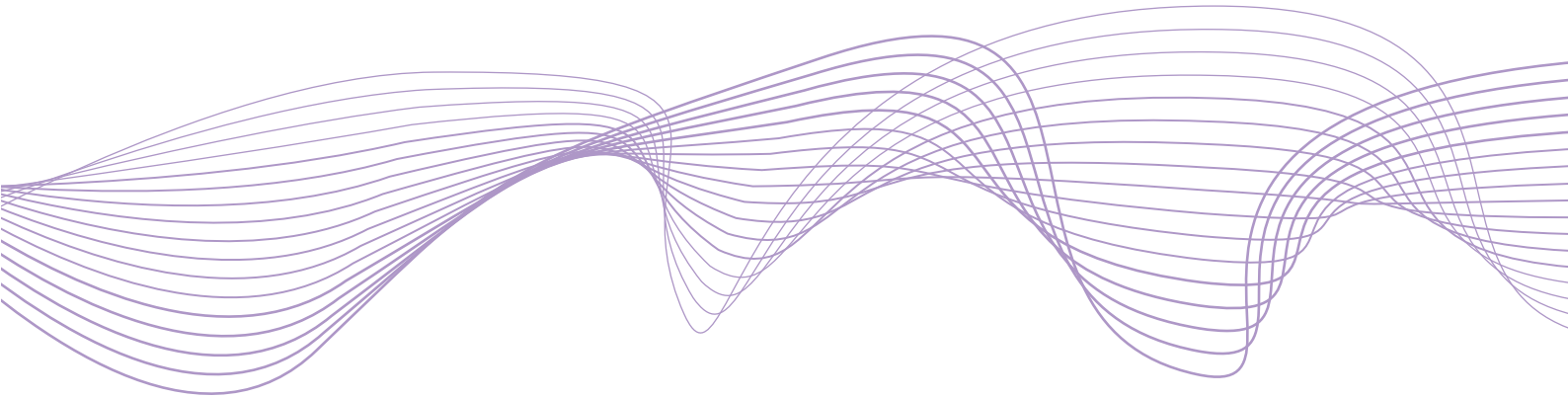# Working Paper Series

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Retrenchment of euro area banks and international banking models

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Abstract

In this paper, we analyze the importance of international banking models, along the operational and the funding dimensions, for the decline in international positions of European banks since the crisis. Using BIS Consolidated Banking Statistics, we find that the multinational model (higher reliance on local activity) and the decentralized model (higher weight of local funding over local claims) is associated with lower retrenchment. We also find that more business synchronization between the home and the host economy is associated with higher declines in lending after the crisis and that the multinational and decentralized models mitigate such effect. On the other hand, lending to banks is not affected by the correlation of economic cycles between the home and the host country.

1. Introduction

Total foreign claims of European banks (EU) fell by around 40% over the period 2007- 2016 (CGFS, 2016). However, this figure hinders a large degree of heterogeneity at a granular level. For instance, foreign claims on counterparties in advanced economies declined much more than in emerging markets. In addition, a large part of the reduction in EU banks' foreign activity was concentrated in the loans to the banking sector itself. Lending to banks shrank on average by more than 50% in EU countries, reducing its share in the overall activity abroad, from a country average of 31% in 2008 to a 16% in 2017. In this paper, we study whether the global business model implemented by European banking systems in their international expansion contributes to explaining such heterogeneity. In this regards, European banking systems constitute a good laboratory since they are exposed to similar shocks but present a large disparity in the international banking models that they adopt.

Previous empirical literature has shown that policy-related factors, such as regulatory and monetary policies (Bremus and Fratzscher, 2015), or prudential policies and bank levies (Emter et al., 2018) have determined cross-border bank lending activity since the global financial crisis. In the EU case, Emter et al. (2018) find that among the determinants for the overall decline, home factors related to the home banking system are crucial. In particular, they single out the ratio of non-performing loans (NPL) in the country providing credit (home country) as the main factor behind the reduction in cross-border lending. Other authors like McGuire and von Peter (2016) put the focus on the funding mix of banks' foreign affiliates. According to McGuire and von Peter, affiliates that used local funding to back local activity abroad were able to make their balance sheets more resilient while those affiliates that relied more on interbank and cross-border funding were the ones experiencing larger balance sheet contractions in the wake of the crisis.

Using bilateral banking flow data, Wang (2018) investigates how bilateral flows respond to economic uncertainty in the domestic economy and foreign economies while controlling for bilateral characteristics, global risk factors and country-specific unobserved characteristics. The results show that while banks reduce their exposure to a foreign country when it becomes riskier, they tend to increase their exposure to their home country in bad times (a retrenchment). Cerutti (2015), after discussing the measurement of foreign borrowers' and credit exposures, analyzes their drivers during the period 2006-2012. He concludes that both, home and host countries' characteristics matter when explaining the causes behind the decline in cross-border banking activity. The presence of systemic banking crisis and global financial conditions in the home country drive creditor banking systems' foreign exposures. As for borrower's exposures, the results show that from whom and how a country borrows, the international financial conditions that they are exposed to and the borrower's business economic cycle play a role in explaining their evolution.

Following the classification of McCauley et al. (2010) and Gambacorta and van Rixtel (2013) we analyze the global business model at two different but related dimensions: *operational* and *funding*. The operational dimension defines how banking systems operate in the host country. In this dimension, banks can be classified as multinational or international. Multinational banks are characterized by the predominance of local business (either through branches or subsidiaries) in contrast to international banks which conduct mostly cross-border business with non-residents

thus, without establishing affiliates abroad. According to McCauley et al. (2010), German banks are on one side of the spectrum with a large share of cross-border versus local positions, so that they follow the international model, while Spanish banks stand out with the largest share of local activity among the major banking systems hence, following the multinational model.

The funding dimension is based on the location of funding sources used in the banking systems' international activity. In this dimension banks can be classified as centralized or decentralized. Centralized banking systems raise funds at major offices and redistribute them around the group through intra-bank lending. Decentralized banking systems operate in a way such that affiliates raise funds locally to finance local activity abroad, so that they have a lot of autonomy to finance assets in each location. McCauley et al. (2010) show that German and French banks can be characterized as centralized banking systems since their foreign claims are financed predominantly by domestic deposits. On the contrary, Spanish banks tend to implement a decentralized model as their foreign offices raise funds autonomously in each host country.

This paper contributes to the literature on the structural drivers of retrenchment. Building-up on the existing research, we empirically test if the different dimensions of the international banking model adopted by euro area (EA) banking systems play a role in explaining the retrenchment in EAcountries. We postulate that more centralized banking systems and banking systems more in line with the international model are going to be the ones most affected by the deterioration in international financial conditions, and thus, the ones experiencing a larger decline after the crisis, in line with the results in McGuire and von Peter (2016). In contrast to that work, we analyze the separate effects of the two dimensions of the international banking model as well as their role in mitigating or intensifying the effects of home banking characteristics and of the geographic destination of claims.

In order to do so, we focus on the evolution of total claims between the pre and post-crisis periods provided by the banking system of reporting countries in the EA. This is in contrast to other works where either all reporting EU countries (Emter et al., 2018) or a selection of reporting countries is taken (Bremus and Fratzscher, 2015; McGuire and von Peter, 2016). More specifically and in contrast to Emter et al. (2018), we analyze all bilateral claims and not only those directed to EU countries so as to account for bilateral characteristics that can affect the retrenchment (Galstyan and Lane, 2013). Thus, we include those claims devoted to the USA, Latin-American countries and Asian countries. This allows us to take into account the different geographic portfolio composition and, in particular, the relevance of the synchronization between the economic cycles of the home and host countries. As we are interested in the role of international banking models, and in contrast to Emter et al. (2018), we make primarily use of Consolidated Banking Statistics data at the stock level.

