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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 expansion in foreign markets affects their riskiness. We find a robust negative correlation between foreign expansion and bank risk (proxied by various individual and systemic risk metrics). Given individual bank riskiness, banks' expansion reduces the average riskiness of the banks' pool (between effect). Moreover, foreign expansion of any given bank reduces its own risk (within effect). Diversification, competition and regulation channels are all important. Expansion in destination countries with different business cycle co-movement, stricter regulations and higher competition than the origin country decreases a bank's riskiness.

Keywords: banks' risk, systemic risk, global expansion, competition, diversification, regulation
JEL codes: F32; G21

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1 Introduction

Using a newly collected dataset on global banks this paper examines from an empirical point of view a widely debated question, namely whether banks' internationalization has increased or decreased risk. Many attributed the emergence of the crisis to banks' globalization and/or more generally to financial globalization. In 2005 Rajan [36] highlighted the potential increase in risk contagion emerging from finance and banking globalization. A growing empirical literature is emerging on the role that global banks have for credit expansion, liquidity management and competition. There is not yet a definite answer on the balance between the benefits and the dangers of banking globalization. For instance, a recent IMF Financial Stability Report [33] shows that prior to 2007 global risk had increased since 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. Both may have helped reduce global 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). In this paper we argue that under this business model enhanced local monitoring as well as increased competition act as discipline devices.

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 banks' riskiness (using both CDS prices and asset risk metrics, such as loan loss provisions) and systemic risk (using both marginal short-fall and ΔCoVaR metrics). While many elements may foster banks' risk-taking behavior, we question and test whether international expansion through 'bricks and mortar' is responsible for it. Furthermore, we target the different forces at work, investigating whether and how the impact of foreign expansion on bank riskiness can be understood in terms of diversification, competition and/or regulation.

As we want to assess the effects of exogenous shocks to foreign expansion on bank riskiness, our empirical analysis faces several methodological challenges related to reverse causation or potential confounding factors. 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 [29], [30] (we will refer to the second paper as GLL hereafter) and Levine, Lin and Xie [34] (LLX hereafter). The three papers are complementary. The first paper studies the causal links between bank expansion (in terms of assets) and its market valuation. GLL assess the impact of the geographic expansion of banks on their riskiness (proxied by the standard deviation of stock returns) through an asset diversification channel. Instead LLX look 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] The gravity estimation is an ideal candidate instrument since its depends on variables that render it correlated with actual expansion, but not with bank risk or other variables of interest. Using this instrument, they find that geographic expansion reduces valuation, riskiness and funding costs respectively. Our paper is most closely related to GLL in which the authors conjecture that the negative effect on risk happens because of asset diversification. To test this hypothesis they examine how the impact of geographic expansion on riskiness depends on the 'similarity' between the origin and the destination states. They find that a key determinant of the negative relation between geographic expansion and banks' risk is the limited business cycle co-movement between the origin and the destination states. Differently from these papers, we focus on G-SIBs with headquarters in Europe, we test the effects of expansion on various

[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.

individual and systemic risk measures, and use a variant of the gravity instrument.[2]

Most importantly and contrary to the above papers, we look at international expansion, investigating three different transmission channels. We reconsider the diversification channel, but we also test the relevance of regulation and competition channels. Interest in the regulation channel is due to the pre-crisis tendency of banks to expand toward countries with less strict regulation (so called 'regulatory arbitrage'). Interest in the competition channel is motivated by results in the theoretical literature. Allen and Gale [3] show that competition in the deposit market tends to increase banks' risk-taking: as banks need to offer higher rates to entice investors into demanding deposits, they also need to search for higher yield/risk assets. This result is challenged by Boyd and De Nicolo' [6], who show that higher competition in the loan market tends to reduce banks' risk-taking. As more banks serve the loan markets, the rates decline and this brings about a decline in assets' risk due to an adverse selection channel. More recently, Faia and Ottaviano (2016) re-examine the link between banks' risk-taking and competition with a model featuring competition in both deposits' and loans' markets, allowing for dynamic endogenous entry and banks' entry in foreign markets characterized by higher monitoring costs. They show that the link between competition and risk-taking depends on the balance between the relative strength of competition in deposit and loan markets, but that generally, for empirically relevant functions for deposit supply and loan demand, banks' penetration in foreign market tends to reduce banks' risk-taking.

Our empirical findings can summarized as follows. First, there is a strong negative correlation between riskiness and foreign expansion. Using OLS with bank fixed effects to net out composition effects and to account for within variation, we find that regressing riskiness on foreign expansion produces a statistically significant and negative coefficient. Second, we test a selection channel (only low risk banks expand) by comparing OLS with and without bank fixed effects. This comparison reveals the presence of a negative selection effect, confirmed by the fact that regressing openings on bank's risk yields a negative coefficient. Third, to rule out the possibility

[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 Yiona Rubinstein for highlighting this issue to us.

of reverse causation from banks' risk-taking to foreign expansion, we use 2SLS with gravity-based IVs. The instrumented regression of riskiness on foreign expansion produces a negative coefficient estimate as with OLS, but the estimate is larger in absolute value than with OLS. To sum up, foreign expansion reduces the riskiness of the pool of banks in our sample. Banks that expand abroad have lower riskiness ('between effect') and foreign expansion renders any bank less prone to risk ('within effect'). The 'between effect' is, however, less robust than the 'within effect'.

Next, we test which of the aforementioned channels (diversification, competition, regulation) is responsible for our findings. The diversification channel is tested by including a metric for a country's business cycle co-movement with all other countries. To test the competition channel we include market share indices, and to test the regulation channel we use the *Macroprudential Index (MPI)* (see Cerutti, Claessens and Laeven [11]). We find evidence that diversification, competition and regulation all play a role in understanding the 'within effect'. In line with the diversification channel, expansion in destination countries exhibiting lower business cycle co-movement than the origin country decreases a bank's riskiness. In line with the regulation channel, also expansion in destination countries featuring stricter regulation than the origin country decreases a bank's riskiness. As for competition, expansion has a lower impact on riskiness when competition in the origin country is less intense than in the destination countries. In other words, expanding to a more competitive country helps discipline the bank's appetite for risk.

Finally, we examine the impact of expansion on systemic risk metrics. It has been argued that metrics of systemic risk are more informative than bank-based metrics as they capture the role of banks' interconnections in the propagation of risk. In particular, under certain banking industry structures, interconnections may amplify the propagation of risk generated by banks' individual decisions. It is thus conceivable that international expansion, while reducing individual bank risk, might amplify systemic risk due to increased cross-country interconnections in loan and deposit markets. To investigate this scenario, we repeat our estimation procedures for three alternative systemic risk metrics: the conditional capital shortfall 'SRISK' (Brownlees and Engle [7]), the long-run marginal expected shortfall 'LRMES' (Acharya et al. [1]), and the 'ΔCoVaR'

(Adrian and Brunnermeier [2]) computed using either CDS prices or equity prices. For all these measures, we find that foreign expansion reduces also systemic risk. The only exception concerns the ΔCoVaR based on CDS prices, but the corresponding results are not robust. Hence, while interconnections can amplify risk, it is still the case that international expansion reduces a bank's riskiness due to the discipline role of competition and the insurance role of diversification so that altogether there is less risk to be propagated.

The rest of the paper is organized as follows. Section 2 describes our novel dataset. Section 3 presents the empirical strategy and the results on the impact of foreign expansion on bank riskiness. Section 4 reports the findings related to 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 ([23]). 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.[3]

The data has been collected using *Bureau van Dijk's Bankscope*, *Zephyr*, *Bankers Almanac* dataset 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.

[3] 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.

Finally, the dataset has been extended with geographic data from the CEPII's gravity dataset.[4]

We measure international banking expansion by the count of global banks' entries in foreign countries by year, which are given by the number of foreign unit openings.[5] 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%. 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 universal 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, corpo-

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

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

rate and investment banking, asset management, etc). To sum up, 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 universal banks. Indeed our sample includes 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* 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).

We have focused on direct and indirect group's cross-border exposures, by considering both forms of penetration, namely branches and subsidiaries. Additionally, double counting has been avoided. Concerning takeovers, only the merged entity or the acquiring bank have been kept in the sample, while in terms of ownership holding companies have been excluded in countries where the banking group itself is present. As for ownership of a foreign unit, this has been determined based on both direct and indirect ownership structure. A bank or financial company is considered foreign-owned if at least 50% of shares are owned by the parent bank (see also Claessens, Demirguc-Kunt, and Huizinga [16]; Clarke et al. [17]).

Based on the aforementioned criteria, we have identified 444 opening events in 38 host countries during the period $2005-2014$. These events are listed in Table C.1 in Appendix C. This table shows that 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

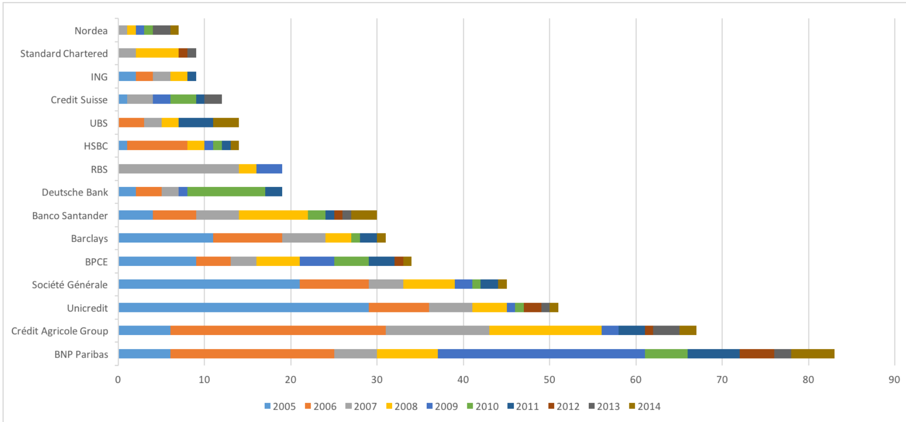

Figure 1 – Foreign expansion of banks over the sample period.

