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International Expansion and Riskiness of Banks

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Abstract
We exploit an original dataset on European G-SIBs to assess how banks' internationalization affects risk in the banking sector. We find a robust negative correlation between foreign expansion and banking risk as captured by various individual bank and systemic risk metrics. An IV strategy based on gravity regressions allows us to conclude that in our sample there is strong evidence that banks' foreign expansion reduces risk, both from an individual bank and a systemic viewpoint. This reduction is associated with better asset diversification with no evidence of any relevant detrimental effect of possible regulatory arbitrage.

Keywords: banks' risk, systemic risk, global expansion, diversification, regulation
JEL codes: F23; F65; G21; G32

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1 Introduction

Using a newly collected dataset on global banks we re-examine a widely debated question, namely whether banks' internationalization increases or decreases risk in the banking sector. Since 2005 when Rajan [34] highlighted the potential increase in risk contagion due to the globalization of banking and finance, a growing empirical literature has emerged on the role that global banks play in credit expansion and liquidity management. Yet, there is still no consensus on the balance between the benefits and the dangers of banking globalization. For instance, a recent IMF Financial Stability Report [31] shows that before 2007, despite potential advantages in terms of risk diversification, global risk had increased as much of financial globalization took place through cross-border activity with little involvement of global banks into local retail activity (so called 'bricks and mortar'). On the contrary, after the crisis two trends have emerged that may have helped reduce risk. First, at global level, regulation has become tighter and more coordinated. Second, there has been a shift in the business model of global banks, which currently tend to operate more through subsidiaries (occasionally through branches). Under this business model, enhanced local monitoring may act as a stronger discipline device.

Leveraging an original panel dataset on the 'bricks and mortar' initiatives of all European banks classified as G-SIBs by the BCBS from 2005 to 2014, we study whether and how foreign expansion has affected individual bank riskiness as well as systemic risk. Furthermore, we investigate potential channels through which that may have happened, emphasizing diversification and regulation.

As we want to assess the effects of exogenous shocks to foreign expansion on bank riskiness, our empirical analysis faces methodological challenges related to reverse causation or potential confounding factors. In particular, banks with different riskiness may have a different propensity to expand abroad so that any observed correlation between foreign expansion and bank riskiness may be due to the latter endogenously affecting the former. To deal with this problem, we follow the IV approach recently put forth by Goetz, Laeven and Levine [25], [26] (we will refer to the second paper as GLL hereafter) and Levine, Lin and Xie [32] (LLX hereafter). The three papers are complementary. The first paper studies the causal links between a bank's expansion (in terms of assets) and its market valuation. GLL assesses the impact of the geographic expansion of banks on their riskiness (proxied by the standard deviation of stock returns) through an asset diversification channel. Differently, LLX looks at the impact of geographic expansion through diversification on banks' funding costs. These papers are based on US data and geographic expansion refers to the expansion in (metropolitan statistical areas in) states different from the one in which a bank is headquartered. The expansion decision itself, however, could be related to the banks' market valuation, risk position or funding costs, especially if the expansion changes their risk-taking incentives. To tackle this endogeneity problem the three studies instrument the observed geographic expansion of a bank with the prediction implied by a 'gravity equation' estimated using the characteristics of the bank's origin and destination markets as well as their reciprocal distance.[1] Gravity estimation is an ideal way to instrument geographic expansion since it depends on variables that make it correlated with actual expansion, but not with bank risk or other variables of interest. Using this instrument, the three papers find that geographic expansion reduces valuation, riskiness and funding costs respectively. Our analysis is most closely related to GLL. This paper conjectures that geographic expansion reduces bank risk thanks to the associated asset diversification. To test this hypothesis GLL examines how the impact of geographic expansion on riskiness depends on the 'similarity' between the origin and the destination states in terms of business cycle. They find that a key determinant of the negative impact of geographic expansion on banks' risk is limited business cycle comovement between the origin and the destination states.

Differently from these papers, we focus on G-SIBs with headquarters in Europe, we study the effects of international rather than intra-national bank expansion, we look at several individual and systemic risk measures, and use our own version of the gravity instrument.[2] Individual bank risk measures include CDS spread, loan loss provisions, standard deviation of returns and

[1]The gravity equation has been extensively and successfully used to explain international flows of goods and services and foreign banking activity. See Appendix D for an overview.

[2]The standard gravity equation would be based on bank-year fixed effects that might be correlated with bank risk. We thus employ specifications of gravity with separate bank and year fixed effects or none. We thank Yona Rubinstein for highlighting this issue to us.

Z-Score (Goetz, Laeven and Levine [26]). Systemic risk measures include conditional capital short-fall (Brownlees and Engle [5]), long-run marginal expected shortfall (Acharya et. al. [1]) and ΔCoVaR computed using either CDS prices or equity prices (Adrian and Brunnermeier [2]). Moreover, with respect to GLL and LLX, we can exploit the international dimension of our data not only to reconsider the diversification channel, but also to test the relevance of the regulation channel. Interest in the latter channel has been revamped by the perceived pre-crisis tendency of banks to expand towards countries with less strict regulation (so called 'regulatory arbitrage').[3]

Our empirical investigations are organized in two steps. First, we look at the relation between foreign expansion (through 'bricks and mortar') and individual bank riskiness. Then, we turn to the channels through which that relation materializes. Our findings in the first step can be summarized as follows. There is a strong negative correlation between bank riskiness and foreign expansion. In particular, OLS regressions with bank fixed effects reveal that a bank's riskiness is negatively related to its foreign expansion. This strong negative correlation survives also when we implement 2SLS regressions with gravity-based IVs to rule out reverse causation from a bank's riskiness to its international expansion. This leads us to conclude causally that the bank's foreign expansion actually reduces its individual riskiness.

As for the channels, to test the diversification channel we consider countries' business cycle comovement with other countries as in GLL and LLX; to test the regulation channel we use the *Macroprudential Index (MPI)* of Cerutti, Claessens and Laeven [9]. Based on these measures, we find strong evidence in support of diversification as well as strong evidence against regulatory arbitrage. In line with the diversification channel, a bank's expansion in destination countries exhibiting different business cycle co-movement than the origin country decreases the bank's riskiness. At odds with regulatory arbitrage, we find no evidence that expansion towards countries with laxer regulation increases individual bank risk.

Finally, the findings of our first step still hold when we consider systemic risk metrics instead of individual bank risk metrics. Our conclusion is, therefore, that in our sample of European

[3]See, e.g., Temesvary [38] and [39]. for studies on US banks; Gulamhussen, Pinheiro and Pozzolo (2014) for an international study.

banks there is strong and robust evidence that banks' foreign expansion decreases risk, both from an individual and a systemic point of view.

The rest of the paper is organized as follows. Section 2 describes our original dataset. Section 3 presents our empirical strategy and the corresponding results concerning the impact of foreign expansion on individual bank riskiness. Section 4 reports our findings on the different channels. Section 5 investigates the impact of foreign expansion on systemic risk. Section 6 concludes.

2 Data

Our analysis exploits an original database on banks' geographic expansion that documents the evolution of banking globalization for a 10-year time period (2005 to 2014) and captures recent trends in the international expansion of European banking groups. The data, related to banks' presence in Europe, cover a diversified range of European economies. Our dataset consists in panel data on foreign expansion decisions (i.e. decisions to enter a foreign market) for the European banks classified as G-SIBs by the BCBS by the end of 2015 ([20]). Based on this we have identified 15 banks located in 8 home countries and 38 potential destination countries (see Appendix A for the complete list of countries included in the dataset). The panel is balanced, as we consider for each bank all potential host countries and years, even if the bank did not establish presence in a foreign country in a specific year and despite missing values in our sample.[4]

The data have been collected using *Bureau van Dijk's Bankscope*, *Zephyr*, *Bankers Almanac* and *Bloomberg*. Several other complementary sources have been used, such as banks' annual reports, consolidated statements, websites, archives, press releases and reports from national central banks, regulatory agencies, international organizations and financial institutions. Finally, the dataset has been extended with geographic data from the CEPII's gravity dataset.[5]

We measure international banking expansion through 'bricks and mortar' by the count of global banks' entries in foreign countries by year, which are given by the number of foreign unit

[4]If the bank did not establish presence in a foreign country in a specific year, the count of its openings is set equal to zero.

[5]This is available at: http://www.cepii.fr/cepii/fr/bdd_modele/presentation.asp?id=6

openings.[6] We define an opening in a host country as a parent bank applying one of the following growth strategies: 'Organic growth' by opening directly a new foreign branch or subsidiary or increasing the activity of already-existing units; 'Merger and Acquisition' through purchases of interest in local banks (ownership $\geq$ 50%) or takeovers; and 'Joint ventures'. Therefore, we consider that a bank enters a foreign market whenever it opens directly a branch or a subsidiary, or acquires, either directly or indirectly, a foreign entity, owning at least 50% (see also Claessens, Demirguc-Kunt, and Huizinga [14] and Clarke et al. [15]). The opening would take place in this case either by increasing own ownership in an already-controlled institution or by acquiring a majority interest in a new one. We do not consider as an opening any new institution resulting from the merger among previously-owned group's entities. The establishment of representative offices, customer desks and the change of legal entity type (branch/subsidiary) are disregarded as well. The parent bank is listed even if the opening was actually implemented by a foreign unit owned by the bank. Nevertheless, the count of openings that we use does not reflect the actual scale of events in each of the host countries, as we do not account for the branch network that an owned foreign unit may develop once it has entered the host economy. When entry in the foreign market takes place through the acquisition of another institution, we count this opening as a single one, independently of the number of different entities belonging to the acquired one already present in that market. To improve precision, we have also obtained detailed year-by-year information on banking global strategies and ownership, extending the traditional sampling.

Our sample includes banks performing traditional retail and commercial banking services. But we also account for independent affiliates providing other banking services (private and investment banking, asset and wealth management), financial joint ventures, leasing companies holding the status of banks or MFI, factoring companies performing pure commercial credit-related activities. Consequently, the financial institutions in our sample are entities providing commercial and investment banking services (retail banking, private banking, corporate and investment banking, asset management, etc.). Hence, our global banks are more akin to universal banks. This is understandable in light of the fact that large banks in Europe tend to operate as

[6] Foreign units refer to incorporated foreign banks or financial companies with more than 50 percent ownership.

universal banks.

Our banks consists of the top ten financial groups in Europe in terms of total assets. The banks considered are: *BNP Paribas*, *Crédit Agricole Group* and *Société Générale* in France; *Banco Santander* in Spain; *Unicredit* in Italy; *HSBC*, *Standard Chartered*, *RBS* (Royal Bank of Scotland) and *Barclays* in the United Kingdom; *Deutsche Bank* in Germany; *ING Bank* in the Netherlands; *UBS* and *Credit Suisse* in Switzerland and *Nordea* in Sweden. We also consider *BPCE*, a banking group consisting of independent, but complementary commercial banking networks that provide also wholesale banking, asset management and financial services. Entities such as mutual and pension fund, trusts, financial holdings companies, instrumental corporations or affiliates performing activities related to private equity, advisory, real estate or insurance have been excluded from our sample. However, we consider joint ventures or leasing companies that hold the status of banks (according to *Bankscope* classification) or Monetary Financial Institutions (as defined by the European Central Bank), together with factoring companies, but only when these perform pure commercial-credit-related activities, as they can all be classified as consumer finance activities (retail banking). Basic summary statistics of our banks in 2014 are reported in Table 1. This table highlights the heterogeneity of banks included in our sample in terms of financial variables and foreign openings. The smallest bank is *Nordea* and the biggest is *HSBC*, which is almost four times bigger in terms of total assets. *HSBC* is also the bank that generated the largest income, whereas *RBS* had a negative income in 2014. In the table we proxy the quality of assets by the loan-loss provisions to total loans (LLP), which are highly variable in the sample. *Unicredit*, *RBS* and *Banco Santander* exhibit large LLP, highlighting assets of relatively poor quality. On the other hand, *Credit Suisse* and *Nordea* display quite low LLP, which testifies relatively good asset quality. Comparing our banks with the Top 65 European banks in terms of assets reveals that our G-SIB sample represents almost 40% of the assets of the Top 65 banks with the average G-SIB bank being larger than the average Top 65 bank.[7] In turn, the Top 65 banks account for roughly 60% of the total assets of all the active banks in Europe.