We provide evidence of the relevance of global business models as determinants of the retrenchment. We find that those banking systems that are characterized by a larger proportion of local claims (multinational systems) are the ones that have retrenched less. We also find that those banking systems that lend mostly cross-border, operating from the home country or in major financial centers (international systems), are the ones that retrenched more their stock of claims abroad. We also find that those financial systems which raise funds locally in the jurisdiction where they are located and where they lend (decentralized systems) have retrenched

less than those that raise funds at major offices and redistribute them around the banking group (centralized systems).

We next study the impact of changes between the pre and the post-crisis period in the EA banking systems along two characteristics: resilience to adverse shocks and the relevance of the traditional banking activity. We document that those banking systems that increased their resilience and those that moved away from traditional activity have retrenchment more. We also find that the decentralized global funding business model contributes to containing the decline in foreign claims for those banking systems that reinforced their resilience after the crisis.

Lastly, we look at the countries where banking systems lend, but in contrast to existing studies we do not focus on geographic areas, but on the degree of synchronization of business cycles between the home and the host country. We find that business synchronization is material in the explanation of the changes in international foreign claims of EU banks, independently of the business model that they have adopted. The interquartile range reduction in the degree of synchronization of business cycles, which could be attained through changes in the composition of borrowing countries, would lower the change in total claims by more than 4 percentage points. This accounts for 25% of the average change in the sample. On top of that, we find that both, the multinational and the decentralized models tend to mitigate the negative effects of higher synchronization between home and host economies on foreign claims.

When we analyse if these results hold when we focus on lending to banks, following Reinhardt and Riddiough (2015), we find that the operational dimension plays a role, directly and through bank characteristics while the funding dimension does it only through bank characteristics. We do not find evidence that synchronization plays a role.

The last section of this paper presents robustness tests. First, we study how the changes in the international banking model affect the changes in total claims. By doing so, we determine that those banking systems that have become more multinational or more decentralized between the pre-crisis period and the post-crisis period, are the ones that have retrenched the least. Then, instead of using specific years to define the pre and post-crisis periods, we propose a "peak-to-through" approach to measure the contraction in the balance sheets of banks' foreign affiliates in the wake of the crisis. In this case, we find the same qualitative results as regards the operational and funding dimensions.

The remainder of the paper is structured as follows. Section 2 provides a description of the data and of our sample and discusses the main variables used in the empirical analysis. Section 3 presents our empirical strategy, baseline specification and the variations we make to it. Section 4 and 5 present our main results and robustness checks respectively. Section 6 summarizes and concludes.

2. Data

2.1. Sources and sample

We use the Bank for International Settlements (BIS) consolidated banking statistics (CBS) as a primary data source. The CBS capture the worldwide consolidated positions of internationally active banking groups headquartered in reporting countries. The data include the claims of

reporting banks' foreign affiliates but exclude intragroup positions, similarly to the consolidation approach followed by banking supervisors.[1]

We use stock data on an immediate borrower basis[2] for domestic banks excluding domestic positions which is available for most EA countries for a period covering the years before and after the crisis. This is in contrast to other studies that make use of the residence-based locational banking statistics (LBS), which include intragroup positions, but exclude local claims of foreign branches and subsidiaries, as they focus on cross-border banking positions.[3] The data comprise foreign financial claims by domestic banks' head offices and foreign affiliates, which include not only credit and securities issued by the private and the public sector, but also derivatives. The use of CBS data is in consonance with the focus of our analysis on the role of banking group's global business model, which has to be defined at the consolidated level. We include cross-border claims in all currencies and local claims in both, local and foreign currency.

The variables that capture the banking system health are collected from the Financial Development and Structure Dataset of the World Bank (Beck et al., 2000 and 2009; Cihák et al., 2012; Beck et al., 2018), the information regarding the regulatory and supervisory frameworks comes from the World Bank Surveys on Bank Regulation (Barth et al., 2013) and the data on macroeconomic variables comes from the World Economic Outlook (International Monetary Fund). Our sample covers 10 reporting EA countries[4] and all of their available counterparty countries for the period 2003 – 2017, so including advanced and emerging economies and offshore banking centers. We drop those host countries for which we do not have at least two reporting countries which lend there. Therefore, the final number of host countries is 135, although not all the 10 reporting countries (i.e., home country) have operations in them.

2.2. Variables

Table 1 contains a description of all the variables included in the analysis. Our aim is to study the drivers of the change in total foreign claims (ΔTCL_{ij}, hereafter total claims) in the EA banking systems. ΔTCL_{ij} is the log difference in the stock of total claims from country *i* banking sector to residents of country *j* before and after the crisis,

$$\Delta TCL_{ij} = \ln \left(TCL_{ij}^{POST} \right) - \ln \left(TCL_{ij}^{PRE} \right) \tag{1}$$

where TCL_{ij}^{PRE} and TCL_{ij}^{POST} denote the average stock of total claims across the period 2005 – 2007 and 2014 – 2016, respectively. We have corrected the original data reported by the BIS for valuation effects due to exchange rate changes, in accordance with Cerutti (2015). Specifically, we construct the changes as the difference between the natural log of the claims at the post-

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[1] See BIS (2015 and 2019) and Avdjiev et al. (2015) for a description of the contents and main characteristics of these statistics.

[2] We use claims on an immediate risk basis, instead of on an ultimate risk basis as our interest does not lie on where the risk is.

[3] For example, the positions of a German bank's subsidiary located in London – which in the LBS are included in the positions of banks in the United Kingdom – are consolidated in the CBS with those of its parent and included in positions of German banks.

[4] We study the following EA countries: Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain.

crisis period and the natural log of the exchange rate-adjusted outstanding claims at the pre-crisis period.[5] Descriptive statistics are reported in Table 2. On average, total claims declined by 16%. However, we observe large heterogeneity in the behavior of bilateral total claims with sizeable increases and decreases.

[Insert Table 1]

[Insert Table 2]

We study the global business model along two dimensions: *operational* and *funding*. To classify a banking system along these two categories, we consider the average of the bilateral position of the EA country *i* when interacting with country *j* for the period 2003 – 2004.

The *operational dimension* is captured by the ratio of total local claims (including both local claims in local currency and in foreign currency) over total claims. The larger the value of the ratio, the more *multinational* the banking system is, since multinational banks are characterized by the predominance of local business in host countries (either through branches or subsidiaries). On the contrary, international banks conduct mostly cross-border business with non-residents without establishing affiliates abroad.

We proxy the *funding dimension* by means of the ratio of local liabilities[6] over total local claims. Decentralized banks operate in a way that activity abroad is locally financed in the host country and thus, the larger the ratio, the more *decentralized* the banking system is.[7]

We analyze the impact of the two dimensions of the global business model under two different metrics: i) a continuous variable as proxied by the corresponding ratio; and ii) a dummy variable which takes value 1 if the continuous variable is above the 90th percentile of the whole distribution. Thus, the corresponding dummies will take value 1 when the operational dimension is multinational and/or when the funding dimension is decentralized.

As recorded in Table 2, we observe large heterogeneity in the business models that characterize the different bilateral relations. However, the centralized and international models account for more than half the bilateral pairs. Local activity accounts for just 30% of total activity abroad for the 90th percentile and it's nearly 90% financed by local funding also for the 90th percentile.

We control for the changes between the pre and post-crisis period in the home country banking system along two characteristics: resilience and the relevance of the traditional banking activity. Resilience to adverse shocks (ΔResilience) is proxied by the z-score of the banking system which can be interpreted as the number of standard deviations that profit can fall before a bank is bankrupt (Roy, 1952). We measure the relevance of the traditional banking activity (ΔTraditionalActivity) as the negative loan-to-deposit ratio. The intuition is that the higher this variable, the closer is the banking system to the traditional banking activity, defined as taking deposits from the public and granting loans. The change is calculated as the difference in the

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[5] To correct for exchange rate changes, we use the shares of the five main currencies for which the BIS collects data (EUR, USD, JPY, GBP and CHF) which is provided at a country bilateral basis, except for Germany, where the disaggregated information by currencies is only available for the aggregate.