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 concentrated between 2008 and 2012, namely the period between the financial crisis of 2007-2008 and the euro area crisis of 2008-2012.

Figure 1 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 *Crèdit 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 2 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 that has been collected ex novo, we also collected a number of other variables for different risk metrics and for use as controls in the regres-

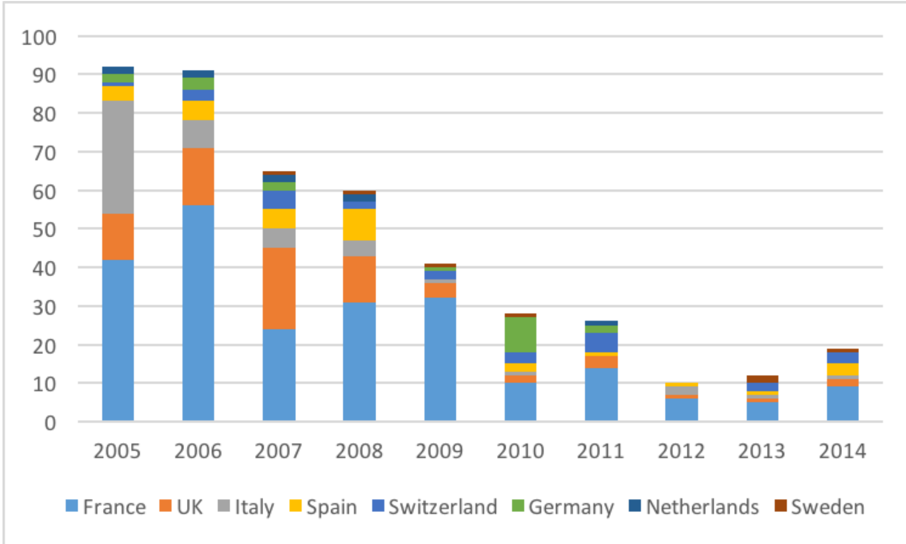

Figure 2 – Openings of foreign bank units by home country and year.

sions. In particular, we estimate the relation between expansion and risk by using both individual bank risk metrics (CDS prices or loan loss provisions) and systemic risk metrics (marginal capital short-falls and CoVaR metrics). The latter allows us to check whether expansion produces contagion effects through interconnections. We provide more details on Section 5 dedicated to systemic rick. As for individual bank risk, we measure it using a market-based variable, namely the CDS price (taken from Bloomberg) and a book-based variable, namely the loan-loss provisions to total loans (taken from Bureau Van Dijk's Bankscope). The CDS price corresponds to the price of the insurance against the default of the company. This is an overall measure of bank's risk (both on the asset and the liability side) as priced by the market. The higher the CDS price, the higher the risk taken by the seller of the CDS and the higher the defaulting probability as seen by the market. The advantages of using this measure are two. First, it captures several aspects of banks' risk. Second, the assessment of risk is done by the market, hence it is not biased by possible banks' manipulations. The disadvantage of this measure is that it might be subject to market exuberance, hence it tends to be more volatile than other book-value metrics. In our case this disadvantage is offset by the fact that we take the average CDS price over the year and that we control for year fixed effects. The loan-loss provisions to total loans correspond to the provisions that the banks set aside to cover losses in the event of defaulting borrowers. Hence the second metric captures asset risk. For a given level of total assets, a higher level of loan loss provisions 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 side, it is a narrower indicator as it captures only loan portfolio risk while a bank might invest in other risky assets and/or hold a risky liability structure.

In any case it seems at first glance that the two metrics are highly correlated (see Figure 3 below). We will however see that the metrics might provide different answers when we examine regressions without bank-year fixed effects.

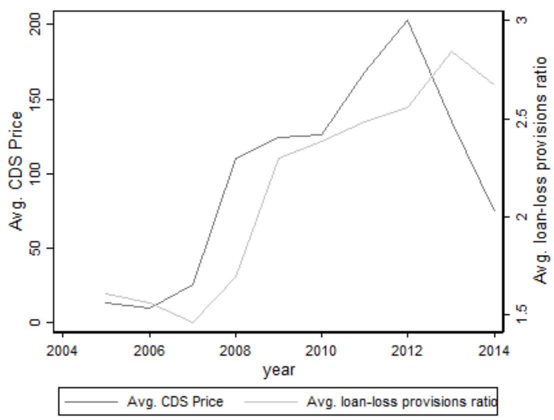

Figure 3 – Average CDS Price and loan-loss provisions in the sample

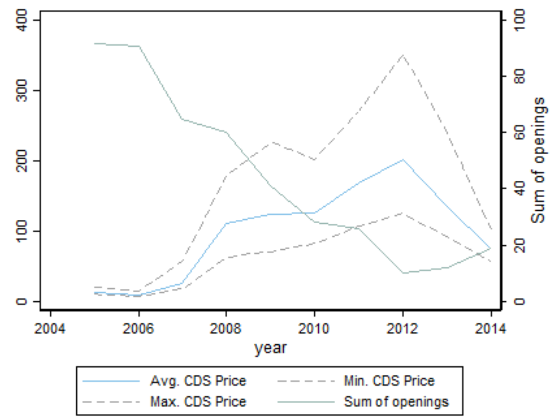

Figure 4 – CDS Prices and total number of openings in the sample

In Figure 4 we display 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 it 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.

Next, following LLX [34] and GLL [30], we measure diversification by computing the following

Table 1 – Descriptive statistics of the main variables used in the empirical analysis.

Variable	Obs.	Mean	Std. Dev.	Min	Max
ln(cds)	140	4.148594	1.077247	1.927346	5.861315
Loan loss provisions to total loans	138	2.118043	1.724864	.2	9.63
Expansion	150	2.96	4.768296	0	29
ln(tot assets)	150	13.97037	.4758832	12.27884	14.80599
ROA bank	139	.3582014	.4461254	-1.61	1.14
Income diversity	139	.7029369	.4935113	-4.418854	.9933677
Asset diversity	139	.7176454	.1773021	.2339715	.9990997
Capital ratio	130	14.33462	3.395106	8.87	25.6
Tier1/Assets	131	46.92355	14.7732	12.81485	81.11484
Deposits/Assets	139	665.2518	149.5965	331.7435	1257.695

indicators of income diversity and asset diversity:

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

and

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

At last, the degree of competition in banking is measured at country level by one minus the Herfindahl-Hirschman index provided by the European Central Bank.[6] To gauge a country's degree of regulation, we include the *Macroprudential Index (MPI)* taken from Cerutti, Claessens and Laeven [11]. Finally, to control for particular links between countries, dyadic gravity variables are considered.

Table 1 summarizes some basic statistics regarding the variables that will be used in our analysis.[7]

[6]The Herfindahl index is provided on a yearly basis by the ECB and manually complemented using Zephyr when results were not available.

[7]Income diversity is negative because we have some negative values for non-interest income.

3 Foreign Expansion and Riskiness

In this section we explore the impact of banks' expansion abroad upon their riskiness. As previously discussed the potential endogeneity problem is dealt through an instrumental variable approach. Our instruments will be given by the estimated gravity between the country of origin and the destination country. The channels through which this impact materializes will be investigated in the next section.

3.1 Endogeneity and Empirical Strategy

To assess the impact of foreign expansion on riskiness, we consider bank k headquartered in country i expanding to country $j \neq i$ in year t. We estimate 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 CDS price 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 account for the constant bank-specific factors that influence the riskiness of the bank. In this specification, the results have thus to be interpreted as materializing *within* bank.

The OLS estimate could, however, be biased if the bank's expansion decision were related to its risk conditions, especially so if the bank expects that its geographic expansion could have an impact on its risk-taking. If the bank believes that expansion could reduce its riskiness, then its decision to go 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 an IV strategy similar to GLL [30] and LLX [34]. The observed geographic expansion of the bank will be instrumented with the one predicted by a gravity equation. This method is akin to the one used in Frankel and Romer [25], 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 equivalent predicted by geographic variables and fixed country characteristics. To the extent that our gravity estimation does not include variables correlated with the risk-taking behavior of the bank, the instrument is correlated with actual openings but not with banks' risk.

Operationally, we proceed as follows. At first (stage zero), 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 hosting country-time fixed effect and ν_k is a bank fixed effect. Second, we aggregate the bilateral predicted counts across destinations to obtain a prediction of the total number of openings of bank k at date t:

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

We estimate the gravity equation under three different specifications. The first is a standard one. In the second we exclude fixed effects that are correlated with changes in the bank's risk. In the standard gravity framework, bank-time fixed effects and hosting-country-time fixed effects are included, but those might be both correlated with banks' risk. Lastly, we check a third specification using no fixed effects at all. We will use the second and 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 for our case. In addition, we use the PPML estimator since this is robust to distribution mis-specification (Cameron and Triverdi [10], Santos-Silva and Tenreyro

[38]). As it is standard in gravity models, we cluster standards errors at the country-pair level (Head and Mayer [31]).

Equation (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 also 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. In 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:

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

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:

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

We will estimate two stage least squares for both the weighted and the unweighted expansion equation. Our two-stage approach consists of the following procedure. In the first stage we estimate the regression of actual openings on predicted ones. We will then use this estimate to instrument openings in the second stage where we will regress riskiness on expansion.

3.2 First Stage: Gravity Prediction

The results of the gravity estimation are reported in Table 2. We employ three different specifications for the gravity equation. The first is more in line with standard estimations conducted in the gravity literature. This specification also allows us to compare our results with those of other papers in the literature that use the standard gravity specification. The second and the third specifications are however better suited to provide us with an instrument as we explain below. In all three specifications the regressors include log(distance), contiguity, the official common language, the common belonging to the European Union or to the Eurozone and the difference in the legal systems. The three specifications differ primarily in the full or partial inclusion of the fixed effects.