[7] The Top 65 European banks consist of our 15 G-SIB banks plus the top 50 European banks in terms of total assets once the G-SIB banks are excluded.

Moreover, the G-SIB banks generate on average two times more income than the average Top 65 bank. The quality of loans and the Capital ratio are, instead, comparable.

As for foreign expansion, Table 1 shows that, based on our aforementioned criteria, we have identified 444 opening events in 38 host countries during the period 2005 − 2014. While a detailed list of events is provided in Table C.1 in Appendix C, their geographical patterns are summarized in Figure 1. The largest number of events took place in Western Europe. Germany and Italy experienced the largest number of foreign bank units' openings, while the smallest number is observed in CEE countries.

Approximately half of the openings in the sample period occurred in the years prior to the crisis. The rate of growth of foreign-bank incorporation shows a substantial decrease (almost 80%) over the period considered. Even if annual decreases persisted from 2005 to 2012, the rate picked up in 2013 and 2014. Nevertheless, the number of openings in those last years was low in absolute terms compared to the number at beginning of the sample period. The largest drops in growth rates are concentrated between 2008 and 2012, namely the period between the financial crisis of 2007-2008 and the euro area crisis of 2008-2012. Figure 2 shows the evolution of foreign expansion by bank and year. The internationalization process was deeper during the pre-crisis period, with the exception of some financial groups such as *BNP Paribas* or *Crédit Agricole*. The former's notable expansion in 2009 was principally due to the acquisition of the Dutch *Fortis*, whereas the latter's was essentially the result of an increase of retail banking activities (Consumer Finance) in several countries in 2008.

Figure 3 illustrates the number of openings by origin country. Over the sample period the country that expanded the most was France, followed by the United Kingdom and Italy. From 2005 to 2014, French banks registered 229 events, while British and Italian ones 73 and 51 respectively. If openings per bank are considered, France and Italy were by far the most globalizing origin countries in terms of banking expansion.

Beyond the dataset on international expansion we assembled *ex novo*, we also collected a number of other variables for different risk metrics and for controls in the regressions. In particular, we will estimate the relation between expansion and risk by using both individual bank risk metrics (CDS spread, loan loss provisions, standard deviation of returns, Z-Score) and systemic risk metrics (conditional capital short-fall, long-run marginal expected shortfall, ΔCoVaR based on CDS or equity prices). The latter will allow us to check whether expansion produces contagion effects through banks' interconnections. We will provide more details on these metrics in Section 5, which is entirely dedicated to systemic risk.

As for individual bank risk, we measure it using two market-based variables, namely the CDS spread and the standard deviation of weekly returns (from *Bloomberg*), a book-based variable, namely the loan-loss provisions to total loans (from *Bureau Van Dijk's Bankscope*) and a composite metric, namely the Z-Score defined as:[8]

$$\text{Z-Score} = \frac{\text{ROA} + \text{Capital Asset Ratio}}{\sigma(\text{returns})}.$$

The CDS spread corresponds to the price of the insurance against the default of the bank. This is an overall measure of individual bank risk (both on the asset and the liability side) as priced by the market. The higher the CDS spread, the higher the risk taken by the seller of the CDS and the higher the defaulting probability as seen by the market. Differently, the standard deviation of returns gives information on the capacity of a bank to generate profits. The more volatile returns are, the less certain the market is about the bank's ability to generate profits and the more it perceives the bank as risky. The advantage of using these market measures is twofold. First, they capture several aspects of individual bank risk. Second, the assessment of risk is done by the market, hence it is not biased by possible manipulations by the bank. The disadvantage of these measures is that they might be subject to market exuberance, hence they tend to be more volatile than book-value metrics. In our case this disadvantage is offset by the fact that we take the average CDS spread and average standard deviation of returns over the year and that we control for year fixed effects. Loan-loss provisions to total loans (LLP) correspond to the provisions that the banks set aside to cover losses in the event of defaulting borrowers. Accordingly, the second metric of individual bank risk captures asset risk. For a given

[8]The standard deviation of returns and the Z-Score are also used in GLL.

level of total assets, a higher level of LLP indicates a higher probability of losses on loans (less solvent borrowers). The advantage of using this second metric is that it is immune from market exuberance. On the other hand, it is a narrower indicator as it captures only loan portfolio risk while a bank may be invested in other risky assets or hold a risky liability structure. Finally the Z-score is described by GLL as the number of standard deviations profits can fall before triggering bankruptcy. It is both book-based and market-based and provides an inverse measure of individual bank risk: the higher it is, the less likely bankruptcy is for the bank.

Table 2 shows the correlation of the aggregate series of our four individual risk measures. These measures are not perfectly correlated and we will see that they might lead to different results in the regression analysis.

In Figure 4 we display the time trends of our individual bank risk metrics. In the case of the Z-Score, we plot the evolution of its opposite (right axis) so as to directly reflect the risk trend. While the figure confirms the pattern in Table 2 whereby the metrics are not perfectly correlated, it also reveals that they follow a common trend reflecting an increase in risk that coincides with the financial crisis of 2007-2008.

Figure 5 displays the yearly average CDS price of all banks, the minimum and the maximum CDS price in our sample (left axis) and the total number of openings (right axis). The latter is a proxy for the magnitude of banks' geographic expansion. The effect of the financial crisis on CDS prices is observed from 2008 and is correlated with a drop in the total number of openings of G-SIB banks in Europe.

The dataset also contains a set of financial indicators. All data are taken from *Bureau Van Dijk's Bankscope*. Banks' size (proxied by total assets), overall financial health and strength (proxied alternatively by the Capital ratio and by the Tier1-to-assets ratio) and banks' profitability (proxied by the Return on assets) are used as controls.

Finally, in the wake of LLX [32] and GLL [26], we measure diversification by computing the following indicators of income diversity and asset diversity:

$$Income\ Diversity = 1 - \frac{|Interest\ inc. - noninterest\ inc.|}{Total\ income}$$

and

$$Asset\ Diversity = 1 - \frac{|Loans - Other\ assets|}{Total\ assets}.$$

To gauge a country's extent of regulation, we consider the *Macroprudential Index (MPI)* by Cerutti, Claessens and Laeven [9]. Specific links between countries are controlled for through dyadic gravity variables.

Table 3 summarizes some key descriptive statistics regarding the variables that will be used in our analysis.[9]

3 International Expansion and Bank Risk

We organize our empirical investigation in two steps. First, in this section we explore the impact of banks' foreign expansion on their individual riskiness. As already discussed, the potential endogeneity problem is dealt with by an instrumental variable approach. Our instruments are obtained from the estimation of a gravity model of international expansion based on the characteristics of the countries of origin and destination. Then, in the next section we will investigate the channels through which expansion impacts on riskiness.

3.1 Endogeneity and Empirical Strategy

To assess the impact of foreign expansion on bank riskiness, we consider bank k headquartered in country i expanding to country $j \neq i$ in year t and start with estimating the following regression by OLS:

$$Riskiness_{kt} = \alpha + \beta_1 \cdot Expansion_{kt} + Z_{kt} \cdot \Gamma + \mu_k + \mu_t + \epsilon_{kt}, \tag{1}$$

where $Riskiness_{kt}$ is measured by the (Naperian) logarithm of the bank's average individual risk metric over year t, $Expansion_{kt}$ corresponds to its total number of openings and Z_{kt} is a set of control variables. We include time fixed effects (μ_t) to control for a specific trend in the data (the crisis of 2007 and its consequences hereafter) and bank fixed effects (μ_k) to

[9] Income diversity could be negative because we have some negative values for non-interest income.

account for constant bank-specific factors that may influence the riskiness of the bank. In this specification, the results have thus to be interpreted as *within* bank. The standard errors are robust to heteroskedasticity.[10]

The OLS estimate could, however, be biased if the bank's expansion decision were related to its risk conditions, especially if the bank expected its geographic expansion to affect its risk-taking profile. For instance, if the bank believed that expansion might reduce its riskiness, then the decision to expand abroad could be driven by an increase in riskiness. In this case the OLS estimate of β_1 would be biased upwards. To deal with this potential endogeneity bias, we use a 2SLS strategy similar to GLL [26] and LLX [32], instrumenting the observed geographic expansion of the bank with the one predicted by a gravity equation. This method is akin to the one used by Frankel and Romer [22], who study the impact of international trade on countries' economic performance by instrumenting the observed bilateral trade flows (which arguably depend on countries' economic performance) with the ones predicted by geographic variables and fixed country characteristics. To the extent that our gravity estimation did not include variables correlated with the risk-taking behavior of the bank, the instrument would be correlated with actual openings but not with bank risk.

Operationally, we proceed as follows. First of all, we compute the predicted bilateral openings from a gravity regression of actual openings in country j by bank k headquartered in country i at date t:

$$Openings_{kjt} = X_{kjt} \cdot \beta + \nu_{jt} + \nu_k + \varepsilon_{kjt} \tag{2}$$

where X_{kjt} are the standard dyadic gravity variables (e.g. distance, common border, common language, etc.), ν_{jt} is a destination country-time fixed effect and ν_k is a bank fixed effect. Second, we aggregate the bilateral predicted openings across destinations to obtain a prediction of the total number of openings of bank k at date t:

[10] In our setting, one would like to cluster the standards errors at the bank-level to account for autocorrelation within cluster. Yet, given the small size of the sample, the number of clusters may be too low (15 groups). We ran these regressions anyway obtaining results that are overall in line with the ones we report. Those results are available on request.

$$Expansion_{kt}^{pred} = \sum_{j \neq i} \left(X_{kjt} \cdot \widehat{\beta} + \widehat{\nu}_{jt} + \widehat{\nu}_k \right). \tag{3}$$

We estimate the gravity equation under three different specifications. The first is a standard one including bank-time fixed effects and destination-country-time fixed effects, but those might be both correlated with bank risk. In the second we, therefore, exclude fixed effects that are likely correlated with changes in the bank's risk. Lastly, in the third specification we exclude all fixed effects. While we will use the first for comparison with the existing literature, we will use the second and the third specifications as bases for alternative instruments.

Equation (2) is estimated using Poisson Pseudo Maximum Likelihood (PPML hereafter). The OLS estimator is not appropriate for count data like ours for three reasons. First, assumptions on normality are not likely to be fulfilled by count models. Second, the OLS estimator could generate negative predictions in the case of count data.Third, the OLS estimator is less apt than a Poisson estimator to deal with the large number of zeros in our count data. Poisson regressions are, therefore, much better suited in our case. In addition, we use the PPML estimator since this is robust to distribution mis-specification (Cameron and Triverdi [8], Santos-Silva and Tenreyro [36]). As it is standard in gravity models, we cluster standards errors at the country-pair level (Head and Mayer [28]).[11]

3.2 Gravity Prediction

The results of the gravity estimation are reported in Table 4. As already discussed, we try three different specifications. The first is more in line with standard estimations conducted in the gravity literature and allows us to compare our results with those of other papers that use the standard gravity specification. The second and the third specifications are, however, better

[11] Predicted expansion (3) does not account for the fact that different openings may have different size and thus different relevance for the bank. To take this into account, we also constructed a weighted measure of predicted expansion, using the share of openings of all other banks in country j to proxy for the relative size of bank i's openings in that country. The corresponding results are reported in Appendix F and are very similar to the ones based on the unweighted measure.

suited to provide us with good instruments as we will explain below. In all three specifications the regressors include log(distance), contiguity, official common language, common membership of the European Union or the Eurozone, and difference in legal systems. The three specifications differ primarily in the full or partial inclusion of fixed effects.