[6] Countries started reporting CBS total liabilities to the BIS in 2012.

[7] We winsorize the *funding model* at 1% as it has few extremely large values.

mean level across the years 2005 – 2007 and 2014 – 2016, respectively, as we do to calculate the change in total claims.

To account for the correlation between the fluctuations in economic activity across markets we follow Kalemli-Ozcan et al. (2013) and compute a proxy of the synchronization of economic cycles (*Synchronization*) as the average of the negative absolute difference between the home and the host country's real GDP growth rates, weighted by the share that the claims to the host country represents over the whole lending activity abroad of the home country (ω_{ij}). In particular, we calculate the bilateral synchronization between country *i* and country *j* as:

$$Synchronization_{ij} = -\frac{1}{T}\sum_{t=1}^{T}\omega_{ijt}\left|\Delta Y_{it} - \Delta Y_{jt}\right| \tag{2}$$

where ΔY_{it} and ΔY_{jt} refer to the *year-on-year* real GDP growth rate of country *i* and *j*, respectively, and T corresponds to the number of quarters employed in the analysis. Due to data restrictions, we use 12 quarters from the period 2005 – 2007. This index is defined so that higher values (i.e., the closer to zero) indicate a higher degree of bilateral synchronization between country *i* and *j*. Table 2 reports a large degree of heterogeneity in the bilateral synchronization. Indeed, the large difference between the median and the mean values points out to the existence of some relations strongly asynchronized.

To capture the regulatory environment, which according to previous work (Emter et al., 2018; and Bremus and Fratzscher, 2015) plays a determinant role, we use the change in the indices constructed by Barth et al. (2013) from the World Bank Surveys of 2011 and 2003 on Bank Regulation. Concretely, we use the change in the index for restrictions on activity ($\Delta RestrictionsIndex$) and the change in the index for prompt corrective action ($\Delta CorrectiveIndex$) in the home country. To control for the macroeconomic environment, we use the change between the average pre and post-crisis period of the real GDP growth rate (ΔGDP) of home and host countries. Pre and post-crisis periods refer to the mean level across the period 2005 – 2007 and 2014 – 2016, respectively.

We also construct a dummy variable (*EA*) that takes value 1 when the host country belongs to the euro area and zero otherwise.

3. Empirical strategy

We empirically test the extent to which the two dimensions of the global business model play a significant role in explaining the evolution of total claims in the EA banking systems. For such aim, we specify the following cross-sectional equation:

$$\Delta TCL_{ij} = \alpha + \beta Model_{ij} + \delta B_i + \theta CV_i + \gamma CV_j + \vartheta \ln\left(TCL_{ij}^{PRE}\right) + \varepsilon_{ij} \tag{3}$$

where ΔTCL_{ij} refers to the change in the stock of total claims from country *i* banking sector to the residents of country *j* before and after the crisis. $Model_{ij}$ contains the proxy for the two dimensions of the global business model. As we analyze the *operational* and *funding* dimensions separately, $Model_{ij}$ refers to any of the two variables. The model variable is predetermined with respect to the change in total claims. That is, it is computed using the values of 2003-2004.

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Besides our main variable of interest, we include B_i, a vector that contains the change in home country banking system characteristics. In addition, CV_i and CV_j contain a set of control variables relative to the home and host countries, respectively. CV_i contains proxies for the regulatory and the macroeconomic environment, while CV_j includes variables that refer to the macroeconomic environment and a dummy variable that indicates whether the host country belongs to the EA or not. We do not control for the regulatory environment in the host country due to the lack of information for many of these countries. Following Emter et al. (2018), we control for the pre-crisis levels of bilateral lending positions $\ln\left(TCL_{ij}^{PRE}\right)$ given the possibility of reversion to the mean in bilateral portfolio investment partners, thus controlling for the size of the bilateral relation. We estimate equation (3) by OLS with heteroskedastic robust standard errors.

Equation (3) constitutes our baseline specification. It enables us to study the impact of the two dimensions of the global business model in the retrenchment observed in the EA banking systems after the financial crisis. Using differenced variables in the regression alleviates endogeneity concerns, as time-invariant unobserved country and country-pair specific factors that may affect both the model and the changes in cross-border activity are differenced out.

Next, we propose some variations to equation (3) to analyze how the global business model interacts with important drivers of the retrenchment such as the home country banking characteristics. With that aim, we propose the estimation of the following equation:

$$\Delta TCL_{ij} = \alpha + \beta Model_{ij} + \delta B_i + \varphi\left(Model_{ij} \times B_i\right) + \theta CV_i + \gamma CV_j \\ + \vartheta \ln\left(TCL_{ij}^{PRE}\right) + \varepsilon_{ij} \tag{4}$$

where the novelty is the interaction term between the global business model variables and the changes in the home country banking characteristics $\left(Model_{ij} \times B_i\right)$. For the sake of simplicity and to make interpretation more straight-forward, the $Model_{ij}$ related variables included in this specification correspond to the dummy variables and not to the continuous ones. The interaction terms tell us whether each dimension of the international banking model intensifies or mitigates the effects of other characteristics of the home country banking system. The sign and statistical significance of φ will provide evidence of the existence and direction of the interaction.

As EA banking systems share many characteristics, they are subject to the same monetary policy and are exposed to common shocks, we next analyze whether the impact of the global business model on the retrenchment of EA countries is different when the host country is also an EA country or not. Thus, we specify the following equation:

$$\Delta TCL_{ij} = \alpha + \beta Model_{ij} + \varphi\left(Model_{ij} \times EA_i\right) + \delta B_i + \theta CV_i + \gamma CV_j + \\ \vartheta \ln\left(TCL_{ij}^{PRE}\right) + \varepsilon_{ij} \tag{5}$$

where we include the cross product between the global business model variables and the euro area dummy variable. As in equation (4), the $Model_{ij}$ related variables correspond to the dummy variables.

Finally, we elaborate more on the geographic dimension related to the host country. Previous works, aligned with the approach in equation (5), look at the differential effect of different economic zones in relation to their level of development or their geographic location. Instead, to

capture these diverging effects, we use the concept of business cycle synchronization. As far as the correlation between the cycles in the home and the host country is low, the activity abroad will play an insulating role. On the contrary, if both cycles are highly correlated, the recession in the home country will reinforce the recession in the host country. Thus, we propose the following variation of equation (3):

$$\Delta TCL_{ij} = \alpha + \beta Model_{ij} + \zeta Synchronization_{ij} + \varphi\left(Model_{ij} \times Synchronization_{ij}\right) + \delta B_i + \theta CV_i + \gamma CV_j + \vartheta \ln\left(TCL\ _{ij}^{PRE}\right) + \varepsilon_{ij} \tag{6}$$

We include the interaction between the global business model variables and our measure of synchronization to test for the possibility of international banking models reinforcing or mitigating the effects of business cycle synchronization.

4. Results

4.1. All counterparty sectors

Table 3 reports the estimates of equation (3). Columns (1) – (2) present the results for the *operational* dimension of the international banking model. The difference between both columns emerges from the measurement of such dimension as a continuous variable (column (1)) or as a dummy variable (column (2)). Independently of the variable used in the analysis, we provide evidence that the multinational banking model is associated with increases in international lending after the crisis. Thus, those banking systems which follow the international model are the ones that retrenched more. This finding is in accordance with Emter et al. (2018), which show that those banking systems with more local orientation before the crisis seemed to experience smaller balance sheet contractions once the crisis was under way. On economic terms, the result in column (1) implies that an interquartile range increase in the operational model (i.e., moving towards a multinational model) decreases the retrenchment in 1 percentage point which accounts for the 6% of the observed retrenchment in sample.

[Insert Table 3]

Results on the *funding* dimension are reported in columns (3) – (4) of Table 3. They consistently show that more decentralized banking systems are associated with higher increases in lending, in line with the findings in McGuire and von Peter (2016). Therefore, those banking systems which financed local claims with non-local funds before the global financial crisis experienced larger declines in lending activity. However, in economic terms the impact of the funding dimension is negligible.

