out the issues regarding the transformation into multinational banks, the increasing size and/or complexity of the networks of affiliates (branches and/or subsidiaries), the incentives to take more risk and exacerbated banking fragility, and the influence in both the domestic and the foreign markets. Therefore, the purpose of this dissertation is to analyze the determinants of bank internationalization and investigate the impact of the presence abroad on the parent bank's individual risk and its systemic influence. More precisely we focus on 1) the choice of a host country and a foreign organizational strategy given the banking regulation and the level of economic development of both the host and the home countries; 2) the effect of foreign organizational and geographic complexity on parent bank performance (i.e. risk and profitability), and 3) whether the influence of bank internationalization on systemic risk are affected by financial distress. This concluding chapter highlights the main findings and contributions of each of the three previous chapters and proposes some policy implications.

In the first chapter of this thesis, we investigate the determinants of foreign bank presence in developing countries as opposed to developed countries by focusing on the regulatory environment in both the home and the host countries. In addition, we look into why banks choose to build in a specific host country a network of a specific affiliate's type rather than another. In particular, we consider four banking regulation indexes that assess the entry requirements into the banking system, the restrictiveness in bank activities, the stringency of capital requirements, and the power of the supervisors. Our aim in chapter 1 is twofold. First, we determine countries' and banks' characteristics that influence the presence of banks in high-, middle-, or low-income foreign countries. Second, after controlling for the factors that explain the selection of a foreign location, we analyze the banks' presence in the host market with an exclusive business model of branches only or subsidiaries only or with a dual business model of both forms.

To this end, over the 2011–2013 period, we consider parent banks with an ultimate owner from the European Union and subsidiaries headquartered in the EU with their ultimate owner either in the EU or out of the EU. From the final sample of 1,251 banks of which 289 conduct foreign activities under 20,850 foreign affiliates hosted in 154 host countries at

different levels of economic development, the results show that both home country and host country regulations matter but in different ways. Low-income countries with stringent restrictions on bank activities are less likely to attract foreign entities; yet the likelihood increases when the barriers to entry are higher. In host countries where the capital regulatory index and official supervisory power are lower than at home, the incentives to operate foreign entities decrease. These findings suggest that in most host locations, rather than entering countries with lax regulation, banks prefer to expand in environments with more stringent regulatory and supervisory guidelines. Analyzing the financial characteristics of banks that operate foreign networks, retail-oriented banks are more likely to penetrate low-income countries than high-income countries. In less developed countries, banks probably expand to build up traditional deposit-taking operations but in mature markets, they rather expand when they are focused on wholesale banking services. Regarding the choice of a foreign organizational strategy, banks are more likely to run foreign branches rather than subsidiaries in both high-income and low-income countries that restrain banking activities. Yet, they establish both types of affiliates when they enter middle-income countries that limit their activities. Moreover, as strong entry restrictions are likely to favor subsidiary operations in all locations, branch activities are more common in middle-income and low-income countries with stringent capital requirements and greater supervisory power. As well, banks' business models also matter as retail-oriented banks operate subsidiaries only or both forms in high-income and middle-income host countries.

The second chapter is built on the little literature on the impact of bank foreign complexity on the parent bank individual risk and profitability. Complexity is a measure of how intricate is a network of different activities, and/or different legal entities, and/or in domestic or foreign markets, and/or exposed to different products. From the previous chapter database, we assemble a dataset of 825 commercial, cooperative, and savings banks from the European Union and empirically investigate whether the bank internationalization and the complexity of the foreign network of affiliates affect the bank performance across the 2011–2013 period. Specifically, we analyze what are the implications of the bank’s presence abroad, the number of host countries, the foreign organizational complexity through an exclusive business model with subsidiaries only or branches only or a dual model with both types of affiliates, and the geographic diversity and dispersion of all entities around eight world regions.

Our findings portray strong evidence that bank internationalization is globally associated with significant lower probability of failure, lower asset risk and leverage risk, less volatile returns, but poorer profitability. A closer look reveals that the expansion in multiple host countries bears the lowest influence on bank performance. Since multinational banks evaluate the benefits of internationalization at the first stage of going abroad, the additional benefits of a presence in many foreign countries are fewer. Moreover, we test whether there is a specific foreign affiliates' structure that favors banking stability and the results point to a negative relationship between a parent bank's foreign organizational complexity of its risk and profitability. Particularly, banks operating a more complex network with foreign subsidiaries and branches are more stable than banks with foreign branches exclusively which in turn are more stable than banks owning subsidiaries only abroad. For deeper insights, we test the impact of the dispersion of the affiliates around different world regions. Geographic complexity negatively affects bank risk (lower default risk, asset risk, and leverage risk) but increase both the risk-taking behavior and the profitability. Then, in a further investigation that accounts the acute time of the European sovereign debt crisis (i.e. the year 2011), we observe a greater impact of internationalization and foreign complexity on the parent bank individual performance. Banks engaged into cross-border operations tend to be less vulnerable as internationalization might help global banks to better resist or smooth the downfall of economic shocks.