Column (1) reports the results of the gravity model estimated with the full set of fixed effects, including bank-year fixed effects. This specification, which is more in line with the ones employed in the traditional gravity literature, allows us to account for multilateral resistance terms (see Head and Mayer [28]). Multilateral resistance between two countries is their average barriers with all their partners (see Van Wincoop and Anderson [3]). Considering the opening of a new bank branch in Europe, multilateral resistance corresponds to the average barriers to foreign expansion in all other countries. In particular, for given bilateral barriers between two countries, i and j, higher barriers between i and the other countries are likely to raise the number of new branches that a bank headquartered in country j opens in country i. We do not use, however, the predicted gravity value from this specification as our instrument: the presence of the bank-year fixed effects, a factor which is likely to be correlated with bank risk, would make the gravity prediction correlated with the dependent variable of our second stage. Hence, the endogeneity problem would remain. Nevertheless, it is instructive to discuss the results of this specification. Firstly, the estimation delivers an elasticity of openings to distance of -0.662. The magnitude of this coefficient is discussed and compared with other banking gravity papers in Appendix . Secondly and surprisingly, sharing a common language has a negative impact on bilateral bank openings. This could be due to the fact that having an official common language is collinear to distance or contiguity in our sample. Thirdly, being members of the European Union and the Eurozone does not have any impact in this specification. Lastly, as should be expected, having a different legal system in the destination country compared to the country of origin has an important negative impact on banks' openings.

Column (2) reports the results obtained by estimating the same gravity equation but without any fixed effects. The estimated gravity from this model is one of our candidate instruments, which we call IV1. The elasticity to distance is a bit lower in this case. Contiguity and common membership of the European Union or the Eurozone now have positive and significant impacts on bilateral openings.

Finally, column (3) reports the results obtained including bank and host-year fixed effects (but not bank-year fixed effects). In our view this specification delivers the best instrument, which we call IV2. As it is generated using bank (k) and hosting country-year (jt) fixed effects, it is more accurate than IV1, making the prediction of the gravity equation more precise. We will therefore take IV2 as our baseline instrument and use IV1 only to ensure that our baseline results are not driven by any eventual correlation of the fixed effects in IV2 with bank risk. Estimates in column (3) are anyway very close to the ones in column (1). When the instrument is constructed as IV2, it is generated using out-of-sample prediction. Observations that are always 0 for an origin-destination pair are dropped from the estimation.

3.3 Impact of Expansion on Riskiness

We now study the impact of expansion on riskiness, comparing the OLS estimates with the 2SLS ones that use IV1 and IV2 as alternative instruments. We also compare specifications alternative sets of fixed effects. We finally use different sets of standard controls, namely: no controls; log(total assets), return on assets, income diversity, asset diversity, as well as the capital ratio of the headquarters (Control Set 1); Tier 1 capital over assets and deposits over assets instead of the capital ratio (Control Set 2). These variables are meant to control for other factors affecting bank riskiness beyond international expansion through 'bricks and mortar'. Control Set 2 is richer than Control Set 1 and we consider it to be our baseline. In this section we report also the results obtained with Control Set 1 as robustness check. For parsimony, in the next Section 4 we will only include Control Set 2.

Table 5 reports the estimated coefficients of the relation between foreign expansion and bank riskiness for our four individual risk metrics (CDS spread, loan loss provisions, standard deviation of returns, Z-Score). The inclusion of bank fixed effects in all specifications allows us to look at the relation within banks ('within effect'). This nets out any composition effect through which the observed relation between the average riskiness of our banks and foreign expansion could be driven by the fact that banks with different *ex ante* riskiness expand at different rates ('between effect'). Time fixed effects account for common time trends in the risk metrics.

In columns (1), (4) and (7), the OLS estimates document a robust negative correlation between expansion and riskiness when riskiness is assessed through the CDS spread of the bank, the standard deviation of its weekly returns and its Z-score. The coefficients for the loan-loss provisions are not significantly different from zero: foreign expansion seems to have no effect on asset risk.

The other columns of Table 5 deal with the potential endogeneity bias using the two instruments IV1 and IV2 computed in the first stage. Both instruments generate good F-stats in the first stage regressions confirming that they are not weak. For all risk metrics and for all set of controls and instrumental variables, we find a robust negative impact of foreign expansion on bank risk. In all cases the associated coefficient is larger than in the OLS regressions. The regressions based on our baseline instrument IV2 – in columns (6) for Control Set 1 and (9) for Control Set 2 – generate estimates of intermediate magnitude between OLS and IV1-based 2SLS. In particular, column (6) tells us that on average each new foreign opening by a bank decreases its CDS spread by 3.6%, its loan-loss provisions ratios by 0.08 percentage points, the standard deviation of its returns by 2.4% and increases its Z-Score (which is inversely related to risk) by 1.9%.[12] These effects correspond to the impact of one foreign opening per year, which is the median number of openings per bank in our sample. For banks in the fourth quartile of openings (those that open at least four foreign units a given year), the cumulated effect of their openings translates on average into a decrease of 12% in the CDS spread, of 0.32 percentage points in the loan-loss provisions ratio (to be compared with an average ratio of 2.16), of 9.6% in the standard deviation of market returns, and into an increase of 7.6% in the Z-Score.

To summarize, after its foreign expansion the market considers the bank as less risky in terms of both its ability to continue activity (as captured by smaller CDS spread, which proxies credit risk) and its ability to generate a stable income flow (as captured by smaller standard deviation of returns). Foreign expansion also reduces the asset risk of the bank as measured by the loan-loss

[12]The corresponding effects in column (9) are 4.2%, 11%, 2.6% and 2.5%.

provision ratio, which is a book-based measure of risk. After expanding abroad, the bank can reduce the provisions it sets aside as its asset risk has decreased. Finally, the fact that foreign expansion increases the Z-Score of the bank means that after expansion the event of bankruptcy is less likely to happen from a mixed market-based and book-based point of view.

4 Diversification and Regulation

In this section we investigate the channels through which international expansion may affect individual bank risk. We consider two different channels: diversification and regulation. The first channel has been examined by the recent empirical literature based on US data (GLL [26] and LLX [32]). The idea is that foreign expansion may allow banks to better diversify their portfolio of assets and thus reduce their riskiness. According to the second channel, foreign expansion may impact bank risk if destination countries have different regulatory regimes than the origin country. In this respect, expansion to destinations with stricter prudential rules than the origin country may reduce risk. Interest in this channel stems, however, from the concern that, all the rest equal, banks may favor expansion to destination with laxer prudential rules, thus raising rather than reducing risk through 'regulatory arbitrage'.

Before turning to the regression analysis, it is useful to provide an overview of some descriptive statistics (see Table B.1 in Appendix B for additional details). Origin countries tend to be rather different from other countries in terms of diversification and regulation. In particular, origin countries have on average higher business cycle comovement with the rest of the Europe (0.92 against 0.8 in terms of growth correlation), and more similar regulations. In our sample, 75% of all foreign openings take place in destinations that have lower comovement with the rest of Europe, and 54% in countries that have stricter regulations than the origin country.

4.1 Diversification

We examine the relevance of the diversification channel by exploiting the variation in a destination country's business cycle comovement with the other destination countries and how it compares with the comovement of the origin country (i.e. the country of residence for all parent holdings) with all other countries in the sample. Business cycle comovement is measured in terms of growth rate; we distinguish between expansions to destination countries with higher (or equal) and lower business cycle comovement than the origin country.[13]

To address the problem of endogeneity for these two types of expansions, we implement a 2SLS procedure with two new instruments based on IV2: the predicted expansion to countries with higher comovement than the origin country; and the predicted expansion to countries with lower comovement than the origin country.[14] As for controls, we focus on our preferred set (Control Set 2).

The corresponding results are reported in the first two columns of Table 6. In light of the OLS estimate in column (1) one could be tempted to conclude that it is openings in countries with lower comovement that drive the overall negative impact of foreign expansion on bank riskiness as measured by the CDS spread, the volatility of returns or the Z-Score. However, once the endogeneity bias is removed in the 2SLS estimate of column (2), we find a decrease in risk when banks' expansion takes place in a country with either lower and higher business cycle comovement vis-a-vis the rest of the destination countries.[15] This concurs with the diversification hypothesis. It is worth noting that, for each risk metric, expansion to countries featuring higher comovement with the rest of Europe has a larger coefficient estimate than expansion to countries with lower

[13]As all destination countries' comovements are computed with respect to the other destination countries, a possible concern is that expansions to countries with lower or higher comovement may be collinear. When we checked whether this is indeed the case in our sample, we found that the variance inflation factor (VIF) takes a value of 2 against a threshold value of 10 for collinearity. This shows that collinearity is not an issue in our sample.

[14]Alternative instruments based on IV1 are associated with a low Kleinberger-Paap F-Stat for the first stage. The choice of IV2 is also suggested by the size of our sample with matrix rows given by the countries of origin (the only ones from which headquartered banks expand).

[15]The F-statistic of the first stage reported is the Kleibergen-Paap Wald F statistic that accounts for the two first stage regressions. According to Stock and Yogo [37], an acceptable threshold value for this F-statistic with two endogenous regressors is 4.58. Moreover, the Sanderson-Windmeijer multivariate F test of excluded instruments for each first-stage regressions (available upon request) confirms the suitability of our instrumentation.

comovement. This can be explained by the possibility to hedge against global risk in line with the results of GLL [26] and LLX [32]). It could also be explained by the fact that in Europe the countries with high comovement are the countries with stronger economic fundamentals. Conversely, the countries with a low comovement are generally countries with weaker economic fundamentals, which may weaken the risk-reduction effect of expansion in these countries, even though it is still significant.

Be that as it may, the overall message of the first two columns of Table 6 is that diversification is an important channel through which international expansion reduces individual bank risk.

4.2 Regulation

To examine the role of differences in regulatory environments in explaining the negative impact of foreign expansion on bank riskiness, we measure the strictness of regulation by the macroprudential index (MPI) of Cerutti, Claessens and Laeven [9]. This index takes values between 0 and 12, with 12 being the highest degree of macroprudential regulation. It is constructed from information about the reliance of the national monitoring authorities on the following indicators: loan-to-value ratio, debt-to-income ratio, dynamic loan-loss provisioning, countercyclical buffer, leverage ratio, capital surcharges on SIFIs, limits on interbank exposures, concentration limits, limits on foreign currency loans and domestic currency loans, and countercyclical reserve requirements.

For each origin country we partition destination countries in two groups depending on whether or not their regulation is laxer than the origin country's. As with diversification, openings in the two categories of destinations are instrumented with the respective predicted expansions as generated through the gravity estimation with bank and hosting country-year fixed effects (IV2).

Results, reported in columns (3) and (4) of Table 6, vary across risk metrics. In the case of the CDS spread, the OLS estimate reveals a negative correlation of bank risk with openings in countries with laxer regulation than the origin country, and no correlation otherwise. This is reversed in the 2SLS estimates, indicating that the overall risk-decreasing effect of international expansion is driven by openings in countries with stricter regulation than the origin country. On the other hand, if we look at the other three risk metrics, the signs of both the OLS and 2SLS coefficients are all in line with the OLS estimate for the CDS.

The overall message of the last two columns of Table 6 is, therefore, that there is no evidence that, if at all present, any regulatory arbitrage motive (which may induce expansion towards countries with laxer regulation) ends up increasing individual bank risk.

5 International Expansion and Systemic Risk

In the previous sections we have focused on risk metrics that allow us to understand how a bank's international expansion affects its individual riskiness. From an aggregate perspective, however, it is also crucial to understand whether the bank's expansion affects the overall riskiness of the banking sector through spillovers to other banks' riskiness. In this respect, it has been argued that for crisis prediction metrics of systemic risk are significantly more informative than the bank-based metrics we have used so far, the reason being that systemic metrics capture the role of banks' interconnections in the propagation of risk. Under certain banking industry structures, interconnections might indeed amplify the propagation of risk generated by individual banks' decisions so that, while reducing individual bank risk, international expansion may still end up increasing the systemic risk associated with more interconnectivity. The idea is that banks that expand abroad become gateways through which shocks spread across countries, thus fostering their international propagation ('contagion') and systemic risk.