Turning to the effects of the changes in the banking sector characteristics, we find that those banking systems that have increased their resilience to adverse shocks and those that have moved away from traditional activity have retrenchment more. Banking systems experiencing greater credit losses saw their capital base eroded at the beginning of the crisis and thus, tended to shrink their balance sheets more (McGuire and Von Peter, 2016). Those that, after the crisis, made the effort to recover or even reinforce their resilience did so at the expenses of lower lending abroad. Those that reduced their reliance on deposits to finance credit, also reduced their activity abroad as they had to face the adverse funding conditions which arose in wholesale markets.

Next, we analyze how the international banking model interacts with changes in the characteristics of the home country banking system through the estimation of equation (4). Table 4 reports the results. For comparability, columns (1) and (3) contain the estimates of the baseline specification while columns (2) and (4) report the results with the interaction terms. We find that the negative association between increases in resilience and the change in lending is mitigated by the decentralized model (see column (4)). Therefore, those banking systems with a large proportion of local claims funded by local liabilities and which increased their resilience between the pre and post-crisis periods, experienced smaller balance sheet contractions after the crisis than those which increased their resilience but funded their local claims with other sources of funding. On the contrary, we do not find evidence that the operational dimension of the international banking model plays any significant role in mitigating or exacerbating the impact of the changes in home country banking characteristics on the evolution of total foreign claims.[8]

[Insert Table 4]

Table 5 contains the results of equation (5) in which we study whether the impact of the international banking model on the retrenchment of EA countries is different when the host country is also an EA country. Columns (1) and (3) report the results for the baseline specification while columns (2) and (4) show the interactions with the EA dummy variable of the impact of the operational and the funding dimensions, respectively. We do not find evidence that the decline in foreign claims in EA countries differs from the average decline in the rest of the world. In addition, the international banking model which characterized the bilateral relation between two different EA countries before the crisis does not have any significant different impact in relation to non-EA countries. So, the size of the effect of the predominance of local activity before the crisis (i.e., the operational dimension) of whether local activity before the crisis was mostly financed with local funds (i.e., the funding dimension) in EA countries is similar to the effect of these dimensions of global business models in other countries.

[Insert Table 5]

The previous result illustrates that the use of pre-specified economic areas may have important limitations for the analysis. Thus, we take an alternative approach and allow the pair of countries involved in the transaction to define their relationship based not on their geographic location, but on the concept of business cycle synchronization. We postulate that it is not the economic area itself which explains the changes in foreign claims to different host countries, but the relationship between the economic cycles of the home and the host countries. A low correlation between the cycles in the home and the host country will insulate the activity abroad from negative idiosyncratic shocks in the home country. On the contrary, if both cycles are highly correlated, the negative shock in the home country will compound a shock of the same sign in the borrowing host.

Using equation (6) we analyze the extent to which the degree of synchronization is an important driver behind the retrenchment of total claims in the EA countries and whether the different dimensions of the international banking model intensify or mitigate the role of synchronization. Table 6 reports the results. Columns (1) and (3) correspond to the baseline analysis while columns

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[8] Estimates of equation (4) using the international banking model on its continuum form provide the same qualitative results.

(2) and (4) report the estimates of equation (6) for the operational and funding model, respectively. We find that more business synchronization before the crisis is associated with higher declines in lending after the crisis. This can result from the fact that lower synchronization implies that a recession in the home country does not usually take place at the same time as in the host country, so that such geographic diversification isolates the group activity abroad from idiosyncratic shocks. Therefore, lower synchronization allows for diversification benefits as it does not reinforce negative shocks.

[Insert Table 6]

As for the interaction of business cycles and the international banking model, we find evidence that higher reliance on local activity and higher weights of local funding over local claims mitigate the negative effects of synchronization. In other words, we find that a positive correlation between the economic cycles of the home and the host country has a lower negative association with the retrenchment of total claims if the international banking model is multinational or if it is decentralized.

In fact, the tests reported at the bottom of table 6 show that the negative impact of business synchronization on the change of total claims before and after the crisis is more than halved for those home countries that develop local business in the host countries (i.e. multinational model) or those that finance their local business with local funding (i.e. decentralized model). This result reflects the relevance of the geographic destination of lending, and more in particular, the importance of lending to jurisdictions whose economic cycle is not aligned with that of the home country, since this can act as a stabilizing factor for the balance sheet of home countries.

4.2. Lending to banks

A large part of the reduction in EU bank's foreign claims after the crisis was concentrated in the loans to the banking sector itself and, in particular, to EA host countries CGFS (2016). While in 2008 more than half of interbank lending was directed to the EA, ten years later the proportion had declined to a country average of 41%. According to Sapienza and Zingales (2012), this cut in lending to banks probably was a result of a loss of trust in financial institutions, as it hinders the participation in the financial system and can have negative effects on financing and investments. Thus, in this section we focus on the lending activity to banks to determine whether the previously documented impact of the two dimensions of the global business model holds for this subgroup of claims.

The variable under study, lending to banks (LTB), is the lending provided to banks outside the group, operating in another jurisdiction. To construct this variable, we take advantage of the allocation by sectors of BIS CBS claims and use claims to banks, which exclude central banks and multinational development banks. We define ΔLTB_{ij} as the change in the stock of claims from country i banking sector to resident banks of country j before and after the crisis. As we did with total claims, we compute it as the log difference in the average stock of claims from country i banking sector to bank residents of country j before (2005-2007) and after (2014-2016) the crisis. As before, we have corrected the original data reported by the BIS for valuation effects due to exchange rate changes. Declines in lending to the banking sector seem to be the norm in our data, as reported in Table 2, although for some bilateral pairs we observe increases in the stock of interbank claims after the crisis.

We estimate the specifications in equations (3), (4) and (6) using as dependent variable ΔLTB_{ij}. Table 7 reports the results of the analyses. We observe that the findings obtained for the role of global models in relation to claims to all sectors still hold when focusing on the lending to banks. Those systems with high local claims (more multinational) and high local liabilities given their local claims (more decentralized) experienced a lower reduction in lending to banks. On the other hand, we do not find evidence of a negative impact of synchronization on lending to banks.

[Insert Table 7]

Differences arise in relation to the role of bank's traditional activity and the interaction of synchronization with the two dimensions of international banking models. We do not find evidence that those banking systems which increased their traditional activity increased more their lending to banks, neither that any of the dimensions of international models interact with synchronization to affect lending to banks.

5. Robustness tests

In this section, we provide robustness tests for different definitions as regards the change in lending.

5.1. Changes in the banking model

First, we study how the changes in the international banking model affect the changes in total claims between the pre and post-crisis periods. In our baseline specification, the $Model_{ij}$ variable was predetermined with respect to the change of total claims. That is, it was computed using the values of the two dimensions of the model in 2003-2004. Here, we allow the $Model_{ij}$ variable to change. To do so, we calculate the changes between the pre (2005-2007) and post-crisis period (2014-2016) for each one of the ratios that proxy the operational and funding dimensions of the international banking model:

$$\Delta Model_{ij} = \left(Model_{ij}^{POST}\right) - \left(Model_{ij}^{PRE}\right) \qquad (7)$$

We also construct two dummy variables to capture the direction in the change of the international banking model. The first dummy variable (*Dummy for operational model change*) takes value 1 for those bilateral pairs whose relationship became more multinational and value 0 if they became more international between the pre and post-crisis periods. The second dummy variable (*Dummy for funding model change*) takes value 1 for those bilateral pairs whose relationship became more decentralized and value 0 if they became more centralized.