We display in column (1) the results of the gravity model estimated with the full set of 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 [31]). Multilateral resistance between two countries is the average barrier of the two regions with all their partners (see Van Wincoop and Anderson [4]). Considering the opening of a new bank branch in Europe, multilateral resistance corresponds to the average barriers to the banking investment with all other countries. For given bilateral barriers between two countries, i and j, higher barriers between i and 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. Indeed 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. First, 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 . Second and surprisingly, sharing a common language has a negative impact on bilateral banks openings. This could be due to the fact that having an official common language is collinear to the distance or the continuity in our sample. Third, being members of the European Union and the Eurozone does not have any impact in this specification. Last and as expected, having a different legal system in the host country compared to the country of origin has an important negative impact on banks' openings.

In column (2), we estimate the same gravity equation but without any fixed effects. The estimated gravity from this model is one of our candidate instruments (named IV1 in the tables). The elasticity to distance is a bit lower in this case. Contiguity or the common belonging to the

European Union or the Eurozone now have a positive and significant impact on banking gravity.

Finally, we estimate the specification in column (3), which includes bank and host-year fixed effects. In our view this specification delivers the best instrument (named IV2 in the tables), albeit we also employ the predicted value implied by the second specification. Results for this case are very close to the ones with the full set of fixed effects. When the instrument is estimated with this set of fixed effects, it is generated using out-of-sample prediction, ignoring that observations that are always 0 for the couplet (source country, host country) are dropped from the estimation.

Table 2 – 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

3.3 Causal Effects of Expansion on Riskiness

We now test the impact of expansion on riskiness. We do so by comparing the OLS estimates with the two-stage least squares using gravity predictions as instruments. We also compare specifications with different assumptions on the fixed effects. We use a standard set of controls, namely log(total assets), return on assets, income diversity, asset diversity, the ratios for the headquartered bank of capital, Tier 1 over assets and deposits over assets. Those variables are meant to controls for other channels through which bank riskiness might be affected, beyond international expansion through 'bricks and mortar'.

In Table 3 columns 1, 4 and 7 show OLS estimates, while the others show 2SLS estimates. All regressions in this table do not include bank fixed effects. This allows us to provide a '*between*' interpretation of the results, as it reveals whether high levels of openings are related to low bank riskiness. The between interpretation captures a selection effect, according to which ex ante only the most cautious banks tend to expand internationally. We keep time fixed effects to account for the common trend of CDS prices. Column (1) shows the OLS estimates by controlling only for the size of the bank in terms of assets. This baseline specification delivers a negative and significant correlation between expansion and riskiness. In other words, banks tend to expand abroad when they are less risky based on the market assessment. We dissect the negative relation by dividing our CDS variable in quantiles. When we do so, we observe a statistically significant difference in terms of openings between the quartiles. In the first quartile of CDS prices banks open on average 6.2 affiliates per year; banks in the second quartile open on average 3.7 affiliates per year; the remaining banks open on average 1.6 affiliates per year. This difference however could be explained by reverse causation, namely by the fact that, by increasing banks' CDS prices, the economic crisis of 2007-2008 induced banks to reduce foreign expansion. Finally, notice that the negative correlation holds when we control for bank-specific variables in columns (4) and (7).

The other columns of Table 3 account for the potential endogeneity bias using the instrument computed in the first stage. We must note that the instrument generated using a gravity model with fixed effects (column 3 of Table 2) performs better (in terms of F-stat) than the one generated without fixed effects (column 2 of Table 2), albeit both exhibit reasonable F-stats. Columns 2, 5 and 8 show results using the instrument estimated without fixed effects, while columns 3, 6 and 9 shows results using the instrument estimated with fixed effects. Overall, first-stage-regression coefficients have the sign and the magnitude expected. For both instruments, there is a positive and almost unitary correlation between predicted and actual expansion. In columns (2) and (3) we do not find any causal effect from expansion to riskiness: banks that expand more are on average less risky, but do not become less risky because they expand more. Controlling for more bank-level characteristics, we find in column (6) a negative and significant coefficient, but this effect disappears when we change some control variables. All in all, the 'between' causal effect of expansion on riskiness is not very robust. Once again the 'between' effect could be explained by the fact that when a bank is more risky (when the price of its CDS is higher), the probability of default is higher and expansion is likely to be limited. In our case, banks became more risky at the moment of the economic crisis of 2008 (see Figure 4), and they expanded less during this period.

In Table 4, we run exactly the same regression on the weighted expansion measure. Results are very similar to the ones of Table 3, thereby confirming our previous findings also when we account for the size of the openings.

In Table 5, we add bank-year fixed effects to our regressions in order to look at the results '*within*' the bank. These estimations are informative on the causal effect from geographic expansion to the riskiness of each bank. Once again, in columns (1), (4) and (7) we show OLS estimates with different sets of controls and instruments. In all three cases, we find again a robust negative correlation between expansion and riskiness. A bank expands abroad when it is less risky. There is also a positive, albeit not robust, effect of bank size on riskiness. Turning to the 2SLS estimation (columns 2, 3, 5, 6, 8, 9), we find a negative coefficient on expansion which is robust to different sets of controls. The geographic expansion of a bank tends to decrease its riskiness. The coefficient is larger (in absolute terms) than the one in the OLS estimation. In column (2) each new opening abroad decreases the price of the CDS by 3.5% (the other 2SLS columns can be interpreted analogously). If we consider the median number of openings by year, that is 1, expansion abroad reduces the CDS price by 3.5%. For banks that open 4 affiliates in a given year (corresponding to the fourth quartile), these openings contributes to a decrease of the CDS price by 14%. The results confirm our hypothesis that the OLS estimates are upwardly biased.

Table 3 – Dependent variable: CDS price. OLS and 2SLS regressions without bank-fixed effects. Unweighted metric of expansion.

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) 2SLS	(7) OLS	(8) 2SLS	(9) 2SLS
First Stage									
Pred. expansion		1.246***	0.770***		2.052***	0.802***		1.754***	0.760***
		(0.419)	(0.150)		(0.583)	(0.167)		(0.461)	(0.151)
Second Stage									
Expansion	-0.0101***	0.0114	-0.0103	-0.0103***	-0.0198	-0.0206**	-0.00793**	0.000222	-0.0112
	(0.00373)	(0.0192)	(0.00746)	(0.00388)	(0.0131)	(0.00889)	(0.00372)	(0.0128)	(0.00786)
ln(Tot Assets)	-0.0239	-0.0583	-0.0235	-0.0765	-0.0575	-0.0558	-0.0745	-0.0884*	-0.0690
	(0.0422)	(0.0522)	(0.0425)	(0.0484)	(0.0557)	(0.0509)	(0.0464)	(0.0492)	(0.0461)
ROA				-0.0758	-0.0809	-0.0813	-0.109	-0.103	-0.112
				(0.0801)	(0.0757)	(0.0762)	(0.0812)	(0.0754)	(0.0761)
Income diversity				-0.0725	-0.0642	-0.0635	-0.0516	-0.0617	-0.0476
				(0.0481)	(0.0440)	(0.0428)	(0.0435)	(0.0452)	(0.0394)
Asset diversity				-0.262**	-0.236*	-0.234*	-0.270*	-0.314*	-0.252
				(0.125)	(0.125)	(0.123)	(0.158)	(0.162)	(0.155)
ratio_k				-0.0189**	-0.0210***	-0.0211***			
				(0.00737)	(0.00752)	(0.00696)			
Tier1/Asset							0.00205	0.00289	0.00171
							(0.00283)	(0.00287)	(0.00278)
Deposits/Asset							-0.000105	-0.000151	-8.66e-05
							(0.000196)	(0.000188)	(0.000193)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.949	0.942	0.949	0.953	0.952	0.952	0.952	0.951	0.952
Bank Fixed effects	No	No	No	No	No	No	No	No	No
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
F-Test 1st		8.870	26.39		12.37	22.95		14.47	25.35

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 4 – Dependent variable: CDS price. OLS and 2SLS regressions without bank-fixed effects. Weighted metric for expansion.

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) 2SLS	(7) OLS	(8) 2SLS	(9) 2SLS
Expansion w	-0.00963***	0.0111	-0.00998	-0.00983***	-0.0191	-0.0199**	-0.00752**	0.000302	-0.0108
	(0.00361)	(0.0185)	(0.00717)	(0.00375)	(0.0128)	(0.00852)	(0.00361)	(0.0123)	(0.00754)
ln(Tot Assets)	-0.0239	-0.0586	-0.0233	-0.0767	-0.0573	-0.0556	-0.0746	-0.0886*	-0.0688
	(0.0422)	(0.0524)	(0.0425)	(0.0484)	(0.0559)	(0.0508)	(0.0464)	(0.0493)	(0.0461)
ROA				-0.0754	-0.0803	-0.0807	-0.109	-0.103	-0.111
				(0.0801)	(0.0757)	(0.0763)	(0.0812)	(0.0754)	(0.0761)
Income diversity				-0.0726	-0.0641	-0.0633	-0.0517	-0.0618	-0.0475
				(0.0482)	(0.0441)	(0.0429)	(0.0436)	(0.0452)	(0.0394)
Asset diversity				-0.263**	-0.237*	-0.235*	-0.271*	-0.314*	-0.253
				(0.125)	(0.125)	(0.123)	(0.158)	(0.161)	(0.155)
ratio_k				-0.0189**	-0.0210***	-0.0212***			
				(0.00737)	(0.00755)	(0.00697)			
Tier1/Asset							0.00207	0.00290	0.00172
							(0.00283)	(0.00286)	(0.00277)
Deposits/Asset							-0.000106	-0.000151	-8.69e-05
							(0.000196)	(0.000188)	(0.000193)
Observations	150	150	150	140	140	140	141	141	141
R-squared	0.949	0.942	0.949	0.953	0.952	0.952	0.952	0.951	0.952
Bank Fixed effects	No	No	No	No	No	No	No	No	No
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
F-Test 1st		8.944	26.84		12.39	23.41		14.52	25.84

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.