We check whether this is the case in our sample by repeating the analysis of Section 3 after replacing individual bank risk metrics with systemic risk metrics. We use four different systemic risk measures: conditional capital short-fall (SRISK; see Brownlees and Engle [5]), long-run marginal expected shortfall (LRMES; see Acharya et. al. [1]) and ΔCoVaR computed using either CDS prices or equity prices (see Adrian and Brunnermeier [2]). SRISK is the capital short-fall of a bank conditional on a severe market decline. LRMES is the propensity to be under-capitalized when the system as a whole is under-capitalized. Finally, ΔCoVaR measures the contribution to systemic risk when an institution goes from normal to stressed situation (as defined by the VaR).[16]

Results are reported in Table 7. As we did in Section 3, to check robustness the table displays the results obtained for alternative instruments (IV1 and IV2) and for different sets of controls (No controls, Control Set 1 and Control Set 2). For three risk measures (LRMES, SRISK and ΔCoVaR computed with equity prices) there is a negative and significant causal effect of international expansion on systemic risk with remarkable consistency of results across the different measures. Only the impact of expansion on ΔCoVaR computed with CDS is positive, but not robust across specifications.[17]

In principle, several forces may be at work. First, all metrics of systemic risk account for the fact that a new bank entering the market can contribute to the diffusion of risk through various channels. A new entrant may invest in local loans bearing risk correlated with the portfolio risk of local banks. The new entrant may also obtain short-term funds from the local deposit market and provide short-term funds to the local interbank market. This implies that the new entrant may be exposed to the same funding risk as the local banks in each destination country, and may also potentially contribute to spread liquidity risk. For these reasons expansion may increase systemic risk. On the other hand, by reducing its own individual risk, the new entrant may reduce overall liquidity and portfolio risk. Our finding that foreign expansion reduces systemic risk suggests that these forces prevail over contagion.

Lastly, some have argued that a bank's leverage ratio (sum of assets over equities) might be a better predictor of the bank's risk than weighted types of risk metrics like the ones considered above. The main argument supporting this simpler metric is that some large banks (such as Lehman Brothers), before defaulting during the financial crisis, exhibited acceptable bank capital ratios (which are based on VaR assessment through banks' internal models) but very high leverage ratios. With this in mind, we first checked whether there is any statistically significant relation between our risk metrics (one at a time) and leverage for the banks in our sample. We could find none.[18] As the relation between leverage and risk-sensitive metrics changes across our banks,

[16] Appendix E details each measure and their source or calculations, also reporting some descriptive statistics.

[17] Results are similar when the expansion is weighted according to equation 5. See Appendix F for details.

[18] We constructed leverage using ORBIF data. Equities data available in ORBIF do not cover our entire dataset

statistically leverage does not seem to have much predictive power as far as banks' risk exposure is concerned. We then re-run the regressions above using leverage as risk metric. The estimated coefficient on foreign expansion turned out to be insignificant.

Our conclusion is that in our sample of European banks there is strong and robust evidence that banks' foreign expansion decreases risk, not only from an individual viewpoint but also from a systemic viewpoint.

6 Conclusion

We have built an original dataset on European banks classified as G-SIBs by the BIS to assess whether expansion in foreign markets increases their riskiness, and through which channels this eventually happens.

We have found that there is a strong negative correlation between individual bank riskiness and foreign expansion. We have shown that this correlation can be given a causal interpretation: a bank's foreign expansion reduces its individual riskiness. This reduction is associated with better asset diversification with no evidence of any relevant detrimental effect of possible regulatory arbitrage.

We have also investigated the impact of foreign expansion on systemic risk measures. Consistently across different measures, we have found that international expansion has also a negative causal effect on systemic risk. We interpret this finding as evidence that, despite the fact that international expansion might spread the contagion of individual bank risk, ultimately the insurance role of diversification seems to prevail.

While it is undeniable that prior to the crisis a large part of the banking system had built up risk and this led to the subsequent events, which factors mostly fostered banks' incentives toward building up risk is still an open question.[19] Our analysis suggests that banks' international

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of GSIBs, therefore we had to restrict attention either to the full set of banks over the period 2009-2014 or to a subset of 7 banks for the period 2004-2014.

[19] A common explanation for risk building up before the financial crisis is that persistent expansionary monetary policy might have strengthened risk-taking incentives. See Heider, Schepens and Saidi [30] for a recent panel data

expansion through a 'bricks and mortar' type of business model does not seem to be the culprit.

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analysis.

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7 Figures

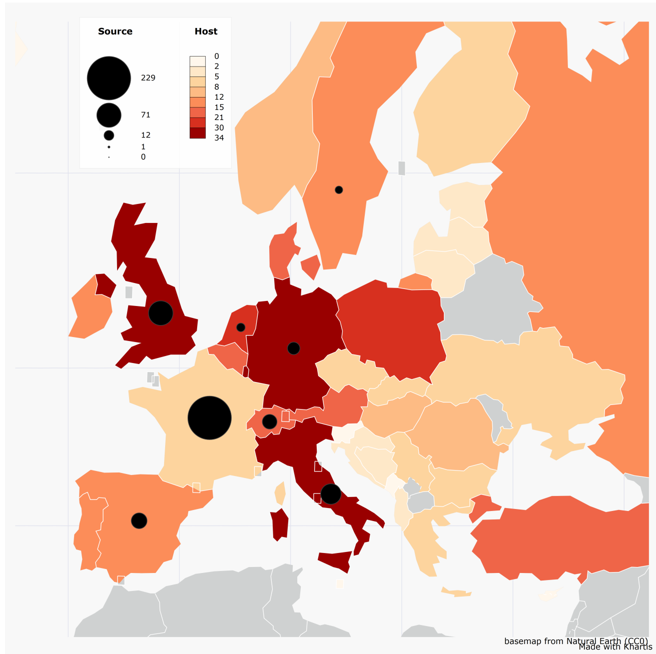

Figure 1 – Openings by source and host country

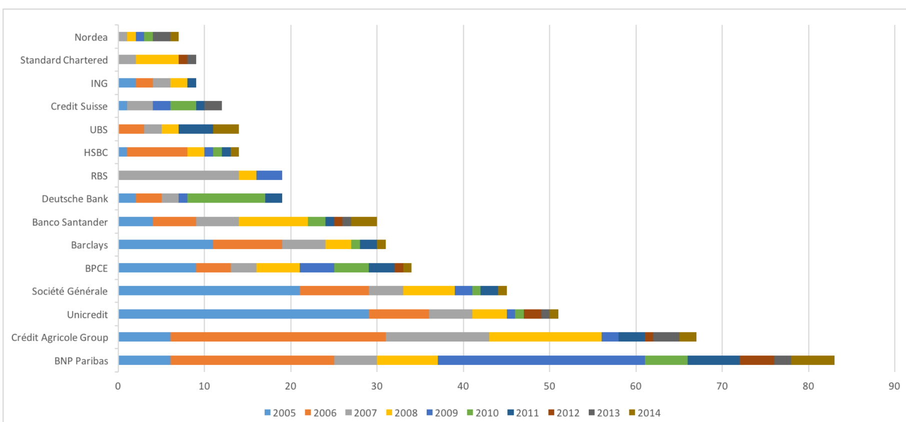

Figure 2 – Foreign expansion of banks over the sample period.

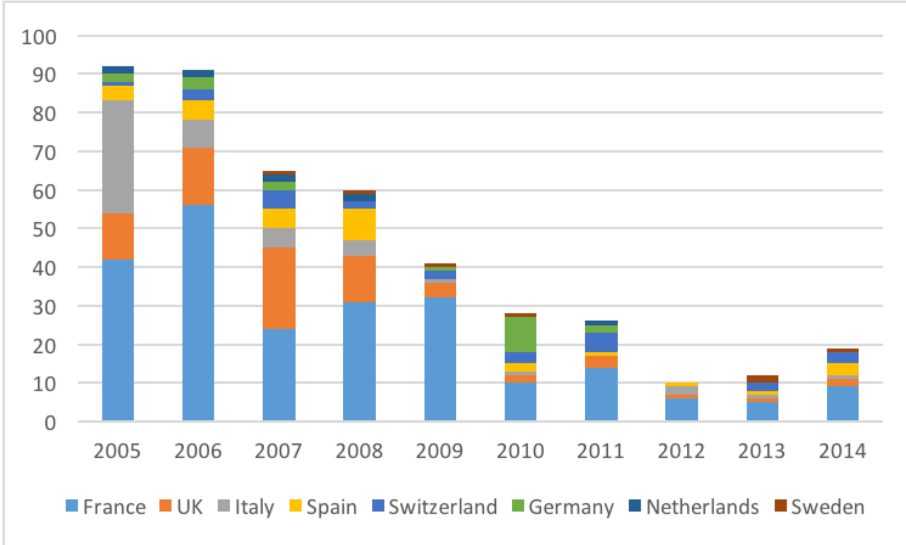

Figure 3 – Openings of foreign bank units by home country and year.

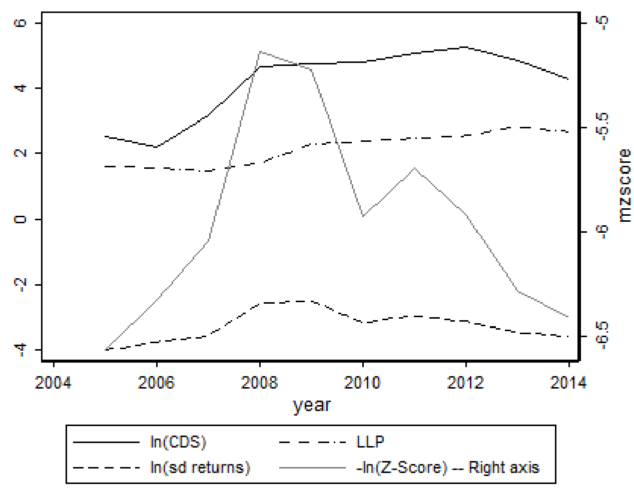

Figure 4 – Individual Risk metrics

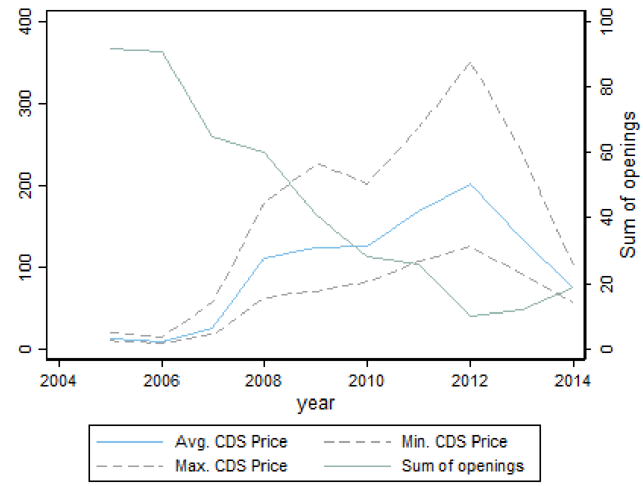

Figure 5 – CDS Prices and total number of openings in the sample

8 Tables

Table 1 – Descriptive statistics: Banks included in the sample in 2014

Bank	Country	Total Assets	Net income	LLP	K Ratio	# Openings
Nordea	Sweden	669342	2843	0.91	20.7	7
ING Bank	Netherlands	992856	3778	1.14	14.58	9
Standard Chartered	UK	725914	3618	1.38	16.71	9
Credit Suisse	Switzerland	921462	4070	0.28	20.8	12
HSBC	UK	2634139	14135	1.25	15.6	14
UBS	Switzerland	1062478	2723	0.22	25.6	14
Deutschebank	Germany	1708703	3761	1.27	17.2	19
Royal Bank of Scotland	UK	1051019	-1316	4.97	17.1	19
Banco Santander	Spain	1266296	7355	3.65	13.3	30
Barclays	UK	1357906	3811	1.26	16.5	31
Groupe BPCE	France	1223298	1926	2.87	13.8	34
Societe Generale	France	1308138	2896	4.31	14.3	45
Unicredit	Italy	844217	2171	9.63	13.41	51
Credit Agricole	France	1589044	2751	3.04	18.4	67
BNP Paribas	France	2077758	6030	3.85	12.6	83
Sum Top 65		48894842	130021	-	-	-
Average Top 65		752228	2000	2.76	16.99	-
Sum		19432570	60553	-	-	444
Share of top 65		39.7 %	46.6 %			
Average		1295505	4037	2.67	16.71	30
St. dev.		530271.7	3380.9	2.446	3.530	22.9

Total assets and Net Income are expressed in millions of dollars. LLP corresponds to the Loan-Loss provisions to total loans ratio and K ratio to the Capital ratio. The top 65 includes the 15 banks in our sample and the top 50 largest European banks in terms of total assets (once the banks in our sample are excluded).