We estimate equations (3), (4) and (6) having substituted the $Model_{ij}$ variable by the difference in the corresponding ratios. The results in Table 8 show that we obtain the same qualitative results as regards the operational and funding dimension: having moved towards a more locally focused global model or having increased the local funding given the local activity is associated with a lower retrenchment. The main difference with the previous results is that we find evidence that having moved towards a more multinational global model mitigates the positive effect of having increased the proportion of traditional activity.

[Insert Table 8]

5.2. Peak-to-through approach

Finally, instead of using specific years to define the pre and the post-crisis periods, we propose a peak-to-trough approach to measure the contraction in the balance sheets of banks' foreign activity in the wake of the financial crisis. For each bilateral relation, the change is calculated by comparing the peak value of total claims between Q1 2006 and Q1 2009 with the minimum claims value from Q2 2009 to Q4 2017. The dependent variable thus becomes:

$$\Delta TCLPeak_{ij} = \ln\left(TCL_{ij}^{TROUGH}\right) - \ln\left(TCL_{ij}^{PEAK}\right) \tag{8}$$

where TCL_{ij}^{PEAK} and TCL_{ij}^{TROUGH} denote the peak value of total claims between 2006Q1 and 2009 Q1 and the minimum claims value from 2009Q2 to 2017Q4, respectively, corrected for valuation effects due to exchange rate changes. We estimate equations (3), (4) and (6), using ΔTCL_{ij}^{PEAK} as the dependent variable and substituting $\ln\left(TCL_{ij}^{PRE}\right)$, by $\ln\left(TCL_{ij}^{PEAK}\right)$, for consistency. Our main results, which are reported in Table 9 remain robust to this alternative dependent variable.

[Insert Table 9]

6. Conclusion

The goal of this paper is to analyze the importance of international banking models, for the decline in international positions of EA banks since the crisis, using BIS consolidated banking statistics. We study the international banking model along the operational and the funding dimensions, proxied by the weight of local activity and of local funding for local activity, respectively. We investigate whether these dimensions are directly associated to the change in foreign claims and whether they affect how banking characteristics of the home country and business cycle synchronization contribute to the change. We then focus on lending to the banking sector, which is the sector which has had the largest decline since the crisis to assess whether the same results are obtained.

Employing a cross-sectional difference approach which compares the pre and the post-crisis periods we find that the multinational model (higher reliance on local activity) and the decentralized model (higher weight of local funding over local claims) is associated to lower retrenchment. We also find that multinational banking systems which increased their resilience experienced smaller balance sheet contractions after the crisis. When we explore the relevance of the choice of the host country and, in particular, the correlation between the cycles in the home and the host countries, we find that more business synchronization is associated with higher declines in lending after the crisis and that the multinational and decentralized models mitigate such effect. We observe that the findings obtained for the role of international banking models in relation to claims to all sectors still hold when focusing on the lending to banks. The main difference arises as the different dimensions of the international banking models do not play a role in isolating banking systems from the influence of the synchronization of economic cycles when lending to banks. In fact, we cannot find empirical evidence of synchronization affecting lending to banks.

Our findings suggest that the resilience of foreign banking claims could be strengthened by promoting a shift towards a multinational and decentralized international banking model that

focuses its foreign exposures on countries with limited business cycle synchronization vis-à-vis the bank's home country.

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Table 1: Definition of variables

Variable	Definition	Data Source
ΔTCL_{ij}	The change in total claims over time is defined as the log difference in the mean of total claims from country i banking sector to residents of country j before (2005/07) and after the crisis (2014/16).	Bank for International Settlements - Consolidated Banking Statistics
Operational dimension$_{ij}$	It is the average ratio of total local claims (local claims in local and foreign currency) over total claims between the home country i and the host country j for the period 2003/04. The larger the value of the ratio, the more multinational the banking sector is.	Bank for International Settlements - Consolidated Banking Statistics
Dummy for operational dimension$_{ij}$	Dummy variable which takes value 1 if the *Operational dimension* variable is above the 90th percentile of the whole distribution. Thus, this variable takes value 1 when the operational dimension is multinational and 0 when it is international.	Bank for International Settlements - Consolidated Banking Statistics
ΔOperational dimension$_{ij}$	The change over time of the operational dimension is defined as the difference between the average pre-crisis levels (2005/07) of total local claims over total claims and the post-crisis levels (2014/16).	Bank for International Settlements - Consolidated Banking Statistics
Funding dimension$_{ij}$	It is the average ratio of local liabilities over total local claims between the home country i and the host country j for the period 2003/04. The larger the value of the ratio, the more decentralized the banking sector is.	Bank for International Settlements - Consolidated Banking Statistics
Dummy for funding dimension$_{ij}$	Dummy variable which takes value 1 if the *Funding dimension* variable is above the 90th percentile of the whole distribution. Thus, this variable takes value 1 when the funding dimension is decentralized and 0 when it is centralized.	Bank for International Settlements - Consolidated Banking Statistics
ΔFunding dimension$_{ij}$	The change over time of the funding dimension is defined as the difference between the average pre-crisis levels (2005/07) of local liabilities over total local claims and the post-crisis levels (2014/16).	Bank for International Settlements - Consolidated Banking Statistics
Synchronization$_{ij}$	*Synchronization* is a measure which proxies the correlation between the fluctuations in economic activity across markets. It is measured as the negative absolute difference between two countries' real GDP average growth rates for 2005/07, weighted by the share that lending to the host country j represents over the whole lending activity abroad of country i.	International Monetary Fund - World Economic Outlook (April 2019) and own calculations
ΔLTB_{ij}	The change in lending to banks is defined as the log difference in the average of total claims from country i banking sector to bank-residents of country j before (2005/07) and after the crisis (2014/16).	Bank for International Settlements - Consolidated Banking Statistics
ΔTraditional Activity$_i$	Negative difference in the mean loan-to-deposit ratio of country i before (2005/07) and after the crisis (2014/16).	Beck et al., 2018 - Financial Development and Structure Dataset

$\Delta Resilience_i$	Difference in the mean z-score of country i before (2005/07) and after the crisis (2014/16).	Beck et al., 2018 - Financial Development and Structure Dataset
ΔGDP_{ij}	Difference in the average real GDP growth rate of country i and j before (2005/07) and after the crisis (2014/16).	IMF - World Economic Outlook (April 2019)
$\Delta Restrictions\ Index_i$	Change over the period 2003/11 in the indicator of overall restrictions on banking activities. Such banking activities could be: engaging in underwriting, brokering and dealing in securities, engaging in insurance underwriting and selling, or engaging in real estate investment, development and management. Higher values of this variable indicate increases in restrictions.	Barth et al., 2013 - World Bank Surveys on Bank Regulation
$\Delta Corrective\ Index_i$	Change over the period 2003/11 in the indicator of whether a law establishes predetermined levels of bank solvency deterioration that forces automatic actions, such as intervention. The higher the value of this indicator, the higher the promptness in corrective action.	Barth et al., 2013 - World Bank Surveys on Bank Regulation
EA_j	Dummy variable that takes value 1 if the host country is a euro area country. The euro area countries (as of 2016) for which we have information are: Austria, Belgium, Cyprus, Estonia, Finland, France, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Slovakia, Slovenia and Spain; and 0 otherwise.	Own calculations

TABLE 2: Summary Statistics

PANEL A – Continuous Variables						
	Obs.	Mean	Median	Std. Dev	P10	P90
Bilateral variables						
Change in total claims	1112	-0.16	0.01	2.06	-2.53	2.04
Operational model	1112	7.12	0.00	17.47	0.00	29.70
Funding model	1112	22.59	0.00	56.94	0.00	88.04
Total claims post-crisis (2014/16) *Millions, USD*	1112	7961	105	35859	1	14298
Synchronization	1112	-1.71	-0.07	5.86	-4.12	-0.00
Change in operational model	933	3.21	0.00	27.12	-26.89	39.56
Change in funding model	933	-16.50	0.00	214.70	-38.36	11.87
Change in lending to banks	788	-0.75	-0.51	2.42	-3.87	1.95
Source and recipient country variables						
Change in Traditional Activity	10	-16.57	-11.72	35.93	-66.57	30.76
Change in Resilience	10	2.39	2.89	5.10	-5.18	8.01
Average change in real GDP growth rate (home country)	10	-0.53	-1.12	3.01	-3.27	3.70
Average change in real GDP growth rate (host country)	135	-3.12	-2.16	5.17	-8.2	0.43