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

Several other results stand out. In column (2), the first-stage regression has a surprisingly large coefficient of 28.66. This is due to the use of fixed effects in the first stage compared with the 'zero stage' where we do not use fixed effects to generate the prediction. The results of columns (2) to (6) show a positive effect of size on riskiness: this is intuitive since larger banks are usually more leveraged and exhibit more skewed asset and liability risk. Larger income diversity (between interest and non-interest income) has a negative effect on the riskiness of the bank (columns (4) to (9)). This result provides already a first assessment of the diversification channel that will be tested in more depth in the next section. Higher ratios of Tier1 capital to total assets and of deposits to total assets are consistently associated with lower riskiness of the banks as measured using CDS prices. This message is reasonable: well capitalized banks are priced better in terms of risk by the market. Both instruments (the one estimated with fixed effects and the one estimated without fixed effects) give similar and consistent results associated with a large F-stat.

At last, notice that we performed various robustness checks (not shown for brevity) by excluding specific control variables (such as the ROA or the capital ratios). In all cases the estimation results discussed so far are confirmed.

In Table 6, we run the same estimation on the weighted expansion measure. Results are very similar to the ones of Table 3, confirming that previous findings hold even when accounting for the size of the openings.

Next we test the robustness of our results to changing the risk metric. In the following tables, we move from a market-based measure of bank risk to a book-based measure, namely the loan-loss provisions to total loans. The first metric captures overall bank risk (both on the asset and the liability side) as measured by the market and it also possesses a predictive power. The second metric captures more banks' asset risk. Both measures have similar trends, especially since the financial crisis impacted the two in a similar way (see Figure 3). In Table 7, we run the estimation without any fixed effects. OLS regressions in columns (1), (4) and (7) illustrate that banks with higher loan loss provisions expand more. Recall that this regression accounts for a 'between' causal effect. Ex ante banks that advance higher loan loss provisions are effectively the

Table 5 – Dependent variable: CDS price. OLS and 2SLS regressions with bank-fixed effects. Unweighted metric of expansion.

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) 2SLS	(7) OLS	(8) 2SLS	(9) 2SLS
First Stage									
Pred expansion		28.66***	1.622***		33.06***	1.591***		32.66***	1.763***
		(8.455)	(0.451)		(10.22)	(0.440)		(8.901)	(0.406)
Second Stage									
Expansion	-0.0131***	-0.0351**	-0.0351***	-0.0109***	-0.0291**	-0.0362***	-0.0121***	-0.0454***	-0.0421***
	(0.00389)	(0.0153)	(0.0115)	(0.00404)	(0.0141)	(0.0119)	(0.00327)	(0.0142)	(0.0107)
ln(Tot Assets)	0.186*	0.214**	0.214**	0.162	0.203*	0.218**	-0.0356	-0.0490	-0.0477
	(0.102)	(0.100)	(0.0972)	(0.103)	(0.104)	(0.106)	(0.124)	(0.119)	(0.117)
ROA				-0.0472	-0.0461	-0.0457	-0.00391	0.00595	0.00496
				(0.0846)	(0.0809)	(0.0839)	(0.0720)	(0.0721)	(0.0705)
Income diversity				-0.0854**	-0.0795**	-0.0772**	-0.116***	-0.111***	-0.111***
				(0.0397)	(0.0358)	(0.0364)	(0.0354)	(0.0339)	(0.0327)
Asset diversity				-0.164	0.0551	0.140	0.239	0.681*	0.637*
				(0.283)	(0.317)	(0.311)	(0.309)	(0.364)	(0.354)
ratio_k				-0.0125	-0.00911	-0.00781			
				(0.00996)	(0.00925)	(0.00994)			
Tier1/Asset							-0.0109**	-0.0151***	-0.0147***
							(0.00472)	(0.00489)	(0.00477)
Deposits/Asset							-0.000588***	-0.000476	-0.000487*
							(0.000181)	(0.000289)	(0.000270)
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	0.964
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
F-Test 1st		11.49	12.93		10.47	13.09		13.47	18.82

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 6 – Dependent variable: CDS price. OLS and 2SLS regressions with bank-fixed effects. Weighted metric of expansion.

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) 2SLS	(7) OLS	(8) 2SLS	(9) 2SLS
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)	(0.0103)
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	0.00526
				(0.0845)	(0.0808)	(0.0839)	(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	-0.00794			
				(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
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
F-Test 1st		11.59	13.43		10.52	13.53		13.52	19.47

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

ones behaving more cautiously. Hence one interpretation is that only more cautious banks tend to expand abroad. It shall be noted however that it is not possible to trace a consistent relation between CDS prices and LLP, since this differs across banks (as illustrated by Figure 5).

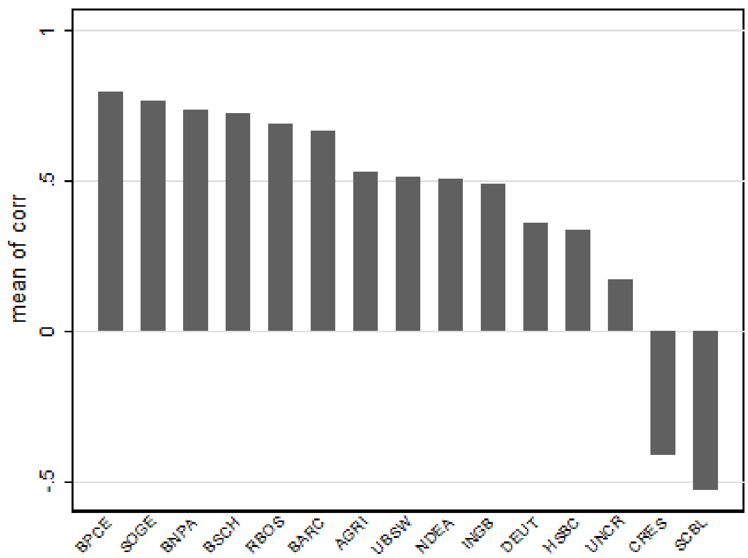

Figure 5 – Correlation between LLP and CDS

Turning to the 2SLS estimations, we find a systematically strong positive impact of expansion on the loan loss provision ratio, which seems to confirm the selection effect just highlighted. In this case the ex ante selection effect implies that only the most cautious banks, namely the ones that store more loan loss provisions in anticipation of uncertainty, tend to globalize. Several other results stand out. We find a positive effect of the return on assets on the riskiness of the bank. This is intuitive and captures a search for yield effect: banks who invest in higher yield assets also exhibit a riskier asset portfolio. We also find a positive effect of the capital to asset ratio and the Tier1 to asset ratio on riskiness. This is well explained by the Basel II pro-cyclicality of the regulatory ratios. As asset risk raises the regulator requires the bank to increase the regulatory ratios. This does not contradict the result highlighted in Table 5, namely that well capitalized banks are considered sound in terms of risk by the market.

In Table 8, we run the same regressions on the weighted expansion measure. Results are very similar to the ones of Table 8, confirming robustness when we account for the size of the openings.

Table 7 – Dependent variable: loan loss provisions over loans. OLS and 2SLS regressions without bank-fixed effects. Unweighted metric of expansion.

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) 2SLS	(7) OLS	(8) 2SLS	(9) 2SLS
First Stage									
Pred expansion		1.144***	0.694***		1.734***	0.737***		1.524***	0.694***
		(0.381)	(0.132)		(0.514)	(0.152)		(0.413)	(0.136)
Second Stage									
Expansion	0.0987***	0.608***	0.457***	0.0499**	0.311***	0.307***	0.102***	0.604***	0.403***
	(0.0186)	(0.209)	(0.105)	(0.0198)	(0.114)	(0.0795)	(0.0203)	(0.171)	(0.0933)
ln(Tot Assets)	0.0424	-0.823	-0.566*	-0.0328	-0.568	-0.559*	0.0462	-0.837*	-0.484
	(0.228)	(0.513)	(0.340)	(0.245)	(0.360)	(0.325)	(0.213)	(0.462)	(0.301)
ROA				-1.433***	-1.443***	-1.443***	-1.935***	-1.898***	-1.913***
				(0.489)	(0.444)	(0.444)	(0.512)	(0.440)	(0.429)
Income diversity				0.373*	0.203	0.205	0.608**	0.118	0.313
				(0.194)	(0.190)	(0.185)	(0.234)	(0.233)	(0.197)
Asset diversity				0.909	0.417	0.425	-0.285	-2.406*	-1.559
				(0.564)	(0.754)	(0.722)	(0.737)	(1.388)	(0.991)
ratio_k				-0.261***	-0.206***	-0.207***			
				(0.0412)	(0.0438)	(0.0420)			
Tier1/Asset							0.0623***	0.117***	0.0954***
							(0.0145)	(0.0302)	(0.0212)
Deposits/Asset							-0.00269***	-0.00605**	-0.00471***
							(0.000841)	(0.00262)	(0.00172)
Observations	148	148	148	139	139	139	140	140	140
R-squared	0.139	-1.196	-0.521	0.451	0.111	0.121	0.370	-0.861	-0.074
Bank Fixed effects	No	No	No	No	No	No	No	No	No
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
F-Test 1st		9.030	27.70		11.38	23.46		13.61	26.13

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 8 – Dependent variable: loan loss provisions over loans. OLS and 2SLS regressions without bank-fixed effects. Weighted metric of expansion.

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) 2SLS	(7) OLS	(8) 2SLS	(9) 2SLS
Expansion w	0.0953***	0.586***	0.436***	0.0485**	0.300***	0.292***	0.0980***	0.583***	0.384***
	(0.0178)	(0.201)	(0.100)	(0.0191)	(0.110)	(0.0756)	(0.0195)	(0.165)	(0.0891)
ln(Tot Assets)	0.0415	-0.826	-0.561*	-0.0340	-0.572	-0.553*	0.0449	-0.845*	-0.481
	(0.227)	(0.512)	(0.338)	(0.245)	(0.360)	(0.322)	(0.213)	(0.463)	(0.298)
ROA				-1.434***	-1.450***	-1.450***	-1.937***	-1.909***	-1.921***
				(0.489)	(0.444)	(0.444)	(0.512)	(0.443)	(0.430)
Income diversity				0.372*	0.199	0.205	0.607**	0.112	0.315
				(0.194)	(0.190)	(0.185)	(0.234)	(0.233)	(0.197)
Asset diversity				0.910	0.427	0.443	-0.277	-2.357*	-1.505
				(0.563)	(0.752)	(0.715)	(0.736)	(1.387)	(0.982)
ratio_k				-0.260***	-0.206***	-0.207***			
				(0.0412)	(0.0439)	(0.0419)			
Tier1/Asset							0.0622***	0.116***	0.0942***
							(0.0144)	(0.0300)	(0.0209)
Deposits/Asset							-0.00268***	-0.00602**	-0.00465***
							(0.000840)	(0.00261)	(0.00170)
Observations	148	148	148	139	139	139	140	140	140
R-squared	0.139	-1.192	-0.504	0.451	0.110	0.133	0.370	-0.864	-0.060
Bank Fixed effects	No	No	No	No	No	No	No	No	No
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
F-Test 1st		9.072	27.94		11.33	23.80		13.59	26.43

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.