Finally, going from the previous results, the third chapter considers a small sample of listed banks and examines how bank internationalization affects bank systemic risk and whether this effect is different across normal times and distress times of the financial system. The peak years of the 2008–2009 global financial crisis followed by the 2010–2011 European sovereign debt crisis provide a natural experiment that allows us to investigate the effect of bank complexity on systemic risk. Accordingly, our attention is centered on European listed financial institutions that have foreign operations around the world or that do not. Considering the state and soundness of the banking industry, we explore the relationship between systemic risk and bank internationalization through foreign subsidiaries and regional complexity.

For this purpose, we construct measures of systemic risk for a sample of 105 publicly traded banks headquartered in 15 European countries from 2005 to 2013. We question the impact of owning foreign subsidiaries, or having a wide presence in many host countries and different regions, or geographically dispersing subsidiaries around regions in years prior (2005–2007), during (2008–2011), and following (2012–2013) the two aforementioned crises.

One result in the second chapter highlights that banks conducting cross-border operations tend to be less vulnerable; possibly because through their foreign network they build a shield that helped to better resist economic shocks. The evidence in chapter 3 does not fully support the previous conclusion. Indeed, we find that while operating a subsidiary abroad is associated with lower systemic risk in normal times, the impact is totally reversed when the banking system undergoes global shocks. Our results point to an increase in the fragility of international publicly traded banks during years of distress. Another look at the period after both the global financial and the European sovereign debt crises indicates that the negative effect of bank internationalization was long-lived with an even worse contribution to bank systemic risk. In addition, the relationship still stands when we examine the impact of owning many subsidiaries and the dispersal in different host countries and multiple world regions. Our findings suggest that bank internationalization is a source of greater stability in calm periods but turns out to increase instability during the 2008–2011 crisis times. As listed banks are affected by the changes on financial markets and the state of the overall economy in both the home and the host countries, expanding foreign affiliates increases the sensitivity of banks to multiple shocks relatively to banks that conduct domestic operations only or the privately owned ones.

Overall, the findings in this thesis challenge some of the existing literature and carry several policy implications for banking regulators and supervisors.

On one hand, home country and host country regulatory requirements and prudential rules play an important role in bank foreign expansion but differently for developing and developed countries. On another hand, contrary to other studies, internationalization and foreign complexity might not be necessary negative for the stability of banking systems. We were not able to find significant and conclusive evidence that stringent home banking regulation systematically and uniformly lead to greater financial stability and higher profitability.

First, banking authorities should be alert by our finding that when facing strong supervisory power abroad, banks will rather operate foreign branches than subsidiaries in middle-income and low-income countries but establish subsidiaries in high-income countries. Regulators and supervisors should be aware that banks from richer economies arbitrate the supervision at home relatively to that in less developed nations and establish foreign branches that will be subject to the home supervision when the level abroad is greater. Second, as

highly capitalized banks mostly operate subsidiaries in both high- and low-income countries, the existence of internal capital markets through which parent banks can channel funds in both directions deserves a specific attention. Third, our results emphasize that stringent bank activity restrictions and regulatory capital requirements are negatively associated with bank risk and positively with profitability and strong supervisory power produces opposite effect on the bank performance i.e. higher risk and poorer profitability. A restrictive environment is not necessarily effective if the ultimate objective is to contain bank's risk and contagion and favor the stability of financial systems. In drawing future regulatory and supervisory frameworks to better monitor and manage banks' foreign expansion and stability, policy makers should take into account the structure and geographic dispersion of banking groups.

Over the entire dissertation, in addressing concerns on bank internationalization, we contribute to different strands of the banking literature and bring forth an agenda for future researches. The evidence that banks rather establish their foreign affiliates in countries with stringent banking regulation should be also tested in the light of an historical database of foreign bank locations and banking regulation. Indeed, with different data spread over several years, future research will determine where and how do banks expand abroad in regards of the growth of the number of affiliates, the affiliate's date of creation, the age, the possible transformation of a branch into a subsidiary or vice-versa and the date of such happening, and the evolution of countries' regulation stringency and economic development. The results might suggest a pattern defining which type of home and host countries should be more closely monitored and which organizational strategy should be promoted abroad. In addition, considering the specific activities conducted in domestic and foreign affiliates should shed a light on the relationship between bank internationalization and business complexity. Aside from our investigation of the effect of internationalization on the parent bank's individual risk and profitability, a further research might be to test the effect on the consolidated banking group's performance. Moreover, whether the performance of a banking group, the ability to reallocate parent bank's or subsidiary's capital into an internal capital markets to recapitalized the different entities of a multinational institution appear to affect banks' behavior and sensitivity to economic instability in the home and the host countries should be subjects of more researches.