PANEL B – Categorical Variables		
	Observations/Categories	Number
Host countries (total)	135	
Eurozone host countries	16	11.85 (%)
Change in restrictions on banking activities (# of jurisdictions which)	Increase	1
	No change	3
	Decrease	6
Change in corrective action (# of jurisdictions which)	Increase	5
	No change	3
	Decrease	2

Table 3: Effects of the international banking model on euro area countries' retrenchment

This table reports the impact of the international banking model on the change in total claims (post vs. pre-crisis) of EA countries, presenting the results of the estimation of equation (3). The dependent variable is the log difference of the stock of total claims before (2005/07) and after (2014/16) the crisis corrected for valuation effects due to exchange rate changes. The international banking model is studied at two dimensions: operational (cols. (1)-(2)) and funding (cols. (3)-(4)). We classify each bilateral relation as regards the value for the period 2003/05 of the ratio of total local claims over total claims and local liabilities over total local claims for the operational and funding dimensions, respectively. In each specification, we either use the ratio itself or a dummy variable taking value one if the ratio is within the 90th percentile, and zero otherwise. The table includes the coefficients for changes between the pre and the post-crisis periods in two banking characteristics of the home country: resilience (captured by the z-score) and the relevance of the traditional banking activity (*TraditionalActivity*, proxied by the negative loan-to-deposit ratio). All specifications include the pre-crisis level of total claims (in logs), macroeconomic controls for both the home and the host countries, the changes in regulation for the home country (the change in restrictions on activity and the change in prompt corrective action) and a EA dummy variable which takes value 1 if the host country is also a EA country. P-values are reported in brackets. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	OPERATIONAL DIMENSION		FUNDING DIMENSION	
	(1)	(2)	(3)	(4)
International Banking Model variables				
Operational dimension	0.011***			
	(0.000)			
Dummy for operational dimension		0.549***		
(1:multinational; 0:international)		(0.000)		
Funding model			0.002**	
			(0.036)	
Dummy for funding dimension				0.365**
(1:decentralized; 0:centralized)				(0.013)
Role of changes in home country banking characteristics				
ΔResilience (z-score)	-0.085***	-0.085***	-0.086***	-0.088***
	(0.000)	(0.000)	(0.000)	(0.000)
ΔTraditionalActivity	0.015***	0.016***	0.015***	0.015***
	(0.000)	(0.000)	(0.000)	(0.000)
Macroeconomic Controls	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes
EA Dummy Variable	Yes	Yes	Yes	Yes
Observations	1,112	1,112	1,112	1,112
R-squared (corrected)	0.312	0.312	0.308	0.308

Table 4: Interactions of the effects of the international banking model with home country characteristics on euro area countries' retrenchment

This table reports the impact of the international banking model and its interaction with home country banking characteristics on the change in total claims (post- vs. pre-crisis) of EA countries. Panel A presents the results of the estimation of equation (4) in cols. (2) and (4) while cols. (1) and (3) correspond to the baseline analysis. The dependent variable is the log difference of the stock of total claims before (2005/07) and after (2014/16) the crisis corrected for valuation effects due to exchange rate changes. The international banking model is studied at two dimensions: operational (cols. (1)-(2)) and funding (cols. (3)-(4)). We classify each bilateral relation with reference to the value for the period 2003/05 of the ratio of total local claims over total claims and local liabilities over total local claims for the operational and funding dimensions, respectively. The Table includes the interaction of the model indicators with changes between the pre and the post-crisis periods in two banking characteristics of the home country: resilience (as captured by the z-score) and the relevance of the traditional banking activity (TraditionalActivity, proxied by the negative loan-to-deposit ratio). All specifications include the pre-crisis level of total claims (in logs), macroeconomic controls for both the home and the host countries, the changes in regulation for the home country (the change in restrictions on activity and the change in prompt corrective action) and a EA dummy variable which takes value 1 if the host country is also a EA country. Panel B reports the results of t-tests of linear combinations of the coefficients. P-values are reported in brackets. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Regression Analysis	OPERATIONAL DIMENSION		FUNDING DIMENSION	
	(1)	(2)	(3)	(4)
International Banking Model variables				
Dummy for operational dimension (1:multinational; 0:international)	0.549***	0.538***		
	(0.000)	(0.001)		
Dummy for funding dimension (1:decentralized; 0:centralized)			0.365**	0.265
			(0.0128)	(0.110)
Role of changes in home country banking characteristics				
ΔResilience (z-score)	-0.085***	-0.089***	-0.088***	-0.096***
	(0.000)	(0.000)	(0.000)	(0.000)
ΔTraditionalActivity	0.016***	0.016***	0.015***	0.016***
	(0.000)	(0.000)	(0.000)	(0.000)
ΔResilience*Dummy for operational dimension		0.035		
		(0.255)		
ΔTraditionalActivity*Dummy for operational dimension		-0.005		
		(0.307)		
ΔResilience*Dummy for funding dimension				0.071**
				(0.024)
ΔTraditionalActivity*Dummy for funding dimension				-0.005
				(0.291)
Macroeconomic Controls	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes
EA Dummy Variable	Yes	Yes	Yes	Yes
Observations	1,112	1,112	1,112	1,112
R-squared (corrected)	0.312	0.311	0.308	0.308
Panel B:Test on the linear combinations				
ΔResilience+ΔResilience*Dummy for operational dimension		-0.054**		
		(0.046)		
ΔTraditionalActivity+ΔTraditionalActivity*Dummy for operational dimension		0.011**		
		(0.020)		
ΔResilience+ΔResilience*Dummy for funding dimension				-0.025
				(0.377)
ΔTraditionalActivity+ΔTraditionalActivity*Dummy for funding dimension				0.010**
				(0.046)

Table 5: Role of euro area being the host country on the effects of the international banking model on euro area countries' retrenchment

This table reports the impact of international banking model and its interaction with EA dummy variables on the change in total claims (post- vs. pre-crisis) of EA countries. Panel A presents the results of the estimation of equation (5) in cols. (2) and (4), while cols. (1) and (3) correspond to the baseline analysis. The dependent variable is the log difference of the stock of total claims before (2005/07) and after (2014/16) the crisis corrected for valuation effects due to exchange rate changes. The international banking model is studied at two dimensions: operational (cols. (1)-(2)) and funding (cols. (3)-(4)). We classify each bilateral relation with reference to the value for the period 2003/05 of the ratio of total local claims over total claims and local liabilities over total local claims for the operational and funding dimensions, respectively. The table includes the interaction of the model indicators with the EA dummy variable which takes value 1 if the host country is also a EA country and zero otherwise. It also reports the coefficients for changes between the pre and the post-crisis periods in two banking characteristics of the home country: resilience (as captured by the z-score) and the relevance of the traditional banking activity (TraditionalActivity, proxied by the negative loan-to-deposit ratio). All specifications include the pre-crisis level of total claims (in logs), macroeconomic controls for both the home and the host countries, the changes in regulation for the home country (the change in restrictions on activity and the change in prompt corrective action) and an EA dummy variable which takes value 1 if the host country is also an EA country. Panel B reports the results of t-tests of linear combinations of the coefficients. P-values are reported in brackets. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Regression Analysis	OPERATIONAL DIMENSION		FUNDING DIMENSION	
	(1)	(2)	(3)	(4)
International Banking model variables				
Dummy for operational dimension (1:multinational; 0:international)	0.549***	0.548***		
	(0.000)	(0.000)		
Dummy for funding dimension (1:decentralized; 0:centralized)			0.365**	0.396**
			(0.0128)	(0.0234)
Role of changes in home country banking characteristics				
ΔResilience (z-score)	-0.085***	-0.085***	-0.088***	-0.088***
	(0.000)	(0.000)	(0.000)	(0.000)
ΔTraditionalActivity	0.016***	0.016***	0.015***	0.015***
	(0.000)	(0.000)	(0.000)	(0.000)
Role of EA host countries				
EA Dummy Variable	0.081	0.080	0.037	0.069
	(0.550)	(0.581)	(0.783)	(0.631)
*EA Dummy Variable*Dummy for operational dimension*		0.003		
		(0.993)		
*EA Dummy Variable*Dummy for funding dimension*				-0.123
				(0.677)
Macroeconomic Controls	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes
EA Dummy Variable	Yes	Yes	Yes	Yes
Observations	1,112	1,112	1,112	1,112
R-squared (corrected)	0.312	0.311	0.308	0.308
Panel B:Test on the linear combinations				
*EA Dummy Variable+EA Dummy Variable*Dummy for operational dimension*		0.083		
		(0.772)		
*EA Dummy Variable+EA Dummy Variable*Dummy for funding dimension*				-0.054
				(0.843)