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

In Table 9 we re-estimate the above specifications, whose dependent variable is given by the loan loss provisions over loans, but add bank fixed effects. Results have, therefore, a 'within' interpretation. In the three different OLS specifications (as usual reported in columns (1), (4) and (7)), the coefficient for expansion is always not significantly different from zero. Accordingly, expansion seems to have no effect on the bank's asset risk. As for the 2SLS estimation, we have again a very high coefficient on our first stage for the first instrument that is likely due to the inclusion of fixed effects. F-stats of the first stage are again relatively high, and the estimation of our second instrument (the one estimated through a gravity with fixed effects) is as expected. In all cases, we find that expansion has an effect on riskiness. Specifically it decreases loan loss provisions: this implies that banks that expand can reduce how much provisions they set aside since their asset risk has decreased. With both instruments, coefficients are larger in absolute value than the OLS coefficients but, when the instrument is generated using a gravity model without fixed effects, the coefficient is twice as large. To quantify the impact of expansion on the bank's risk consider column (9). This is indeed our preferred specification. In this case the median number of openings in a year (1 opening) decreases the bank's loan-loss provisions ratio by 0.08 percentage points. For 4 openings (corresponding to the fourth quartile of openings), geographic expansion reduces the loan loss provisions to asset ratio by 0.32 percentage points (the average ratio being 2.16). These findings suggests that expansion has an effect on the quality/risk of loans granted by the banks since the provisions for loan loss decreases after the expansion. The results are robust to different set of fixed effects.

In Table 10, we run the same estimation as before but on the weighted expansion measure. Results are very similar to the ones of Table 10. Our results also hold when we account for opening size.

4 Diversification, Competition and Regulation

In this section we dissect our previous results and explore the channels driving them. We consider three different channels: asset diversification, competition and regulation. The first

Table 9 – Dependent variable: loan loss provisions over loans. OLS and 2SLS regressions with bank-fixed effects. Unweighted metric of expansion.

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) 2SLS	(7) OLS	(8) 2SLS	(9) 2SLS
First Stage									
Pred expansion		23.47***	1.400***		26.74***	1.406***		27.92***	1.582***
		(6.877)	(0.392)		(8.530)	(0.397)		(7.794)	(0.366)
Second Stage									
Expansion	-0.0235	-0.232***	-0.0939*	-0.00435	-0.218***	-0.0783*	-0.00244	-0.252***	-0.109***
	(0.0166)	(0.0806)	(0.0491)	(0.0134)	(0.0811)	(0.0426)	(0.0139)	(0.0748)	(0.0412)
ln(Tot Assets)	-0.307	-0.222	-0.278	-0.717	-0.442	-0.622	-0.712	-0.796*	-0.748**
	(0.387)	(0.363)	(0.332)	(0.440)	(0.433)	(0.384)	(0.469)	(0.440)	(0.378)
ROA				-0.818*	-0.760*	-0.798**	-0.753	-0.681	-0.723*
				(0.415)	(0.459)	(0.392)	(0.457)	(0.483)	(0.428)
Income diversity				0.111	0.155	0.126	0.0659	0.105	0.0824
				(0.168)	(0.225)	(0.170)	(0.195)	(0.252)	(0.199)
Asset diversity				-2.258***	-0.316	-1.586*	-1.411	0.805	-0.468
				(0.854)	(1.338)	(0.884)	(0.983)	(1.338)	(0.972)
ratio_k				-0.0693	-0.0400	-0.0592			
				(0.0483)	(0.0560)	(0.0448)			
Tier1/Asset							-0.00403	-0.0259	-0.0133
							(0.0128)	(0.0190)	(0.0129)
Deposits/Asset							-0.00226***	-0.000894	-0.00168
							(0.000724)	(0.00189)	(0.00109)
Observations	148	148	148	139	139	139	140	140	140
R-squared	0.822	0.660	0.803	0.851	0.683	0.831	0.857	0.631	0.816
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
F-Test 1st		11.64	12.77		9.825	12.57		12.83	18.72

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 10 – Dependent variable: loan loss provisions over loans. OLS and 2SLS regressions with bank-fixed effects. Weighted metric of expansion.

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) 2SLS	(7) OLS	(8) 2SLS	(9) 2SLS
First Stage									
Pred expansion		23.47***	1.400***		26.74***	1.406***		27.92***	1.582***
		(6.877)	(0.392)		(8.530)	(0.397)		(7.794)	(0.366)
Second Stage									
Expansion	-0.0235	-0.232***	-0.0939*	-0.00435	-0.218***	-0.0783*	-0.00244	-0.252***	-0.109***
	(0.0166)	(0.0806)	(0.0491)	(0.0134)	(0.0811)	(0.0426)	(0.0139)	(0.0748)	(0.0412)
ln(Tot Assets)	-0.307	-0.222	-0.278	-0.717	-0.442	-0.622	-0.712	-0.796*	-0.748**
	(0.387)	(0.363)	(0.332)	(0.440)	(0.433)	(0.384)	(0.469)	(0.440)	(0.378)
ROA				-0.818*	-0.760*	-0.798**	-0.753	-0.681	-0.723*
				(0.415)	(0.459)	(0.392)	(0.457)	(0.483)	(0.428)
Income diversity				0.111	0.155	0.126	0.0659	0.105	0.0824
				(0.168)	(0.225)	(0.170)	(0.195)	(0.252)	(0.199)
Asset diversity				-2.258***	-0.316	-1.586*	-1.411	0.805	-0.468
				(0.854)	(1.338)	(0.884)	(0.983)	(1.338)	(0.972)
ratio_k				-0.0693	-0.0400	-0.0592			
				(0.0483)	(0.0560)	(0.0448)			
Tier1/Asset							-0.00403	-0.0259	-0.0133
							(0.0128)	(0.0190)	(0.0129)
Deposits/Asset							-0.00226***	-0.000894	-0.00168
							(0.000724)	(0.00189)	(0.00109)
Observations	148	148	148	139	139	139	140	140	140
R-squared	0.822	0.660	0.803	0.851	0.683	0.831	0.857	0.631	0.816
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
F-Test 1st		11.64	12.77		9.825	12.57		12.83	18.72

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

channel has been examined by the recent empirical literature based on US data (GLL [30] and LLX [34]). The second channel has been explored in the theoretical literature (Allen and Gale [3], Boyd and De Nicolo' [6] and Faia and Ottaviano[21]), but has received little attention in the empirical literature. The third channel has attracted the attention of several commentators who see in regulatory arbitrage a key motivation for banks' expansion. In the years prior to the crisis, regulations indeed varied significantly across countries (despite the Basel suggestions common to all countries), thus offering banks headquartered in countries with stricter regulations the opportunity to expand in countries with laxer regimes. Below we explore the importance of those three channels. In particular, we examine whether the negative impact of foreign expansion on bank riskiness varies when expansion involves destination countries with different degrees of business cycle co-movement, competition or regulation relative to the origin country. In other words, we examine how the various channels contribute to the negative relation between expansion and risk.

Before turning to the regressions, it is useful to provide an overview of some descriptive statistics (see also Appendix D for more details). Origin countries tend to be rather different from other countries in terms of diversification, competition 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), more competition (0.92 against 0.87 in terms of Herfindahl-Hirschman Index) and more similar regulations.[8] In our sample, 75% of all openings take place in countries that have lower co-movement with the rest of the Europe than the origin country, 59% in countries that are less competitive and 54% in countries that have stricter regulations. This seems to suggest that banks tend to expand to countries with business cycles that are less correlated with the rest of Europe than those of the origin country (possibly due to diversification motives), to countries that are less competitive than the origin country (possibly due to the fact that headquarters of large bank holding companies are usually located in countries with better financial institutions), and to countries with better regulation (possibly due to the fact that after the crisis banks wished to signal more compliance in order to improve their

[8] See Table B.1 in Appendix B for additional details.

reputation and their franchise value).

4.1 Diversification

First, we test the impact of the diversification motive on the relation between risk and expansion. We do so by exploiting the variation in a destination country's business cycle co-movement with the other destination countries and how it compares with the co-movement of the origin country (i.e. the country of residence for all parent holdings) with all other countries in the sample. Business cycle co-movement (labelled *cmv*) is measured in terms of growth rate and we distinguish between expansions to destination countries with higher and lower business cycle co-movement than the origin country.[9]

To address the problem of endogeneity with these two types of expansions, we then repeat our 2SLS with two new instruments: the predicted expansion to countries with higher co-movement than the origin country; and the predicted expansion to countries with lower comovement than the origin country. Our initial baseline instrument is the one generated through the gravity estimation with bank and hosting country-year fixed effects.[10] This choice is motivated by the fact that the other instruments have a very low correlation with the actual openings. Except for the change in instruments all other controls remain as before.

The corresponding results are reported in Table 11. The dependent variable is the CDS price. We focus on this since, as explained before, CDS price provide an overall measure of bank risk and have better predictive power. We use the unweighted instrument in the first two columns and the weighted one in the second two columns. OLS estimates (columns (1) and (3)) suggest that it is openings in countries with lower comovement that drive the overall negative impact of foreign expansion on bank riskiness. However, once the endogeneity bias is removed in 2SLS estimates, we find a decrease in risk when banks' expansion takes place in a country with lower

[9]As all destination countries' co-movements 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.