Table 2 – Correlation of individual bank risk measures

	ln(CDS)	LLP	ln(σ returns)	ln(Z-Score)
ln(CDS)	1	-	-	-
LLP	0.7771	1	-	-
ln(σ returns)	0.7292	0.2525	1	-
ln(Z-Score)	-0.5551	0.005	-0.9653	1

Table 3 – Descriptive statistics of the main variables used in the empirical analysis.

Variable	Obs.	Mean	Std. Dev.	Min	Max
ln(cds)	150	4.169849	1.084089	1.927346	5.861315
Loan loss provisions to total loans	148	2.163919	1.688423	0.2	9.63
Expansion	150	2.96	4.768296	0	29
ln(tot assets)	150	13.97037	0.475883	12.27884	14.80599
ROA bank	149	0.344899	0.440993	-1.61	1.14
Income diversity	149	0.689189	0.48887	-4.41885	0.993368
Asset diversity	149	0.694767	0.191827	0.233972	0.9991
Capital ratio	140	14.23043	3.341646	8.87	25.6
Tier1/Assets	141	44.75991	16.27295	12.81485	81.11484
Deposits/Assets	149	639.0486	174.8888	194.4988	1257.695

Table 4 – Banking gravity

	PPML (1)	PPML (2)	PPML (3)
ln(distance)	-0.662***	-0.553***	-0.651***
	(0.170)	(0.149)	(0.173)
Contiguity	0.0367	0.910***	0.104
	(0.219)	(0.266)	(0.212)
Off. common lang.	-0.719*	-0.921***	-0.663*
	(0.391)	(0.271)	(0.360)
EU_{ij}	0.690	0.984*	0.932*
	(0.524)	(0.592)	(0.512)
$Euro_{ij}$	-0.382	0.714***	-0.294
	(0.277)	(0.201)	(0.276)
Diff. legal syst.	-0.629**	-0.123	-0.694**
	(0.310)	(0.171)	(0.275)
Observations	2,109	5,550	2,896
R-squared	0.296	0.026	0.193
Host-year fixed effects	Yes	No	Yes
Bank fixed effects	No	No	Yes
Bank-year fixed effects	Yes	No	No

Robust standard errors clustered at the bank-hosting-country level in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5 – Within effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		No controls			Control Set 1			Control Set 2	
	OLS	IV1	IV2	OLS	IV1	IV2	OLS	IV1	IV2
First stage		25.950**	1.578***		33.060***	1.578***		32.664***	1.748***
		(7.6931)	(0.4457)		(10.2185)	(0.4359)		(8.9013)	(0.4036)
ln(CDS)	-0.0126***	-0.0429**	-0.0371***	-0.0109***	-0.0291**	-0.0362***	-0.0121***	-0.0454***	-0.0422***
	(0.00395)	(0.0177)	(0.0121)	(0.00404)	(0.0141)	(0.0119)	(0.00327)	(0.0142)	(0.0107)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.968	0.957	0.961	0.970	0.966	0.962	0.974	0.961	0.963
F-Test 1st		11.38	12.53		10.47	13.10		13.47	18.75
LLP	-0.0239	-0.222***	-0.0912*	-0.00435	-0.218***	-0.0789*	-0.00244	-0.252***	-0.110***
	(0.0167)	(0.0782)	(0.0488)	(0.0134)	(0.0811)	(0.0427)	(0.0139)	(0.0748)	(0.0413)
Observations	148	148	148	139	139	139	140	140	140
R-squared	0.821	0.674	0.804	0.851	0.683	0.830	0.857	0.631	0.816
F-Test 1st		11.08	12.31		9.825	12.60		12.83	18.69
ln(σ returns)	-0.00944**	-0.0438***	-0.0230**	-0.00893**	-0.0378***	-0.0237**	-0.00846**	-0.0426***	-0.0265***
	(0.00373)	(0.0138)	(0.00985)	(0.00362)	(0.0127)	(0.00982)	(0.00354)	(0.0114)	(0.00892)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.906	0.848	0.897	0.917	0.875	0.906	0.921	0.864	0.905
F-Test 1st		11.38	12.53		10.47	13.10		13.47	18.75
ln(Z-Score)	0.0110**	0.0564***	0.0264**	0.00795**	0.0319***	0.0188**	0.00929**	0.0484***	0.0248**
	(0.00460)	(0.0178)	(0.0120)	(0.00375)	(0.0117)	(0.00885)	(0.00433)	(0.0141)	(0.00963)
Observations	140	140	140	140	140	140	140	140	140
R-squared	0.879	0.787	0.869	0.932	0.908	0.927	0.912	0.849	0.902
F-Test 1st		11.77	12.23		10.47	13.10		14.14	18.59

Robust standard errors in parentheses. The first stage regressions are the ones with ln(CDS) as risk metric in the 2SLS estimation (for other metrics the first stage statistics could be slightly different as the number of observations could be different). Each regression includes bank and year fixed effects. IV1 refers to the instrument generated without fixed effects. IV2 refers to the instrument generated with bank and host-country-time fixed effects. Control Set 1: ln(Total Assets), Income Diversity, Asset Diversity, Capital Ratio. In Control Set 2 the Capital ratio is replaced by the Tier1 ratio and the Deposit-to-asset ratio. *** p<0.01, ** p<0.05, * p<0.1

Table 6 – Testing for the diversification and the regulation channel. OLS and 2SLS regressions with bank and year fixed effects.

		(1)	(2)	(3)	(4)
		Comovement		**MPI**	
	Control Set 2	OLS	2SLS	OLS	2SLS
ln(CDS)	Openings in countries with lower ...	-0.0143***	-0.0393***	-0.0171**	-0.0233
		(0.00376)	(0.0124)	(0.00654)	(0.0172)
	Openings in countries with higher ...	-0.000146	-0.105**	-0.00499	-0.0724***
		(0.0139)	(0.0475)	(0.00875)	(0.0260)
	Observations	141	141	141	141
	R-squared	0.974	0.952	0.974	0.959
	Kleinberger-Paap F-Stat		6.416		11.66
LLP	Openings in countries with lower ...	-0.0135	-0.0980*	-0.0358	-0.254***
		(0.0172)	(0.0505)	(0.0255)	(0.0940)
	Openings in countries with higher ...	0.0521	-0.464**	0.0392	0.114
		(0.0426)	(0.196)	(0.0283)	(0.115)
	Observations	140	140	140	140
	R-squared	0.859	0.700	0.859	0.798
	Kleinberger-Paap F-Stat		6.166		12.99
ln(σ returns)	Openings in countries with lower ...	-0.0116***	-0.0242**	-0.0169***	-0.0309**
		(0.00383)	(0.00973)	(0.00625)	(0.0143)
	Openings in countries with higher ...	0.00807	-0.0778**	0.00345	-0.0195
		(0.0148)	(0.0330)	(0.00956)	(0.0207)
	Observations	141	141	141	141
	R-squared	0.922	0.873	0.922	0.907
	Kleinberger-Paap F-Stat		6.416		11.66
ln(Z-Score)	Openings in countries with lower ...	0.0127***	0.0213**	0.0218***	0.0418**
		(0.00481)	(0.0108)	(0.00733)	(0.0164)
	Openings in countries with higher ...	-0.00817	0.0985**	-0.00812	-0.00185
		(0.0157)	(0.0424)	(0.00985)	(0.0220)
	Observations	140	140	140	140
	R-squared	0.913	0.858	0.915	0.906
	Kleinberger-Paap F-Stat		6.783		11.59

Robust standard errors in parentheses. Each regression includes bank and year fixed effects. IV2 refers to the instrument generated with bank and host-country-time fixed effects. Control Set 2: ln(Total Assets), Income Diversity, Asset Diversity, Tier1 ratio and Deposit-to-asset ratio.

*** p<0.01, ** p<0.05, * p<0.1

Table 7 – OLS and 2SLS estimates of systemic risk metrics against international expansions. Specification includes bank and time fixed effects.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	No controls			Control Set 1			Control Set 2		
	OLS	IV1	IV2	OLS	IV1	IV2	OLS	IV1	IV2
LRMES	-0.314*	-1.331*	-1.172**	-0.320	-1.504***	-1.226**	-0.388**	-1.279***	-1.092***
	(0.186)	(0.702)	(0.463)	(0.199)	(0.546)	(0.476)	(0.191)	(0.484)	(0.383)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.743	0.645	0.674	0.732	0.597	0.653	0.756	0.680	0.709
F-Test 1st		11.38	12.53		10.47	13.10		13.47	18.75
SRISK	-0.579	-4.269***	-3.247***	-0.664*	-3.953***	-3.426***	-0.671*	-3.803***	-3.326***
	(0.371)	(1.270)	(0.981)	(0.338)	(1.252)	(1.035)	(0.365)	(1.021)	(0.814)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.846	0.624	0.730	0.872	0.707	0.756	0.873	0.725	0.766
F-Test 1st		11.38	12.53		10.47	13.10		13.47	18.75
ΔCoVaR CDS	-0.000276	-0.00183	0.00885	-0.000696	0.0102	0.00902	-0.000518	0.00702	0.0131**
	(0.00245)	(0.00804)	(0.00616)	(0.00247)	(0.00715)	(0.00629)	(0.00251)	(0.00711)	(0.00624)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.767	0.767	0.751	0.801	0.779	0.783	0.792	0.782	0.758
F-Test 1st		11.38	12.53		10.47	13.10		13.47	18.75
ΔCoVaR Equ.	-0.000716*	-0.00665***	-0.00277**	-0.000750*	-0.00643***	-0.00320**	-0.000745	-0.00674***	-0.00335***
	(0.000431)	(0.00222)	(0.00123)	(0.000427)	(0.00207)	(0.00136)	(0.000467)	(0.00197)	(0.00118)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.848	0.728	0.833	0.848	0.738	0.827	0.850	0.729	0.827
F-Test 1st		11.38	12.53		10.47	13.10		13.47	18.75

Robust standard errors in parentheses. Each regression includes bank fixed effects and year fixed effects. IV1 refers to the instrument generated without fixed effects. IV2 refers to the instrument generated with bank and host-country-time fixed effects. Control Set 1: ln(Total Assets), Income Diversity, Asset Diversity, Capital Ratio. In Control Set 2 the Capital ratio is replaced by the Tier1 ratio and the Deposit-to-asset ratio. *** p<0.01, ** p<0.05, * p<0.1

Appendix

A Countries

Origin countries of banks: France, United Kingdom, Switzerland, Italy, Germany, Netherlands, Spain and Sweden.

Host countries: All potential origin countries and Albania, Austria, Belgium, Bulgaria, Bosnia and Herzegovina, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Lithuania, Luxembourg, Latvia, Malta, Montenegro, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Turkey and Ukraine.

B Comovement and Regulation

Table B.1 – Descriptive statistics on comovement and regulation

	Comovement		Regulation	
	Source	Host	Source	Host
Mean	0.92	0.80	1.41	1.56
Sd	0.07	0.16	1.13	1.53
Min	0.78	0.31	0	0
Max	0.97	0.98	3	4.67

Note: Data is averaged over all years in the sample. Source countries are excluded from the host countries statistics

C Openings

Table C.1 – Number of openings of foreign units by host country and year.