Table 6: Role of business synchronization on the effects of the international banking model on euro area countries' retrenchment

This table reports the impact of the international banking model and its interaction with business synchronization on the change in total claims (post- vs. pre-crisis) of EA countries. Panel A presents the results of the estimation of equation (6) in cols. (2) and (4), while cols. (1) and (3) correspond to the baseline analysis. The dependent variable is the log difference of the stock of total claims (2005/07) and after (2014/16) the crisis corrected for valuation effects due to exchange rate changes. The international banking model is studied at two dimensions: operational (cols. (1)-(2)) and funding (cols. (3)-(4)). We classify each bilateral relation with reference to the value for the period 2003/05 of the ratio of total local claims over total claims and local liabilities over total local claims for the operational and funding dimension, respectively. It also reports the coefficients for changes between the pre and the post-crisis periods in two banking characteristics of the home country: resilience (as captured by the z-score) and the relevance of the traditional banking activity (TraditionalActivity, proxied by the negative loan-to-deposit ratio). The role of synchronization and its interaction with the model dummies is included. The variable synchronization is computed as the negative absolute difference between the growth rate in the home and in the host country weighted by the share that the host country has on total foreign claims of the home country for the period 2005/07. All specifications include the pre-crisis level of total claims (in logs), macroeconomic controls for both the home and the host countries, the changes in regulation for the home country (the change in restrictions on activity and the change in prompt corrective action) and a EA dummy variable which takes value 1 if the host country is also a EA country. Panel B reports the results of t-tests of linear combinations of the coefficients. P-values are reported in brackets. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	OPERATIONAL DIMENSION		FUNDING DIMENSION	
Panel A: Regression Analysis				
	(1)	(2)	(3)	(4)
International Banking model variables				
Dummy for operational dimension (1:multinational; 0:international)	0.549***	0.531***		
	(0.000)	(0.000)		
Dummy for funding dimension (1:decentralized; 0:centralized)			0.365**	0.341**
			(0.013)	(0.032)
Role of changes in home country banking characteristics				
ΔResilience (z-score)	-0.085***	-0.074***	-0.088***	-0.078***
	(0.000)	(0.000)	(0.000)	(0.000)
ΔTraditionalActivity	0.016***	0.017***	0.015***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)
Synchronization				
Synchronization		-0.075***		-0.071***
		(0.000)		(0.000)
*Synchronization*Dummy for operational dimension*		0.043*		
		(0.055)		
*Synchronization*Dummy for funding dimension*				0.037**
				(0.044)
Macroeconomic Controls	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes
EA Dummy Variable	Yes	Yes	Yes	Yes
Observations	1,112	1,112	1,112	1,112
R-squared (corrected)	0.312	0.324	0.308	0.322
Panel B:Test on the linear combinations				
*Synchronization+Synchronization*Dummy for operational dimension*		-0.032***		
		(0.007)		
*Synchronization+Synchronization*Dummy for funding dimension*				-0.034***
				(0.005)

Table 7: Interactions of banking characteristics and synchronization with the effects of the international banking models on the change in lending to banks of euro area countries

This table reports the impact of the international banking model, their interaction with home country banking characteristics and the role of synchronization on the change in lending to banks (post- vs. pre-crisis) of EA countries. Panel A presents the results of the estimation of equation (3) in cols. (1) and (4), of equation (4) in cols. (2) and (5) and of equation (6) in cols. (3) and (6). The dependent variable is the log difference of interbank claims before (2005/07) and after (2014/16) the crisis corrected for valuation effects due to exchange rate changes. The international banking model is studied at two dimensions: operational (cols. (1)-(3)) and funding (cols. (4)-(6)). We classify each bilateral relation with reference to the value for the period 2003/05 of the ratio of total local claims over total claims and local liabilities over total local claims for the operational and funding dimension, respectively. It includes (cols. (2) and (5)) the interaction of the model indicators with changes between the pre- and the post-crisis periods in two banking characteristics of the home country: resilience (as captured by the z-score) and the relevance of the traditional banking activity (TraditionalActivity, proxied by the negative loan-to-deposit ratio). The role of synchronization and its interaction with the model dummies is included in cols. (3) and (6). The variable synchronization is computed as the negative absolute difference between the growth rate in the home and in the host country weighted by the share that the host country has on total claims of the home country for the period 2005/07. All specifications include the pre-crisis level of interbank claims (in logs), macroeconomic controls for both the home and the host countries, the changes in regulation for the home country (the change in restrictions on activity and the change in prompt corrective action) and an EA dummy variable which takes value 1 if the host country is also an EA country. Panel B reports the results of t-tests of linear combinations of the coefficients. P-values are reported in brackets. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Regression Analysis	OPERATIONAL MODEL			FUNDING MODEL		
	(1)	(2)	(3)	(4)	(5)	(6)
Global Banking model variables						
Dummy for operational model (1:multinational; 0:international)	0.673***	0.454**	0.699***			
	(0.001)	(0.022)	(0.001)			
Dummy for funding model (1:decentralized; 0:centralized)				0.419**	0.249	0.326
				(0.028)	(0.249)	(0.109)
Role of changes in home country banking characteristics						
ΔResilience (z-score)	-0.058***	-0.057**	-0.049**	-0.060***	-0.069***	-0.053**
	(0.007)	(0.013)	(0.035)	(0.005)	(0.002)	(0.016)
ΔTraditionalActivity	-0.006	-0.007	-0.005	-0.007	-0.006	-0.005
	(0.254)	(0.214)	(0.409)	(0.233)	(0.310)	(0.389)
ΔResilience*Dummy for operational model		0.038				
		(0.415)				
ΔTraditionalActivity*Dummy for operational model		0.012				
		(0.106)				
ΔResilience*Dummy for funding model					0.095**	
					(0.042)	
ΔTraditionalActivity*Dummy for funding model					-0.002	
					(0.820)	
Synchronization						
Synchronization			-0.066			-0.038
			(0.226)			(0.146)
Synchronization*Dummy for operational model			0.051			
			(0.348)			
Synchronization*Dummy for funding model						0.008
						(0.785)
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes	Yes	Yes
EA Dummy Variable	Yes	Yes	Yes	Yes	Yes	Yes
Observations	788	788	788	788	788	788
R-squared (corrected)	0.302	0.303	0.308	0.296	0.297	0.301
Panel B:Test on the linear combinations						
ΔResilience+ΔResilience*Dummy for operational model		-0.019				
		(0.677)				
ΔTraditionalActivity+ΔTraditionalActivity*Dummy for		0.004				
		(0.525)				
ΔResilience+ΔResilience*Dummy for funding model					0.025	
					(0.563)	
ΔTraditionalActivity+ΔTraditionalActivity*Dummy for funding model					-0.008	
					(0.341)	
Synchronization+Synchronization*Dummy for operational model			-0.016			
			(0.272)			
Synchronization+Synchronization*Dummy for funding model						-0.030**
						(0.048)