[10]Notice that the choice of the fixed effect specification is also determined by the size of our sample, whose matrix rows are given by the countries of origin (the only ones where head-quartered banks expand).

and higher business cycle co-movements vis-a-vis the rest of the destination countries. This is explained by the possibility to hedge against global risk in line with the results of GLL [30] and LLX [34]).

Finally, we also checked robustness of results with an alternative specification (not shown for brevity), in which we interact expansion with the co-movement measure. Once again the effect of expansion per se is negative and significant.

4.2 Competition

We now turn to competition, which we measure (inversely) through the canonical indicator of market concentration in the destination country, namely the Herfindahl-Hirschman Index (HHI). We partition origin countries in two groups depending on whether their HHI is higher or lower than the median HHI among origin countries, and we define a 'low competition' dummy variable that takes value 1 for origin countries with higher-than-median HHI and 0 otherwise.[11] As in the case of diversification, having to deal with two types of expansions (from higher-than-median and from lower-than-median HHI countries), we use two instruments: the predicted expansion (with bank and hosting country-year fixed effects); and the predicted expansion interacted with the low competition dummy. Our specification also includes a dummy that is equal to one if the origin country of the parent holding has a low Herfindhal index (high level of competition) as well as the interaction term between this dummy and the variable for expansion.

The results are reported in Table 12 which is constructed in a similar way as Table 11 with the unweighted expansion instrument in columns (1) and (2) and the weighted instrument in columns (3) and (4). Results show that banks headquartered in countries with a higher level of competition (lower-than-median HHI) have lower riskiness (the dummy for the low Herfindhal index in the origin country exhibit a negative and significant coefficient). This can be explained by the fact that banks headquartered in countries with sound financial structures in terms of competition tend to be more disciplined in general. It also shows that expansion for

[11]The median HHI among origin countries corresponds to the bottom 20% HHI among all countries in the sample.

Table 11 – Testing for the diversification channel. Dependent variable: CDS prices. OLS and 2SLS regressions with bank and year fixed effects. Unweighted instrument in the first two-columns and weighted instrument in the second two columns.

VARIABLES	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
Exp. when $cmv_j < cmv_i$	-0.0143***	-0.0393***		
	(0.00376)	(0.0124)		
Exp. when $cmv_j > cmv_i$	-0.000146	-0.104**		
	(0.0139)	(0.0471)		
Exp. w when $cmv_j < cmv_i$			-0.0137***	-0.0381***
			(0.00360)	(0.0119)
Exp. w when $cmv_j > cmv_i$			-0.000204	-0.101**
			(0.0134)	(0.0454)
ln(Tot Assets)	-0.0200	-0.122	-0.0204	-0.121
	(0.126)	(0.132)	(0.126)	(0.132)
ROA	-0.00632	0.0183	-0.00617	0.0184
	(0.0730)	(0.0810)	(0.0730)	(0.0808)
Income diversity	-0.119***	-0.0937**	-0.119***	-0.0923**
	(0.0366)	(0.0415)	(0.0367)	(0.0417)
Asset diversity	0.202	0.910**	0.200	0.896**
	(0.306)	(0.416)	(0.306)	(0.414)
Tier1/Asset	-0.00988*	-0.0202***	-0.00987*	-0.0201***
	(0.00515)	(0.00616)	(0.00514)	(0.00612)
Deposits/Asset	-0.000652***	-0.000168	-0.000652***	-0.000175
	(0.000206)	(0.000449)	(0.000206)	(0.000446)
Observations	141	141	141	141
R-squared	0.974	0.952	0.974	0.952
Bank fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Instr.		IV2		IV2
F-Test 1st		6.496		6.565

Robust standard errors in parentheses. IV2 refers to our preferred instrument generated with bank and hosting-country-time fixed effects.

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

banks headquartered in those countries reduces bank riskiness less than expansion from the other countries. On net the effect of expanding from higher competition countries is essentially null. Therefore, the overall negative impact of expansion on bank riskiness is entirely driven by banks expanding from countries with low levels of competition (higher-than-median HHI). These banks are presumably more likely to expand to destination countries with higher competition and this exerts more discipline, thereby reducing their risk.

This finding can also be rationalized in the wake of Boyd and De Nicolo' [6] and Faia and Ottaviano [21]. In the logic of their models, more competition has two opposite effects in the markets of funds (deposits) and loans when banks have market power in both. On the one hand, tougher competition in the banks' funding market increases the interest rate banks pay as it reduces their oligopsonistic power. On the other hand, tougher competition in the market for loans decreases the spread ('markup') between the interest rate banks earn on loans and the interest rate that they pay on funds. Due to moral hazard investors finance more risky projects when the interest rate on loans is higher. The effect of competition on this interest rate is generally ambiguous depending on whether the oligopsonistic effect or the opposing oligopolistic effect dominates. In our sample expansion from less competitive markets (likely to expand to more competitive markets) drives the overall fall in bank riskiness. This would be consistent with the negative oligopolistic effect of competition on the spread dominating its positive oligopsonistic effect on funding costs as long as expanding from less competitive countries increased the competitive pressure on banks (expansions to destination markets with higher competition in loans).

4.3 Regulation

To examine the role of differences in regulatory environments on the relation between foreign expansion and and bank riskiness, we proxy the strictness of regulation by the macroprudential index (MPI) of Cerutti, Claessens and Laeven [11]. For each origin country i we partition destination countries in two groups depending on whether their regulation is stricter than the origin country ($mpi_j > mpi_i$) or less strict ($mpi_j < mpi_i$). As in the case of diversification, we

Table 12 – Testing for the competition channel. Dependent variable: CDS prices. OLS and 2SLS regressions with bank and year fixed effects. Unweighted instrument in the first two-columns and weighted instrument in the second two columns.

VARIABLES	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
Expansion	-0.0181***	-0.0673***		
	(0.00513)	(0.0204)		
Expansion * $\mathbb{1}_{low\ hhi\ in\ i}$	0.0137**	0.0617***		
	(0.00687)	(0.0205)		
Expansion w			-0.0173***	-0.0642***
			(0.00490)	(0.0196)
Expansion * $\mathbb{1}_{low\ hhi\ in\ i}$ w			0.0131*	0.0590***
			(0.00666)	(0.0198)
$\mathbb{1}_{low\ hhi\ in\ i}$	-0.0944	-0.379***	-0.0942	-0.378***
	(0.0956)	(0.120)	(0.0959)	(0.121)
ln(Tot Assets)	-0.0224	0.0184	-0.0227	0.0167
	(0.125)	(0.118)	(0.125)	(0.118)
ROA	0.00208	0.0227	0.00209	0.0228
	(0.0703)	(0.0610)	(0.0703)	(0.0608)
Income diversity	-0.114***	-0.105***	-0.114***	-0.104***
	(0.0358)	(0.0361)	(0.0359)	(0.0360)
Asset diversity	0.0935	-0.0289	0.0916	-0.0312
	(0.317)	(0.283)	(0.317)	(0.284)
Tier1/Asset	-0.00971*	-0.00846	-0.00969*	-0.00847
	(0.00495)	(0.00520)	(0.00495)	(0.00519)
Deposits/Asset	-0.000616***	-0.000635*	-0.000617***	-0.000638*
	(0.000187)	(0.000332)	(0.000187)	(0.000328)
Observations	141	141	141	141
R-squared	0.975	0.958	0.975	0.958
Bank fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Instr.		IV2		IV2
F-Test 1st		6.853		6.509

Robust standard errors in parentheses. IV2 refers to our preferred instrument generated with bank and hosting-country-time fixed effects.

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

instrument the two endogenous groups of openings with the corresponding predicted expansions.

From the estimates reported in Table 13, we see that a large part of the overall negative effect of geographic expansion on bank riskiness in the sample is (unsurprisingly) driven by expansion to countries with stricter regulation: if banks expand to countries with stricter regulation, the monitoring exerted by the supervisor is likely going to reduce risk. The coefficient on expansions to countries with lower regulation is, instead, insignificant.

5 International Expansion and Systemic Risk

It has been argued that for crisis prediction metrics of systemic risk are significantly more informative than bank-based metrics as the ones we have used so far. Systemic risk metrics (such as the marginal shortfall or the CoVaR) indeed capture the role of banks' interconnections in the propagation of risk. Under certain banking industry structures, interconnections might amplify the propagation of risk generated by banks' decisions. It is thus worthwhile checking whether international expansion, while reducing individual bank risk, amplifies systemic risk associated with interconnectivity. The idea is that by internationalizing a bank increases the extent of its interconnections with the local industry (especially if internalization takes place through 'bricks and mortar'). It becomes therefore exposed not only to its own domestic risk but also to foreign risk, and can also transmit its own individual risk abroad. The conventional wisdom is that, as a result, banks' globalization can increase the extent of contagion, hence systemic risk.

We check whether this is the case in our sample by repeating the above-described econometric procedure after replacing individual bank risk metrics with systemic risk metrics. We use three different systemic risk measures: the conditional capital short-fall (SRISK; see Brownlees and Engle [7]), the long-run marginal expected shortfall (LRMES; see Acharya et. al. [1]) and the ΔCoVaR (see Adrian and Brunnermeier [2]). The SRISK is the capital short-fall of a bank conditional on a severe market decline. The LRMES is the propensity to be under-capitalized when the system as a whole is under-capitalized. Finally, the ΔCoVaR measures the contribution to systemic risk when an institution goes from normal to stressed (as defined by the VaR)

Table 13 – Testing for the regulation channel. Dependent variable: CDS prices. OLS and 2SLS regressions with bank and year fixed effects. Unweighted instrument in the first two-columns and weighted instrument in the second two columns.