Countries	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**Total**
Albania		1	1								2
Austria	2	3	1	5	3	1				1	16
Belgium	4	4	2	2	2				1	1	16
Bulgary	3	2	1	1				1			8
Bosnia and Herzegovina	2	1									3
Switzerlnad	4	3	2	2	3	2					16
Cyprus	1										1
Czech Republic	2	1	1		2	1		1			8
Germany	5	8	4	5	2	1	5	1	2	1	34
Denmark	1	2	2	4	2	2		1	1	2	17
Spain	2	3	1		2	2	1	1	1	1	14
Estonia	2		1								3
Finland	1	1	1	2	1			1		1	8
France	3	2		2		1					8
UK	5	9	4	5	2	1	3		1		30
Greece	1	3	1		1				1		7
Croatia	2	1	1	1							5
Hungary	2	2		2	1	1				1	9
Ireland	4	1	7		1	1					14
Italy	5	7	5	7	2		4		1	1	32
Lithuania	2					1					3
Luxembourg	4	7	6	1	4	3	5		1		31
Latvia	2										2
Malta		1									1
Montenegro	1										1
Netherlands	6	8	4	2	4	3	1		1	1	30
Norway	3		2	2	1			1	1	1	11
Poland	2	2	2	3	2	3	2	2		3	21
Portugal	3	2	2	1	1	1	1		1	1	13
Romania	4	2		3	1					1	11
Russia	3	4	4	2		1	1				15
Serbia	2	3	1								6
Slovakia	2	1	1	1	1						6
Slovenia	1										1
Sweden	2	1	1	2	1	2	1			3	13
Turkey	3	2	7	3	1	1	2	1			20
Ukraine	2	3		2	1						8
TOTAL	**93**	**90**	**65**	**60**	**41**	**28**	**26**	**10**	**12**	**19**	**444**

D Gravity Literature

The gravity framework has originally been used to describe trade flows (see Tinbergen [40] for the seminal contribution) and a large literature now exists providing strong theoretical and empirical basis to this framework. The key idea of gravity is that, all the rest equal, bilateral trade flows between countries decrease with bilateral distance between them because distance raises transport costs. According to the meta analysis of Head and Mayer [28], the elasticity of trade to distance lies between 0.89 and 1.14 depending on the estimation methodology. This framework has also been applied to intangibles flows such as FDI or financial variables, showing that geographical distance raises also other costs than transport costs (e.g. information costs). In these cases, the estimated distance elasticity is lower, but significantly different from 0.

A few papers have specifically measured the impact of geographical variables on cross-border banking and banks' international expansion. Earlier papers include Galindo et al. [23] and Portes and Rey [33]. Portes and Rey [33] show that the geography of information is the main determinant of the pattern of international transactions. Galindo et al. [23] show that bank penetration as measured by the sum of assets of banks of the host country held by banks in the source country decreases with the distance between the two countries. They measure a distance elasticity of 0.32. Buch [7] confirms this result using data of foreign asset holdings of banks located in France, Germany, the UK and the US. She finds an elasticity of 0.65 in 1999 that varies between 0.31 in France to 1.13 in Italy. Focarelli and Pozzolo [21] show that bank foreign investment is also consistent with the gravity framework. Depending on the method used, they find an elasticity of bank foreign investment to distance between 0.3 and 0.47 in their fixed effects specification. Berger et al. [4] propose a gravity analysis of bank expansion through M&A. They find a distance elasticity of 0.88 when they include host country and source country fixed effects. Claessens and Van Horen [11] study the foreign location decisions of banks in a large number of countries in 2009. In order to implement an estimation procedure matching best practice in the gravity literature in international trade, they include competitors' remoteness as an additional regressor. This regressor is intended to absorb the so-called 'multilateral resistance' factors whose omission would lead to biased estimation (see Anderson and Van Wincoop [3]). They find a small distance elasticity of foreign bank ownership that varies between 0.032 and 0.115 depending on the methodology they use.

The difference between our gravity model and these antecedents is that we take into account multilateral resistance factors through exporter-time and importer-time fixed effects in our first estimation in column (1) of Table 4, yet we do not construct our instrumental variable using this specification because bank time-varying fixed effects are likely to be correlated with bank's riskiness as argued by Goetz, Laeven and Levine [26].

Banking litterature

Paper	Year	Dependant variable	Estimation strat.	Dist. coef	Alternative strat.	Alt. coef.
Portes and Rey, JIE	2000	Gross purchases plus sales of portofolio equities (1989-1996)	OLS, no FE	-0.881	OLS bilateral FE	-0.646
Aviat and Coeurdacier, JIE	2007	Financial claims in country j from banks located in country I in 2001	OLS, no FE	-0.445	OLS bilateral FE	-0.74
Coeurdacier and Martin, JoJIE	2009	log of aggregate equity holdings (1), the log of banking claims (3) in 2001	(1) bilateral FE	-0.42	(3) bilateral FE	-0.49
Buch, JMCB	2003	Log of foreign assets 2009	OLS Country FE	-0.29		
Buch, RIE	2005	Log of assets of banks (1983-1999)	OLS Country FE	-0.65	Log of liabilities, OLS, country FE	-0.72
Galindo et al., WP	2003	Sum of assets of banks of the host country in which the source country owns 50 percent or more of their equity in 2001	OLS, bilateral FE	-0.318		
Focarelli and Pozzolo, JoBusiness	2005	Dep var = 0 if the bank has no foreign branches/subsidiaries in j, 1 if it has a foreign branch and 2 if it has a foreign subsidiary at the end of 1998	Multinomial logit for branches	-0.31	Multinomial logit for subsidiaries	-0.30
Berger et al., JIMF	2004	Number of M&A in year t in which a country i financial institution purchased a country j financial institution divided by the product of the GDP of i and j (1985-2000)	Tobit, i, j and t FE	-0.88	Tobit, t FE	-0.64
Claessens and Van Horen, JMCB	2014	Number of banks from country i in country j in 2009	Tobit, no FE	-0.115	Poisson (no FE, set of controls + trade)	-0.033

Vlachos, WP	2004	Portfolio holdings by country i in country j in 2001	OLS, bilateral FE	-0.29		
Faruqee et al., IMF WP	2004	Stock of country j equity held by residents of country i at the end of 1997	Standard gravity variables, no FE	-0.559		
Salins and Benassy-Quere, WP	2006	Portfolio investment stocks from country i to country j	Tobit, no FE	-0.802		
FDI literature						
Head and Ries, JIE	2008	FDI flows	PPML	-0.592		
Trade literature						
Head and Mayer, Handbook of IE	2014	Trade	Meta-analysis - All gravity	-0.89	Meta-analysis - Structural gravity	-1.14

Note: Zeros are generally treated using log(1+variable). FE stands for Fixed effects. "Bilateral FE" means source and host country fixed effects.

E Systemic Risk Metrics

Our systemic risk measures are: the conditional capital short-fall (SRISK), the long-run marginal expected shortfall (LRMES), and ΔCoVaR computed using either CDS prices or equity prices.

E.1 Definitions

SRISK is a forward-looking measure of systemic risk proposed by Bronwlees and Engle [5]. It refers to the expected capital shortfall of a financial firm given a protracted decline in the market and is defined as a function of the firm's size, leverage ratio and conditional long run marginal expected shortfall (LRMES).

In the wake of Acharya et al. [1], LMRES measures how much capital would be needed for the bank in order to be correctly capitalized after a crisis. It is defined as the capital short-fall needed in case of a rare event. Specifically, it is defined as the sensitivity to an hypothetical 40% semi-annual market decline. We use the marginal shortfall measure for European banks. This is computed following the methodology of Engle, Jondeau and Rockinger [18], who adapted the LMRES metric to handle some European peculiarities.

We compute the ΔCoVaR using the methodology of Adrian and Brunnermeier [2]. This metric is the difference between the value at risk (VaR) of a financial system conditional on a financial institution being at the median quantile of the equity return distribution and the VaR conditional on that financial institution experiencing a left-tail loss. The VaR is the loss on a portfolio of assets that will not be exceeded with a certain level of confidence. One can estimate the contribution of each bank to systemic risk by shifting the conditional event from the median to the distressed state of that particular bank. In the original paper, ΔCoVaR is computed using market returns. We use either equity returns (ΔCoVaR EQU) or CDS log returns (ΔCoVaR CDS). To compute a time-varying index, we include a number of state variables: the VIX index, the change in the three-month Treasury bill rate, the change in the slope of the yield curve, a TED spread that corresponds to the spread between the three-months LIBOR rate and the three-month secondary market treasury bill rate, the change in the credit spread between Moody's Baa-rated bonds and ten-year Treasury rates and the Standards and Poors 500 composite index. Each variable is averaged to obtain one value for each month. CoVaR is then computed using the methodology of Adrian and Brunnermeier [2] with monthly values of equity/CDS returns and lagged state variables.

E.2 Data Sources

As for data sources, CDS prices come from Bloomberg and equity prices from Datastream. Both are averaged to obtain monthly (for computing ΔCovar) and yearly (as left-hand side variables) measures. The LRMES and the SRISK metrics are taken from the Centre for Risk Analysis of Lausanne and corresponds to a yearly average using four values by year.[20] Concerning the variables used as states in the ΔCovar estimation: the VIX is taken from the Chicago Boards Option Exchange; the S&P composite index from Datastream; the Moody's Seasoned Baa Corporate Bond Yield Relative to Yield on 10-Year Treasury Constant Maturity, the three-months yield, the ten-years yield and the LIBOR rate come from the Federal Reserve Bank of Saint Louis. All these variables are averaged to obtain monthly values.

E.3 Descriptive statistics

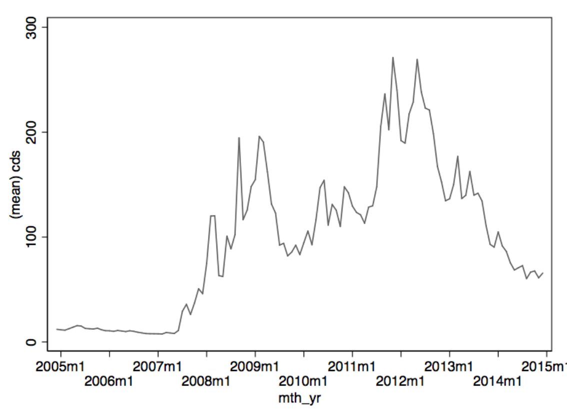

Figure E.1 – Trend for CDS prices

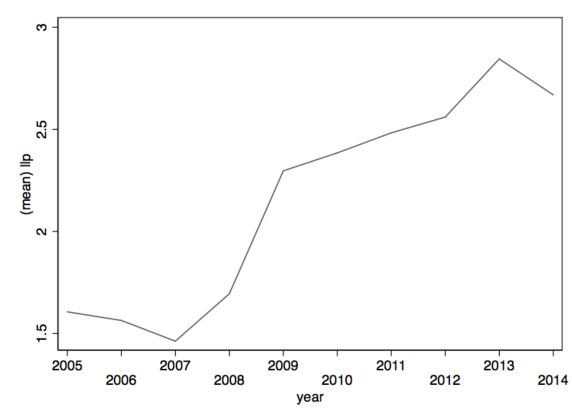

Figure E.2 – Trend for loan-loss provisions to total loans

[20]The results are robust to redefining the annual LRMES/SRISK as the one at the end of December.