Table 8: Robustness checks for the effects of the international banking model on euro area countries' retrenchment: changes in models

This table reports the impact of changes in the international banking model on the change in total claims (post- vs. pre-crisis) of EA countries. The dependent variable is the log difference of the stock of total claims before (2005/07) and after (2014/16) the crisis corrected for valuation effects due to exchange rate changes. Panel A reports the estimates of the impact of the international banking model at two dimensions: operational (cols. (1)-(4)) and funding (cols. (5)-(8)). We classify each bilateral relation as regards the ratio of total local claims over total claims and local liabilities over total local claims for the operational and funding dimensions, respectively. In the table the effect of the model is captured by the change in the respective ratio before and after the crisis. The table includes the coefficients for changes between the pre- and the post-crisis period in two banking characteristics of the home country: resilience (as captured by the z-score) and the relevance of the traditional banking activity (TraditionalActivity, proxied by the negative loan-to-deposit ratio). It also includes their interactions with the model dummy variables (cols (3) and (7). Cols. (4) and (8) include the role of synchronization and its interaction with the model dummy variables. The variable synchronization is computed as the negative absolute difference between the growth rate in the home and in the host country weighted by the share that the host country has on total foreign claims of the home country for the period 2005/07. All specifications include the pre-crisis level of total claims (in logs), macroeconomic controls for both the home and the host country, the changes in regulation for the home country (the change in restrictions on activity and the change in prompt corrective action) and a EA dummy variable which takes value 1 if the host country is also a EA country. Panel B reports the results of t-tests of linear combinations of the coefficients. P-values are reported in brackets. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Regression Analysis	OPERATIONAL DIMENSION				FUNDING DIMENSION			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
International Banking model variables								
Δ Operational dimension	0.009***							
	(0.000)							
Dummy for operational dimension change (1:towards multinational; 0:towards international)		0.545***	0.663***	0.553***				
		(0.000)	(0.000)	(0.000)				
Δ Funding dimension					0.007***			
					(0.001)			
Dummy for funding dimension change (1:towards decentralized; 0:towards centralized)						1.149***	1.086***	1.381***
						(0.000)	(0.000)	(0.000)
Role of changes in home country banking characteristics								
ΔResilience (z-score)	-0.100***	-0.097***	-0.103***	-0.082***	-0.093***	-0.090***	-0.091***	-0.079***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ΔTraditionalActivity	0.011***	0.010***	0.017***	0.012***	0.013***	0.015***	0.015***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ΔResilience*Dummy for operational dimension change			0.027					
			(0.412)					
ΔTraditionalActivity*Dummy for operational dimension change			-0.012**					
			(0.022)					
ΔResilience*Dummy for funding dimension change							0.011	
							(0.810)	
ΔTraditionalActivity*Dummy for funding dimension change							0.003	
							(0.525)	
Synchronization								
Synchronization				-0.090***				-0.090***
				(0.001)				(0.000)
Synchronization*Dummy for operational dimension change				0.053**				
				(0.049)				
Synchronization*Dummy for funding dimension change								0.077***
								(0.000)
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EA Dummy Variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	919	919	919	919	919	919	919	919
R-squared (corrected)	0.319	0.322	0.326	0.336	0.311	0.338	0.337	0.361
Panel B:Test on the linear combinations								
ΔResilience+ΔResilience*Dummy for operational dimension change			-0.077***					
			(0.004)					
ΔTraditionalActivity+ΔTraditionalActivity*Dummy for operational dimension			0.006*					
			(0.054)					
ΔResilience+ΔResilience*Dummy for funding dimension change							-0.080*	
							(0.061)	
ΔTraditionalActivity+ΔTraditionalActivity*Dummy for funding dimension change							0.018***	
							(0.000)	
Synchronization+Synchronization*Dummy for operational dimension change			-0.037***					
			(0.000)					
Synchronization+Synchronization*Dummy for funding dimension change							-0.013	
							(0.360)	

Table 9: Robustness checks for the effects of the international banking model on euro area countries' retrenchment: peak to through

This table reports the impact of the international model on the change in total claims (post- vs. pre-crisis) of EA countries under an alternative measure of the value of the change. The dependent variable is the log difference of the stock of total claims in the peak (between Q1 2006 and Q1 2009) and in the trough (between Q2 2009 and Q4 2017) corrected for valuation effects due to exchange rate changes. Panel A reports the estimates of the impact of the international banking model at two dimensions: operational (cols. (1)-(4)) and funding (cols. (5)-(8)). We classify each bilateral relation as regards the ratio of total local claims over total claims and local liabilities over total local claims for the operational and funding dimensions, respectively. The table includes the coefficients for changes between the pre- and the post-crisis periods in two banking characteristics of the home country: resilience (as captured by the z-score) and the relevance of the traditional banking activity (TraditionalActivity, proxied by the negative loan-to-deposit ratio) as well as interaction terms with the model variables (cols. (3) and (7)). Cols. (4) and (8) include the role of synchronization and its interaction with the international banking model. The variable synchronization is computed as the negative absolute difference between the growth rate in the home and in the host country weighted by the share that the host country has on total foreign claims of the home country for the period 2005/07. All specifications include the peak level of total claims (in logs), macroeconomic controls for both the home and the host country, the changes in regulation for the home country (the change in restrictions on activity and the change in prompt corrective action) and a EA dummy variable which takes value 1 if the host country is also a EA country. Panel B reports the results of t-tests of linear combinations of the coefficients. P-values are reported in brackets. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Regression Analysis	OPERATIONAL DIMENSION				FUNDING DIMENSION			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
International Banking model variables								
Operational dimension	0.022***							
	(0.000)							
Dummy for operational dimension (1:multinational; 0:international)		0.578***	0.666***	0.639***				
		(0.000)	(0.000)	(0.000)				
Funding dimension					0.007***			
					(0.000)			
Dummy for funding dimension (1:decentralized; 0:centralized)						0.413***	0.469**	0.460***
						(0.004)	(0.020)	(0.003)
Role of changes in home country banking characteristics								
ΔResilience (z-score)	-0.040**	-0.032*	-0.032	-0.020	-0.035**	-0.066***	-0,053	-0.055***
	(0.014)	(0.053)	(0.276)	(0.229)	(0.032)	(0.000)	(0.362)	(0.002)
ΔTraditionalActivity	0.017***	0.017***	0.019***	0.019***	0.017***	0.020***	0.022***	0.021***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)
ΔResilience*Dummy for operational dimension			0.0254					
			(0.527)					
ΔTraditionalActivity*Dummy for operational dimension			-0.009					
			(0.101)					
ΔResilience*Dummy for funding dimension							-0.016	
							(0.807)	
ΔTraditionalActivity*Dummy for funding dimension							-0.002	
							(0.826)	
Synchronization								
Synchronization				-0.121***				-0.117**
				(0.000)				(0.015)
Synchronization*Dummy for operational dimension				0.085***				
				(0.002)				
Synchronization*Dummy for funding dimension								0.076
								(0.116)
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EA Dummy Variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168
R-squared (corrected)	0.250	0.239	0.239	0.253	0.247	0.232	0.231	0.245
Panel B:Test on the linear combinations								
ΔResilience+ΔResilience*Dummy for operational dimension			-0.007					
			(0.787)					
ΔTraditionalActivity+ΔTraditionalActivity*Dummy for operational dimension			0.011***					
			(0.009)					
ΔResilience+ΔResilience*Dummy for funding dimension							-0.068***	
							(0.001)	
ΔTraditionalActivity+ΔTraditionalActivity*Dummy for funding dimension							0.020***	
							(0.000)	
Synchronization+Synchronization*Dummy for operational dimension				-0.035**				
				(0.032)				
Synchronization+Synchronization*Dummy for funding dimension								-0.041**
								(0.011)

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