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

ABSTRACT

This thesis examines the determinants of foreign banks' presence and their organizational strategies abroad and tests how such internationalization affects bank performance and systemic risk. The dissertation is comprises of three empirical essays on European banks. The first chapter analyzes whether differences in economic development of the host countries and the maturity of their financial system are relevant to explain how banking regulation affects the choice of the foreign location and the organizational strategy of an exclusive organizational network with only branches or subsidiaries or a mix model with both affiliates' types. The findings indicate that over the 2011–2013 period, European banks prefer high-income countries with numerous activity restrictions and weaker supervision but less developed countries with less restrictions and stronger supervision. Regarding the choice of foreign organizational form, banks rather operate subsidiaries in high and middle-income countries with stringent entry requirements but prefer branches in developing countries with stringent capital requirements and greater supervisory power. However, banks always tend to avoid locations with stronger capital regulation than at home. Yet when they are present in such countries, they operate branches. The second chapter investigates how foreign organizational and geographic complexity affect the parent bank's individual risk and profitability. Our results show that being present abroad is beneficial for bank stability as it contributes to lower default risk. Banks present abroad through both subsidiaries and branches appear to be more stable than banks 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. Chapter 3 considers the state and soundness of the banking system and examines whether the presence of banks abroad with subsidiaries affects bank systemic risk differently during calm period (2005–2007), distress times of the global financial crisis and the European Sovereign debt crisis (2008–2011), and years after (2012–2013). We show for European listed banks that operating subsidiaries abroad is associated with lower systemic risk in normal times. However, when the banking system is facing severe shocks, such internationalization produces on systemic risk reversed and negative effects that are long-lived and aggravated in the years after the crises. Our findings suggest that bank internationalization and foreign complexity are important for greater stability in normal times but turn out to increase instability during years of financial turmoil and in the aftermath.

Keywords: European Banks, Internationalization, Organizational Form, Banking Regulation, Economic Development, Performance, Systemic risk.

RÉSUMÉ

Cette thèse examine les déterminants de la présence des banques à l'étranger et de leur mode d'implantation (succursales ou filiales) ainsi que les effets de leurs stratégies d'internationalisation sur leurs performances et sur le risque systémique. Elle est composée de trois essais empiriques sur l'internationalisation des banques européennes. Le chapitre 1 étudie si le niveau de développement des pays d'accueil et la maturité de leur système financier conditionnent l'impact de la réglementation bancaire sur les choix de localisation et de mode d'implantation à l'étranger, sous une forme exclusive de succursales ou de filiales ou selon un modèle mixte associant les deux formes. Les résultats indiquent sur la période 2011–2013 que les banques européennes choisissent d'être présentes plutôt dans les pays à hauts revenus qui ont des conditions strictes d'entrée et d'activités mais une supervision plus souple où elles s'implantent davantage sous forme de filiales. En revanche, elles privilégient les pays à revenus intermédiaires dont les autorités de supervision sont strictes mais ne restreignent pas les activités bancaires. Elles préfèrent également une présence avec des succursales dans les pays à bas revenus dont la réglementation est rigoureuse. Enfin, bien qu'une réglementation du capital plus sévère dissuade l'internationalisation des banques, toute implantation à l'étranger se fait néanmoins sous forme de succursales. Le chapitre 2 analyse comment la complexité organisationnelle et géographique des banques à l'étranger affecte le risque bancaire et la rentabilité de la banque-mère. Les résultats montrent que les banques présentes dans plus de pays prennent moins de risque, ont une plus faible probabilité de défaut, un plus faible risque de levier ainsi qu'une rentabilité plus faible. Il apparait également que les banques les plus complexes qui opèrent à la fois sous forme de filiales et de succursales dans plusieurs régions du monde sont, à l'exception du risque de l'actif, en moyenne moins risquées que celles qui s'installent uniquement sous forme de succursales. Le chapitre 3 considère la solidité de l'ensemble du système bancaire et teste si la présence des banques à l'étranger par le biais de filiales affecte le risque systémique différemment en temps normal (2005–2007), en temps de crise financière et de crise de la dette souveraine européenne (2008–2011) et au cours des années suivantes (2012–2013). L'analyse montre que la détention de filiales étrangères est associée en temps normal à un moindre risque systémique mais que lorsque le système bancaire fait face à des chocs sévères, l'effet est négatif, persistant et s'accroit durant les années d'après crises. Ces résultats suggèrent que l'internationalisation des banques contribue habituellement à une plus grande stabilité financière mais qu'elle amplifie l'impact systémique des crises.

Mots clés : Banques Européennes, Internationalisation, Structure Organisationnelle, Réglementation Bancaire, Développement Economique, Performance Bancaire, Risque Systémique.