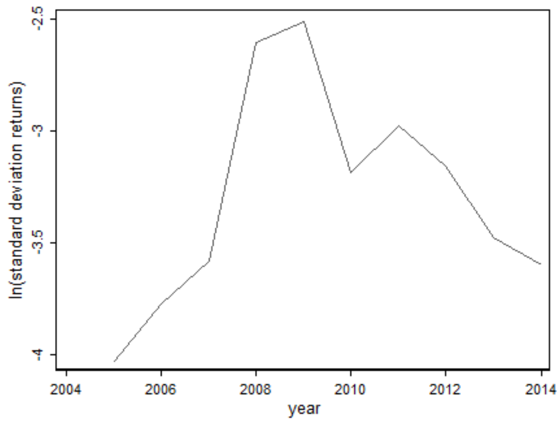

Figure E.3 – Trend for the ln(σ weekly returns)

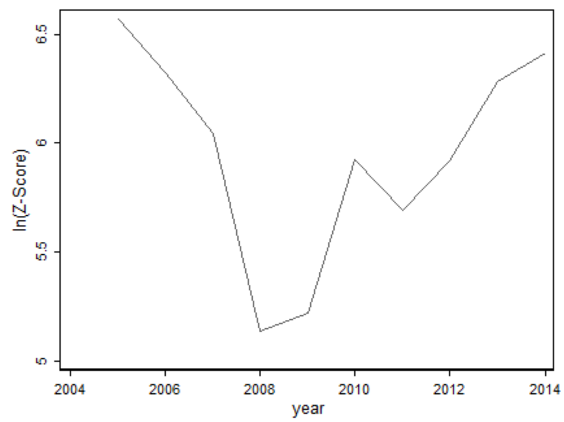

Figure E.4 – Trend for ln(Z-Score)

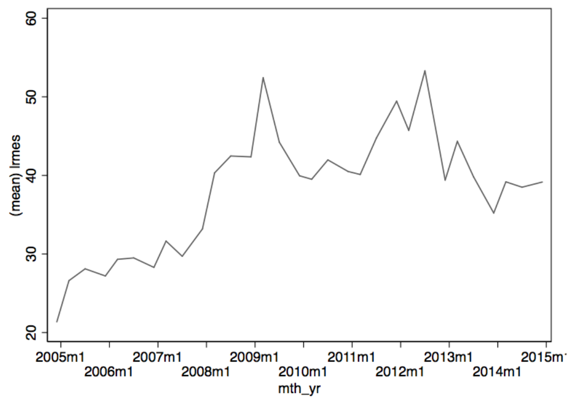

Figure E.5 – Trend for LRMES

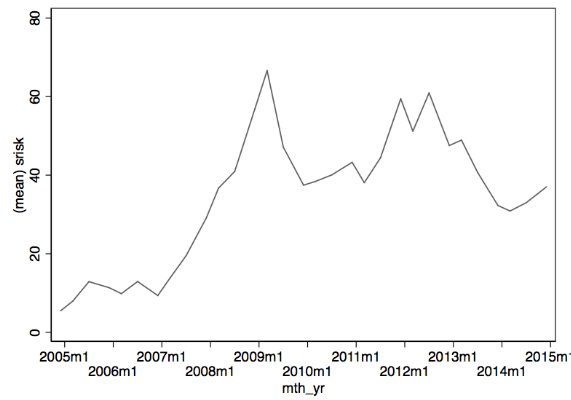

Figure E.6 – Trend for SRISK

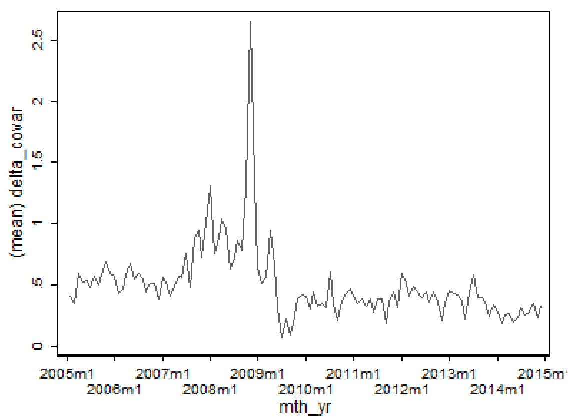

Figure E.7 – Trend for ΔCoVaR CDS

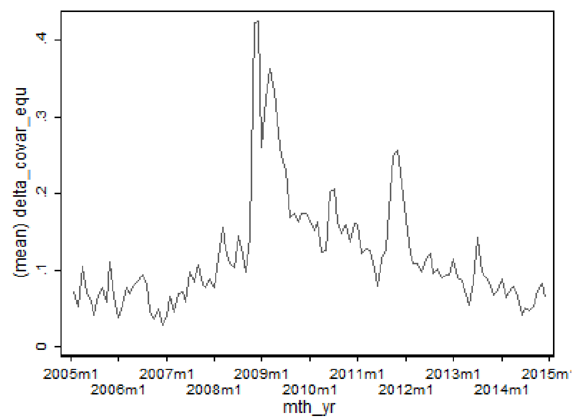

Figure E.8 – Trend for ΔCoVaR EQU

Figures E.1 to E.7 correspond to eight risk metrics. CDS prices, loan-loss provisions, volatility of returns, Z-Score, SRISK, LRMES and ΔCoVaR EQU have similar trends with peaks in 2009 and 2013. The trend of the ΔCoVaR CDS is a bit different with a peak only in 2009. The loan loss provisions to total loans, for which we only have annual measures, has an increasing trend.

F Weighted Predicted Expansion

Predicted expansion (2) does not account for the fact that different openings may have different size and thus different relevance for the bank. To take this into account, we construct a weighted measure of predicted expansion, using the share of openings of all other banks in country j to proxy for the relative size of bank i's openings in that country. This way the weights can be considered exogenous to bank k's choices. Specifically, we define the weight ω_{kjt} attached to $Openings_{kjt}$ as follows:

$$\omega_{kjt} = 1 + \frac{\sum_{h \neq k} openings_{hjt} \cdot total\_assets_{hjt}}{\sum_j \sum_{h \neq k} openings_{hjt} \cdot total\_assets_{hjt}} \in [1, 2]. \tag{4}$$

In our data ω_{kjt} ranges between 1 and 1.32, taking low (high) values for countries of little (great) importance for banks' total assets – which are likely to host small (large) openings. The countries with low values are Albania, Bosnia, Cyprus, Estonia or Iceland, the ones with high values are Germany, Luxembourg, Poland or Spain. The weighted predicted expansion can then be written as:

$$Expansion_{kt}^{wpred} = \sum_{j \neq i} \omega_{kjt} \left(X_{kjt} \cdot \widehat{\beta} + \widehat{\nu}_{jt} + \widehat{\nu}_k \right) \tag{5}$$

In the first stage of 2SLS we estimate the regression of actual openings on predicted expansion (5). We then use this estimate to instrument openings in the second stage where we regress riskiness on expansion. The corresponding results are reported in the following tables, which mimick the ones for the unweighted predicted expansion in the main text.

Table F.1 – Regressions (OLS and 2SLS) weighted, with fixed effects and different controls variables for all the dependent variables: dependent variable ln(CDS Spread).

ln(CDS)	(1) OLS	(2) IV1	(3) IV2	(4) OLS	(5) IV1	(6) IV2	(7) OLS	(8) IV1	(9) IV2
Expansion w	-0.0126***	-0.0340**	-0.0339***	-0.0104***	-0.0282**	-0.0349***	-0.0115***	-0.0441***	-0.0406***
	(0.00374)	(0.0148)	(0.0111)	(0.00389)	(0.0136)	(0.0115)	(0.00314)	(0.0138)	(0.0104)
ln(Tot Assets)	0.185*	0.213**	0.213**	0.162	0.202*	0.217**	-0.0355	-0.0492	-0.0477
	(0.102)	(0.100)	(0.0972)	(0.103)	(0.104)	(0.106)	(0.124)	(0.119)	(0.117)
ROA				-0.0471	-0.0458	-0.0453	-0.00385	0.00635	0.00525
				(0.0845)	(0.0808)	(0.0838)	(0.0720)	(0.0721)	(0.0705)
Income diversity				-0.0852**	-0.0789**	-0.0765**	-0.116***	-0.110***	-0.110***
				(0.0398)	(0.0359)	(0.0364)	(0.0354)	(0.0340)	(0.0328)
Asset diversity				-0.167	0.0514	0.134	0.236	0.676*	0.629*
				(0.283)	(0.317)	(0.311)	(0.309)	(0.365)	(0.354)
ratio_k				-0.0125	-0.00920	-0.00795			
				(0.00997)	(0.00927)	(0.00996)			
Tier1/Asset							-0.0108**	-0.0150***	-0.0146***
							(0.00472)	(0.00489)	(0.00478)
Deposits/Asset							-0.000589***	-0.000479*	-0.000491*
							(0.000181)	(0.000290)	(0.000269)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.969	0.963	0.963	0.970	0.966	0.962	0.974	0.961	0.963
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test 1st		11.59	13.43		10.52	13.52		13.52	19.52

Robust standard errors in parentheses. IV1 refers to the instrument generated without fixed effects. IV2 refers to our preferred instrument generated with bank and hosting-country-time fixed effects.

*** p<0.01, ** p<0.05, * p<0.1

Table F.2 – Regressions (OLS and 2SLS) weighted, with fixed effects and different controls variables for all the dependent variables: dependent variable loan-loss provision to total loans.

LLP	(1) OLS	(2) IV1	(3) IV2	(4) OLS	(5) IV1	(6) IV2	(7) OLS	(8) IV1	(9) IV2
Expansion w	-0.0224	-0.223***	-0.0880*	-0.00398	-0.209***	-0.0733*	-0.00219	-0.243***	-0.103***
	(0.0160)	(0.0778)	(0.0468)	(0.0130)	(0.0780)	(0.0405)	(0.0133)	(0.0723)	(0.0392)
ln(Tot Assets)	-0.308	-0.228	-0.282	-0.718	-0.451	-0.628	-0.712	-0.796*	-0.747**
	(0.387)	(0.363)	(0.332)	(0.440)	(0.432)	(0.384)	(0.470)	(0.440)	(0.378)
ROA				-0.818*	-0.759*	-0.798**	-0.753	-0.679	-0.723*
				(0.415)	(0.459)	(0.391)	(0.457)	(0.483)	(0.428)
Income diversity				0.111	0.159	0.127	0.0659	0.110	0.0842
				(0.168)	(0.224)	(0.170)	(0.195)	(0.252)	(0.198)
Asset diversity				-2.260***	-0.350	-1.616*	-1.413	0.774	-0.501
				(0.854)	(1.326)	(0.876)	(0.984)	(1.335)	(0.968)
ratio_k				-0.0694	-0.0408	-0.0597			
				(0.0483)	(0.0559)	(0.0447)			
Tier1/Asset							-0.00401	-0.0254	-0.0129
							(0.0128)	(0.0190)	(0.0129)
Deposits/Asset							-0.00226***	-0.000925	-0.00170
							(0.000724)	(0.00188)	(0.00108)
Observations	148	148	148	139	139	139	140	140	140
R-squared	0.822	0.660	0.805	0.851	0.684	0.832	0.857	0.631	0.818
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test 1st		11.60	13.16		9.814	12.89		12.81	19.20

Robust standard errors in parentheses. IV1 refers to the instrument generated without fixed effects. IV2 refers to our preferred instrument generated with bank and hosting-country-time fixed effects.