VARIABLES	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
Exp. when $mpi_j < mpi_i$	-0.0171**	-0.0229		
	(0.00654)	(0.0172)		
Exp. when $mpi_j > mpi_i$	-0.00499	-0.0729***		
	(0.00875)	(0.0261)		
Exp. w when $mpi_j < mpi_i$			-0.0161**	-0.0222
			(0.00635)	(0.0165)
Exp. w when $mpi_j > mpi_i$			-0.00523	-0.0700***
			(0.00850)	(0.0252)
ln(Tot Assets)	-0.0369	-0.0426	-0.0368	-0.0427
	(0.125)	(0.122)	(0.125)	(0.122)
ROA	-0.00125	-0.00554	-0.00142	-0.00499
	(0.0731)	(0.0735)	(0.0730)	(0.0733)
Income diversity	-0.118***	-0.100***	-0.118***	-0.0994***
	(0.0355)	(0.0358)	(0.0356)	(0.0359)
Asset diversity	0.216	0.753*	0.215	0.741*
	(0.307)	(0.439)	(0.308)	(0.435)
Tier1/Asset	-0.0102**	-0.0177***	-0.0102**	-0.0176***
	(0.00497)	(0.00628)	(0.00497)	(0.00627)
Deposits/Asset	-0.000658***	-0.000191	-0.000654***	-0.000198
	(0.000207)	(0.000383)	(0.000208)	(0.000383)
Observations	141	141	141	141
R-squared	0.974	0.959	0.974	0.959
Bank fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Instr.		IV2		IV2
F-Test 1st		11.57		11.81

Robust standard errors in parentheses. IV2 refers to our preferred instrument generated with bank and hosting-country-time fixed effects.

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

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

We present results for the benchmark specification, namely the one that includes all control variables, fixed effects, and in which expansion is weighted. Table 14 corresponds to the OLS estimates, Table 15 to the results that use the instrumental variable generated without fixed effects (IV1), and Table 16 to the results with the IV generated with origin country-time (jt) and bank (k) fixed effects (IV2, the preferred IV). In all tables the columns correspond to different systemic systemic risk measures used as dependent variable: the CDS in column (1), the loan loss provision to total loans in column (2), the LRMES in column (3), the SRISK in column (4), the ΔCoVaR computed using CDS returns in column (5), and the ΔCoVaR computed using equity prices in column (6).

In all cases there is a negative and significant impact of international expansion on systemic risk with remarkable consistency of results across the different measures. Only the impact of expansion on the ΔCoVaR CDS is positive, but not robust across specifications. We have also tried various alternative specifications and they lead to the conclusion that the negative and significant impact of international expansion on systemic risk is robust (see Appendix E for details).

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, other forces may operate in the opposite direction. The new entrant may foster competition, which acts as a discipline device for banks in the local market. It may also be able to better diversify its funding resources and its assets, thereby also contributing to reducing overall liquidity and portfolio risk. Our finding that foreign expansion

Table 14 – OLS estimates of systemic risk metrics against international expansions. Specification includes all controls and fixed effects. International expansion is weighted.

OLS	(1) ln(CDS)	(2) LLP	(3) LRMES	(4) SRISK	(5) ΔCoVaR CDS	(6) ΔCoVaR EQU
Expansion w	-0.0115***	-0.00219	-0.377**	-0.652*	-0.000689	-0.000713
	(0.00314)	(0.0133)	(0.185)	(0.353)	(0.00244)	(0.000465)
ln(Tot Assets)	-0.0355	-0.712	-4.613	8.677	0.0907	-0.00840
	(0.124)	(0.470)	(5.149)	(9.531)	(0.0690)	(0.0194)
ROA	-0.00385	-0.753	1.992	-7.132	0.0258	-0.0147*
	(0.0720)	(0.457)	(2.123)	(4.376)	(0.0522)	(0.00764)
Income diversity	-0.116***	0.0659	-0.704	-1.333	-0.116***	0.0130**
	(0.0354)	(0.195)	(1.527)	(1.908)	(0.0324)	(0.00545)
Asset diversity	0.236	-1.413	8.792	18.29	-0.0129	0.00534
	(0.309)	(0.984)	(12.33)	(16.13)	(0.167)	(0.0421)
Tier1/Asset	-0.0108**	-0.00401	-0.504***	-0.424	-0.00199	-0.000303
	(0.00472)	(0.0128)	(0.151)	(0.326)	(0.00320)	(0.000720)
Deposits/Asset	-0.000589***	-0.00226***	0.00854	-0.0161	0.000300**	-3.77e-05
	(0.000181)	(0.000724)	(0.00684)	(0.0159)	(0.000142)	(2.82e-05)
Observations	141	140	141	141	141	141
R-squared	0.974	0.857	0.756	0.873	0.802	0.848
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

would reduces systemic risk suggests that the competition/diversification forces prevail on the opposing contagion ones.

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 recent financial crisis, exhibited acceptable bank capital ratios (which are based on VaR assessment through banks' internal models) but very high leverage ratios. Given this, 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

Table 15 – IV1 estimates, with bank and year fixed effects, of systemic risk metrics against international expansions. International expansion is weighted.

IV1	(1) ln(CDS)	(2) LLP	(3) LRMES	(4) SRISK	(5) ΔCoVaR CDS	(6) ΔCoVaR EQU
Expansion w	-0.0441***	-0.243***	-1.241***	-3.696***	0.00718	-0.00653***
	(0.0138)	(0.0723)	(0.469)	(0.989)	(0.00681)	(0.00192)
ln(Tot Assets)	-0.0492	-0.796*	-4.975	7.401	0.0940	-0.0108
	(0.119)	(0.440)	(4.427)	(8.074)	(0.0644)	(0.0196)
ROA	0.00635	-0.679	2.263	-6.178	0.0233	-0.0129
	(0.0721)	(0.483)	(1.869)	(4.680)	(0.0469)	(0.00816)
Income diversity	-0.110***	0.110	-0.552	-0.796	-0.117***	0.0140**
	(0.0340)	(0.252)	(1.616)	(2.977)	(0.0314)	(0.00616)
Asset diversity	0.676*	0.774	20.50*	59.50**	-0.119	0.0841
	(0.365)	(1.335)	(11.51)	(24.04)	(0.160)	(0.0539)
Tier1/Asset	-0.0150***	-0.0254	-0.614***	-0.813**	-0.000984	-0.00105
	(0.00489)	(0.0190)	(0.153)	(0.339)	(0.00308)	(0.000820)
Deposits/Asset	-0.000479*	-0.000925	0.0115	-0.00579	0.000273*	-1.80e-05
	(0.000290)	(0.00188)	(0.00960)	(0.0287)	(0.000140)	(4.74e-05)
Observations	141	140	141	141	141	141
R-squared	0.961	0.631	0.680	0.723	0.789	0.730
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Instrument	IV1	IV1	IV1	IV1	IV1	IV1
F-Test 1st	13.52	12.81	13.52	13.52	13.52	13.52

Robust standard errors in parentheses. IV1 refers to the instrument generated without fixed effects.
*** p<0.01, ** p<0.05, * p<0.1

could find none.[12] As the relation between leverage and risk-sensitive metrics changes across our banks, statistically leverage does not seem to have much predictive power as far as banks' risk exposure is concerned. Second, we repeated the regressions above using leverage as risk metric. The estimated coefficient on foreign expansion turned out to be insignificant.

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

Table 16 – IV2 estimates, with bank and year fixed effects, of systemic risk metrics against international expansions. International expansion is weighted.

IV2	(1) ln(CDS)	(2) LLP	(3) LRMES	(4) SRISK	(5) ΔCoVaR CDS	(6) ΔCoVaR EQU
Expansion w	-0.0406***	-0.103***	-1.049***	-3.204***	0.0123**	-0.00328***
	(0.0104)	(0.0392)	(0.370)	(0.777)	(0.00592)	(0.00116)
ln(Tot Assets)	-0.0477	-0.747**	-4.895	7.607	0.0962	-0.00947
	(0.117)	(0.378)	(4.411)	(7.807)	(0.0671)	(0.0175)
ROA	0.00525	-0.723*	2.202	-6.332	0.0217	-0.0139**
	(0.0705)	(0.428)	(1.841)	(4.430)	(0.0479)	(0.00699)
Income diversity	-0.110***	0.0842	-0.586	-0.883	-0.118***	0.0134***
	(0.0328)	(0.198)	(1.542)	(2.704)	(0.0335)	(0.00511)
Asset diversity	0.629*	-0.501	17.89	52.84**	-0.188	0.0401
	(0.354)	(0.968)	(11.63)	(21.00)	(0.170)	(0.0408)
Tier1/Asset	-0.0146***	-0.0129	-0.590***	-0.750**	-0.000334	-0.000630
	(0.00478)	(0.0129)	(0.143)	(0.327)	(0.00321)	(0.000697)
Deposits/Asset	-0.000491*	-0.00170	0.0108	-0.00746	0.000256*	-2.90e-05
	(0.000269)	(0.00108)	(0.00886)	(0.0263)	(0.000155)	(3.20e-05)
Observations	141	140	141	141	141	141
R-squared	0.963	0.818	0.710	0.768	0.769	0.825
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Instrument	IV2	IV2	IV2	IV2	IV2	IV2
F-Test 1st	19.52	19.20	19.52	19.52	19.52	19.52

Robust standard errors in parentheses. IV2 refers to our preferred instrument generated with bank and hosting-country-time fixed effects.

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

6 Conclusion

We have built an original dataset on 15 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 distinguished a 'between effect' from a 'within effect'. According to the former effect, banks that expand abroad more have lower riskiness so that, given individual bank riskiness, their expansion reduces the (weighted) average riskiness of the banks' pool. According to the second effect, foreign expansion of any given bank makes the bank less risky.

We have found that there is a strong negative correlation between bank riskiness and foreign expansion. This is due to a robust 'within effect' as well as to a less robust 'between effect'. In terms of the channels, we have found evidence that diversification, competition and regulation are all important in explaining the 'within effect'. Expansion in destination countries with more opportunities for diversification (as captured by different business cycle comovement) and stricter regulation than the origin country decreases a bank's riskiness. As for competition, expansion has a distinct impact on bank risk only when competition in the origin country is less intense than in the destination countries.

We have then investigated the impact of foreign expansion on systemic risk measures. Consitently across different measures, we find that also this impact is negative and significant. We interpret this finding as evidence that, despite the fact that international expansion might spread the contagion of individual bank risk, ultimately the discipline role of competition and the insurance role of diversification seem to prevail.

While it is undeniable that prior to the crisis a large part of the banking system had built risk and this lead to the subsequent events, which factors mostly fostered banks' incentives toward building up risk is still an open question.[13] Our analysis suggests that banks' international expansion through a 'bricks and mortar' type of business model does not seem to be the culprit.

[13]A common explanation for risk building up before the financial crisis is that persistently expansionary monetary policy might have strengthened risk-taking incentives. See Heider, Schepens and Saidi [26] for a recent panel data analysis.

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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, Bulgary, Bosnia and Herzegovina, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Lituania, Luxembourg, Latvia, Malta, Montenegro, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Turkey and Ukraine.

B Comovement, Regulation and Competition

Table B.1 – Descriptive statistics on comovement, regulation and competition

	Comovement		Competition		Regulation	
	Source	Host	Source	Host	Source	Host
Mean	0.92	0.80	0.92	0.87	1.44	1.49
Sd	0.07	0.16	0.06	0.07	1.13	1.41
Min	0.78	0.31	0.98	0.97	0.00	0.00
Max	0.97	0.98	0.80	0.69	3.00	4.89

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 (Tinbergen [39] being the first to apply this framework) and a large literature now exists providing strong theoretical and empirical basis to this framework. The key idea of gravity is that bilateral trade flows between countries decrease with bilateral distance between them, because distance raises transport costs all other things being equal. According to the meta analysis of Head and Mayer [31], the elasticity of trade to distance falls 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 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. [27] and Portes and Rey [35]. Portes and Rey [35] show that the geography of information is the main determinant of the pattern of international transactions. Galindo et al. [27] show that bank penetration 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 [9] 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 [24] 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. [5] 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 [13] 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 [4]). 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 2, 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 [30].

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

This section describes in detail and presents some statistics of the systemic risk metrics used in Section 6.

E.1 Data: systemic risk measures

We use several different measures for the impact of each individual bank on systemic risk. We use three different systemic risk measures: the conditional capital short-fall (SRISK), the long-run marginal expected shortfall (LRMES) and the ΔCoVaR computed using either CDS prices or equity prices.

SRISK is a forward-looking measure of systemic risk proposed by Bronwlees and Engle [7]. 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). We take the SRISK metric from the Centre for Risk Analysis of Lausanne. It corresponds to a yearly average using four values by year.

The second metric we use is a marginal shortfall along the lines of Acharya et al. [1]. The expected capital shortfall measures how much capital would be needed for the bank as to be correctly capitalized after a crisis. The LMRES 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 comeing from the Centre for Risk Management of Lausanne and is computed following the methodology of Engle, Jondeau and Rockinger [20], who adapted the LMRES by handling some European peculiarities. Again we take the annual measure of these indexes that corresponds to the average of 4 monthly points.[14]

Third we compute the ΔCoVaR using the methodology of Adrian and Brunnermeier [2]. The ΔCoVaR 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

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

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, the ΔCoVaR is computed using the market returns. We use both equity returns (ΔCoVaR EQU) and 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 as 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.

Regarding the data sources, CDS prices come from Bloomberg and equity prices from Datastream. Both are averaged as 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. 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 as to obtain monthly values.

E.2 Descriptive statistics

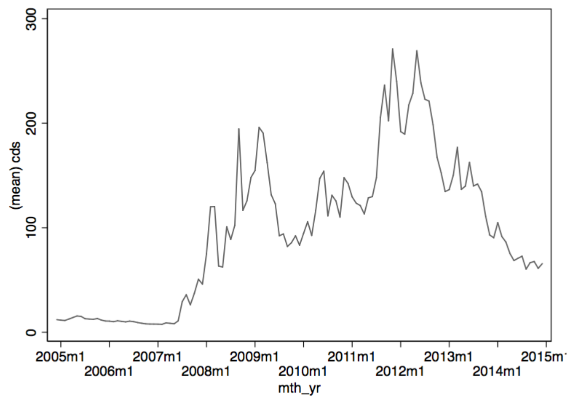

Figure E.1 – Trend for CDS prices

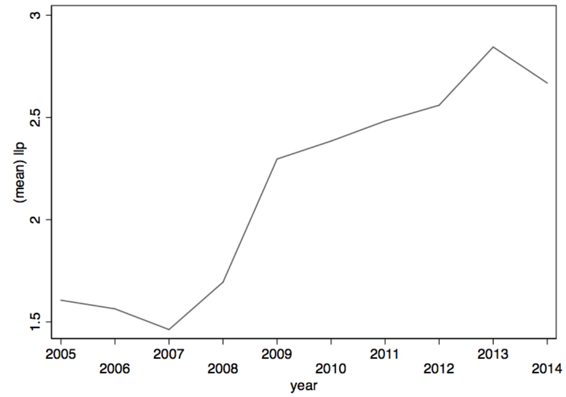

Figure E.2 – Trend for loan-loss provisions to total loans.

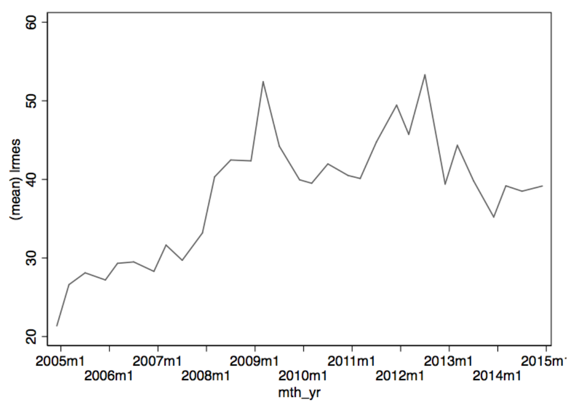

Figure E.3 – Trend for LRMES

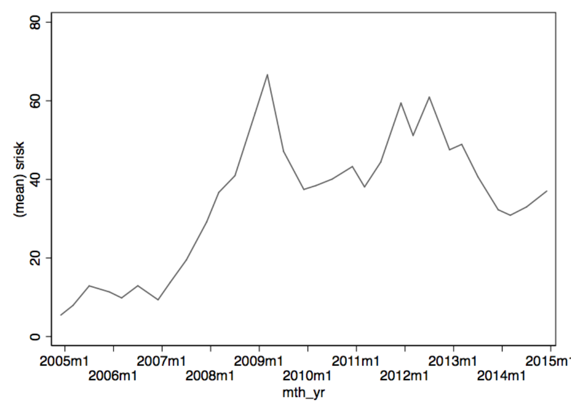

Figure E.4 – Trend for SRISK

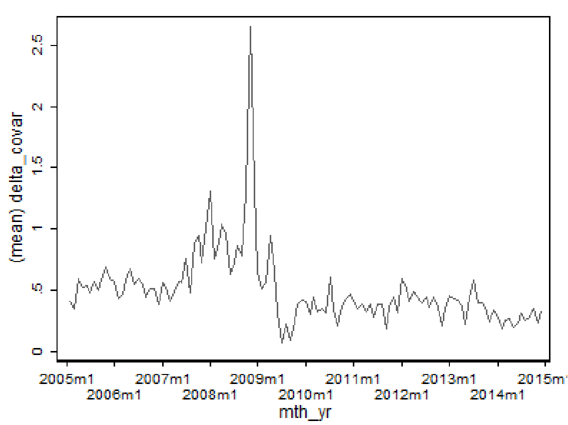

Figure E.5 – Trend for ΔCoVaR CDS

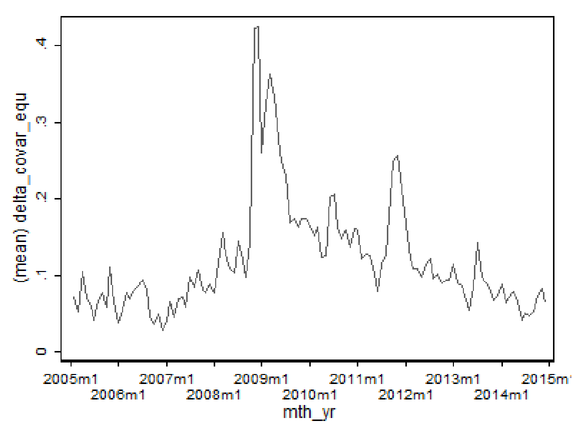

Figure E.6 – Trend for ΔCoVaR EQU

Figures E.1 to E.5 correspond to our 6 risk metrics. CDS prices, 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.

E.3 Other results

We display in this section all the regressions weighted, with fixed effects and different controls variables for all the dependent variables: CDS price, loan-loss provisions to total loans, SRISK, Long run MES, ΔCoVaR CDS and ΔCoVaR EQU (the metric considered is written in the upper left corner of each table).

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

ln(CDS)	(1) OLS	(2) 2SLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) 2SLS	(7) OLS	(8) 2SLS	(9) 2SLS
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
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
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 E.2 – Regressions (OLS and 2SLS) weighted, with fixed effects and different controls variables for all the dependent variables: dependent variable loan-loss provision.

LLP	(1) OLS	(2) 2SLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) 2SLS	(7) OLS	(8) 2SLS	(9) 2SLS
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
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
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 E.3 – Regressions (OLS and 2SLS) weighted, with fixed effects and different controls variables for all the dependent variables: dependent variable LRMES.

LRMES	(1) OLS	(2) 2SLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) 2SLS	(7) OLS	(8) 2SLS	(9) 2SLS
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
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
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 E.4 – Regressions (OLS and 2SLS) weighted, with fixed effects and different controls variables for all the dependent variables: dependent variable SRISK.

SRISK	(1) OLS	(2) 2SLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) 2SLS	(7) OLS	(8) 2SLS	(9) 2SLS
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
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
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 E.5 – 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	2SLS	2SLS	OLS	2SLS	2SLS	OLS	2SLS	2SLS
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
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
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 E.6 – 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) 2SLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) 2SLS	(7) OLS	(8) 2SLS	(9) 2SLS
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
Instrument		IV1	IV2		IV1	IV2		IV1	IV2
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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