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

Table F.3 – Regressions (OLS and 2SLS) weighted, with fixed effects and different controls variables for all the dependent variables: dependent variable ln(σ weekly returns).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(σ weekly returns)	OLS	IV1	IV2	OLS	IV1	IV2	OLS	IV1	IV2
Expansion w	-0.00912**	-0.0425***	-0.0218**	-0.00858**	-0.0367***	-0.0224**	-0.00814**	-0.0414***	-0.0252***
	(0.00360)	(0.0134)	(0.00942)	(0.00350)	(0.0123)	(0.00938)	(0.00342)	(0.0110)	(0.00853)
ln(Tot Assets)				0.128	0.191**	0.159**	0.110	0.0957	0.102
				(0.0887)	(0.0843)	(0.0760)	(0.127)	(0.109)	(0.106)
ROA				-0.184***	-0.182***	-0.183***	-0.164***	-0.153***	-0.158***
				(0.0538)	(0.0632)	(0.0542)	(0.0490)	(0.0569)	(0.0486)
Income diversity				-0.0204	-0.0104	-0.0155	-0.0276	-0.0218	-0.0246
				(0.0225)	(0.0245)	(0.0201)	(0.0222)	(0.0251)	(0.0197)
Asset diversity				0.0322	0.378	0.202	0.166	0.616**	0.397*
				(0.191)	(0.254)	(0.217)	(0.211)	(0.276)	(0.231)
ratio_k				0.00251	0.00777	0.00509			
				(0.00784)	(0.00844)	(0.00716)			
Tier1/Asset							0.000669	-0.00357	-0.00151
							(0.00483)	(0.00490)	(0.00448)
Deposits/Asset							-0.000392	-0.000280	-0.000334
							(0.000240)	(0.000356)	(0.000275)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.906	0.848	0.898	0.917	0.875	0.907	0.921	0.863	0.905
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test 1st		11.47	13.02		10.52	13.54		13.52	19.40

Robust standard errors in parentheses. IV1 refers to the instrument generated without fixed effects. IV2 refers to our preferred instrument generated with bank and hosting-country-time fixed effects.

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

Table F.4 – Regressions (OLS and 2SLS) weighted, with fixed effects and different controls variables for all the dependent variables: dependent variable ln(Z-Score).

ln(Z-Score)	(1) OLS	(2) IV1	(3) IV2	(4) OLS	(5) IV1	(6) IV2	(7) OLS	(8) IV1	(9) IV2
Expansion w	0.0106**	0.0549***	0.0249**	0.00764**	0.0310***	0.0177**	0.00891**	0.0471***	0.0234**
	(0.00444)	(0.0173)	(0.0115)	(0.00362)	(0.0114)	(0.00844)	(0.00418)	(0.0137)	(0.00920)
ln(Tot Assets)				-0.0866	-0.139*	-0.109	-0.210	-0.204*	-0.208*
				(0.0851)	(0.0791)	(0.0722)	(0.135)	(0.114)	(0.111)
ROA				0.261***	0.260***	0.261***	0.300***	0.287***	0.295***
				(0.0537)	(0.0602)	(0.0522)	(0.0638)	(0.0721)	(0.0607)
Income diversity				0.0132	0.00489	0.00963	0.0168	0.00814	0.0135
				(0.0241)	(0.0217)	(0.0200)	(0.0289)	(0.0333)	(0.0256)
Asset diversity				-0.0408	-0.328	-0.164	0.0914	-0.461	-0.119
				(0.191)	(0.239)	(0.203)	(0.257)	(0.333)	(0.269)
ratio_k				0.0577***	0.0533***	0.0558***			
				(0.00778)	(0.00791)	(0.00695)			
Tier1/Asset							-0.000893	0.00416	0.00103
							(0.00515)	(0.00530)	(0.00473)
Deposits/Asset							0.000142	2.30e-05	9.67e-05
							(0.000241)	(0.000370)	(0.000257)
Observations	140	140	140	140	140	140	140	140	140
R-squared	0.879	0.786	0.870	0.932	0.908	0.927	0.912	0.848	0.902
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test 1st		11.84	12.71		10.52	13.54		14.18	19.21

Robust standard errors in parentheses. IV1 refers to the instrument generated without fixed effects. IV2 refers to our preferred instrument generated with bank and hosting-country-time fixed effects.

*** p<0.01, ** p<0.05, * p<0.1

Table F.5 – Regressions (OLS and 2SLS) weighted, with fixed effects and different controls variables for all the dependent variables: dependent variable LRMES.

LRMES	(1) OLS	(2) IV1	(3) IV2	(4) OLS	(5) IV1	(6) IV2	(7) OLS	(8) IV1	(9) IV2
Expansion w	-0.313*	-1.168**	-1.101**	-0.312	-1.458***	-1.181**	-0.377**	-1.241***	-1.049***
	(0.182)	(0.567)	(0.429)	(0.193)	(0.528)	(0.460)	(0.185)	(0.469)	(0.370)
ln(Tot Assets)	2.327	3.439	3.351	3.995	6.579	5.955	-4.613	-4.975	-4.895
	(3.848)	(4.208)	(3.891)	(3.877)	(4.233)	(3.979)	(5.149)	(4.427)	(4.411)
ROA				1.000	1.081	1.062	1.992	2.263	2.202
				(2.061)	(1.921)	(1.839)	(2.123)	(1.869)	(1.841)
Income diversity				-0.187	0.221	0.123	-0.704	-0.552	-0.586
				(1.417)	(1.734)	(1.594)	(1.527)	(1.616)	(1.542)
Asset diversity				-1.295	12.80	9.390	8.792	20.50*	17.89
				(11.22)	(11.07)	(11.49)	(12.33)	(11.51)	(11.63)
ratio_k				0.503	0.717**	0.666*			
				(0.354)	(0.361)	(0.350)			
Tier1/Asset							-0.504***	-0.614***	-0.590***
							(0.151)	(0.153)	(0.143)
Deposits/Asset							0.00854	0.0115	0.0108
							(0.00684)	(0.00960)	(0.00886)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.745	0.671	0.682	0.732	0.597	0.655	0.756	0.680	0.710
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test 1st		11.59	13.43		10.52	13.52		13.52	19.52

Robust standard errors in parentheses. IV1 refers to the instrument generated without fixed effects. IV2 refers to our preferred instrument generated with bank and hosting-country-time fixed effects.

*** p<0.01, ** p<0.05, * p<0.1

Table F.6 – Regressions (OLS and 2SLS) weighted, with fixed effects and different controls variables for all the dependent variables: dependent variable SRISK.

SRISK	(1) OLS	(2) IV1	(3) IV2	(4) OLS	(5) IV1	(6) IV2	(7) OLS	(8) IV1	(9) IV2
Expansion w	-0.621*	-3.330***	-2.931***	-0.645*	-3.837***	-3.299***	-0.652*	-3.696***	-3.204***
	(0.333)	(1.070)	(0.890)	(0.327)	(1.210)	(0.991)	(0.353)	(0.989)	(0.777)
ln(Tot Assets)	19.72***	23.24***	22.72***	19.52***	26.72***	25.51***	8.677	7.401	7.607
	(7.237)	(6.913)	(6.856)	(7.351)	(7.679)	(7.456)	(9.531)	(8.074)	(7.807)
ROA				-9.926**	-9.700*	-9.739*	-7.132	-6.178	-6.332
				(4.727)	(5.326)	(5.020)	(4.376)	(4.680)	(4.430)
Income diversity				-0.417	0.720	0.528	-1.333	-0.796	-0.883
				(2.015)	(3.350)	(3.022)	(1.908)	(2.977)	(2.704)
Asset diversity				-1.226	38.04	31.43	18.29	59.50**	52.84**
				(14.77)	(24.70)	(21.98)	(16.13)	(24.04)	(21.00)
ratio_k				1.443**	2.039**	1.938**			
				(0.669)	(0.820)	(0.779)			
Tier1/Asset							-0.424	-0.813**	-0.750**
							(0.326)	(0.339)	(0.327)
Deposits/Asset							-0.0161	-0.00579	-0.00746
							(0.0159)	(0.0287)	(0.0263)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.860	0.733	0.768	0.872	0.707	0.758	0.873	0.723	0.768
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test 1st		11.59	13.43		10.52	13.52		13.52	19.52

Robust standard errors in parentheses. IV1 refers to the instrument generated without fixed effects. IV2 refers to our preferred instrument generated with bank and hosting-country-time fixed effects.

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

Table F.7 – Regressions (OLS and 2SLS) weighted, with fixed effects and different controls variables for all the dependent variables: dependent variable ΔCoVaR CDS.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ΔCoVaR CDS	OLS	IV1	IV2	OLS	IV1	IV2	OLS	IV1	IV2
Expansion w	-0.000643	0.00213	0.00911	-0.000804	0.0101	0.00832	-0.000689	0.00718	0.0123**
	(0.00240)	(0.00775)	(0.00593)	(0.00241)	(0.00688)	(0.00596)	(0.00244)	(0.00681)	(0.00592)
ln(Tot Assets)	0.118*	0.114**	0.105*	0.119*	0.0949*	0.0988*	0.0907	0.0940	0.0962
	(0.0607)	(0.0507)	(0.0564)	(0.0631)	(0.0537)	(0.0550)	(0.0690)	(0.0644)	(0.0671)
ROA				0.0423	0.0415	0.0416	0.0258	0.0233	0.0217
				(0.0495)	(0.0457)	(0.0452)	(0.0522)	(0.0469)	(0.0479)
Income diversity				-0.114***	-0.118***	-0.117***	-0.116***	-0.117***	-0.118***
				(0.0290)	(0.0302)	(0.0295)	(0.0324)	(0.0314)	(0.0335)
Asset diversity				0.142	0.00803	0.0294	-0.0129	-0.119	-0.188
				(0.147)	(0.152)	(0.149)	(0.167)	(0.160)	(0.170)
ratio_k				-0.00799	-0.0100	-0.00970			
				(0.00907)	(0.00815)	(0.00811)			
Tier1/Asset							-0.00199	-0.000984	-0.000334
							(0.00320)	(0.00308)	(0.00321)
Deposits/Asset							0.000300**	0.000273*	0.000256*
							(0.000142)	(0.000140)	(0.000155)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.776	0.775	0.757	0.809	0.786	0.792	0.802	0.789	0.769
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test 1st		11.59	13.43		10.52	13.52		13.52	19.52

Robust standard errors in parentheses. IV1 refers to the instrument generated without fixed effects. IV2 refers to our preferred instrument generated with bank and hosting-country-time fixed effects.

*** p<0.01, ** p<0.05, * p<0.1

Table F.8 – Regressions (OLS and 2SLS) weighted, with fixed effects and different controls variables for all the dependent variables: dependent variable ΔCoVaR EQU.

ΔCoVaR EQU	(1) OLS	(2) IV1	(3) IV2	(4) OLS	(5) IV1	(6) IV2	(7) OLS	(8) IV1	(9) IV2
Expansion w	-0.000683	-0.00617***	-0.00264**	-0.000721*	-0.00617***	-0.00309**	-0.000713	-0.00653***	-0.00328***
	(0.000430)	(0.00200)	(0.00119)	(0.000422)	(0.00200)	(0.00134)	(0.000465)	(0.00192)	(0.00116)
ln(Tot Assets)	-0.000496	0.00663	0.00204	0.000359	0.0127	0.00570	-0.00840	-0.0108	-0.00947
	(0.0123)	(0.0133)	(0.0111)	(0.0140)	(0.0157)	(0.0131)	(0.0194)	(0.0196)	(0.0175)
ROA				-0.0178**	-0.0174**	-0.0176**	-0.0147*	-0.0129	-0.0139**
				(0.00737)	(0.00856)	(0.00702)	(0.00764)	(0.00816)	(0.00699)
Income diversity				0.0142***	0.0162***	0.0151***	0.0130**	0.0140**	0.0134***
				(0.00501)	(0.00606)	(0.00489)	(0.00545)	(0.00616)	(0.00511)
Asset diversity				-0.0168	0.0503	0.0123	0.00534	0.0841	0.0401
				(0.0388)	(0.0474)	(0.0370)	(0.0421)	(0.0539)	(0.0408)
ratio_k				0.000686	0.00170	0.00113			
				(0.00143)	(0.00155)	(0.00133)			
Tier1/Asset							-0.000303	-0.00105	-0.000630
							(0.000720)	(0.000820)	(0.000697)
Deposits/Asset							-3.77e-05	-1.80e-05	-2.90e-05
							(2.82e-05)	(4.74e-05)	(3.20e-05)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.845	0.739	0.832	0.845	0.741	0.826	0.848	0.730	0.825
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test 1st		11.59	13.43		10.52	13.52		13.52	19.52

Robust standard errors in parentheses. IV1 refers to the instrument generated without fixed effects. IV2 refers to our preferred instrument generated with bank and hosting-country-time fixed effects.

*** p<0.01, ** p<0.05, * p<0.1

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