

Cross-border banking cooperation: From actual to optimal arrangements

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Abstract

Countries and regions differ widely in the degrees to which they coordinate their banking policies – this may be optimal if the gains from cooperation vary accordingly. Based on a model that identifies externalities as the key benefit to cooperation, and country heterogeneity as the cost, we show that actual cooperation arrangements among countries are consistent with predicted gains: pairs of countries with high bilateral externalities are more likely to have formed cooperation, while the propensity to cooperate declines with measures capturing dimensions of country heterogeneity. Applying the framework to regions, we show that there are large variations in the extent to which they can expect to gain from cooperation. For instance, while for the European Union overall gains appear to be limited as high externalities are offset by similarly high heterogeneity, the group of countries that form the Banking Union display characteristics more conducive to cooperation. Our analysis also allows drawing insights as to how existing regional arrangements may be expanded (or narrowed down) to reap higher cooperation gains.

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1 Introduction

The failure of several large cross-border banks during the Global Financial Crisis and the failure of regulators to appropriately coordinate actions and intervene efficiently has given rise to both research exploring the optimal degree of cross-border cooperation and extensive policy actions, resulting in closer cooperation forms, including the banking union for the Eurozone. While the externalities of failures of cross-border banks are well understood by now, it is less clear what the optimal supervisory architecture is to address them. Most importantly, does one size fit all? Is the same type of regulatory cooperation necessary across different regions and different country pairs?

This paper presents preliminary empirical analysis on the optimal degree of cross-border regulatory cooperation across country pairs and within regions and compares desirable degrees of cooperation with actual cooperation. In doing so, the paper contributes to the policy debate on the necessity and feasibility of cross-border regulatory cooperation. When deciding the degree to which regulators across borders cooperate – loose, legally non-binding agreements, closer cooperation arrangements or even supra-national structures – theory suggests two opposing factors (Beck and Wagner, 2016). On the one hand, externalities imposed by cross-border banks on countries other than their home countries call for closer cooperation if not a supra-national structure to internalize these externalities. On the other hand, differences in legal systems, culture and risk preferences might make standardized approaches and supra-national structures less desirable and efficient. The optimal degree of cooperation within a region or between country pairs thus increases in the externalities imposed by cross-border banks and decreases in the heterogeneity of countries.

We use the externality-heterogeneity framework to examine actual cross-border agreements on regulatory cooperation between country pairs. We capture externalities by cross-border banking activities, correlation of stock market indices and whether the countries share (or are pegged to) the same currency. We measure heterogeneity by differences in socio-economic and financial development and differences in legal traditions and regulatory frameworks. Using a sample of European, African and Latin American countries, regression analysis shows that higher externalities and lower heterogeneity

between country pairs predict the presence of regulatory cooperation arrangements. Thus, patterns of cross-country cooperation – at least to some extent – reflect variations in the net benefits from cooperation. This suggests that a uniform push towards more cooperation is not necessarily desirable as there may be countries for which a low degree of cooperation is actually optimal.

We also use the framework to examine how the benefits and costs to cooperation vary among regions and countries. First, we present graphs that summarize externalities and heterogeneity within larger geographic groups, such as the African Union and Latin America as well as smaller geographic groupings with a certain history of cooperation. We find that there are stark differences in the expected gains from cooperation. While they are very high for some groups of countries, the data suggest only modest gains for other countries even though they are characterized by high degrees of externalities. Second, we analyze specific regional groupings, showing graphs gauging whether current membership in such groupings is optimal and whether other countries would fit into these grouping. Taken together, the graphs provide a rich tool for regulators and supervisors around the world for guiding their efforts in improving the international landscape for cross-border cooperation.

This paper relates to a small but rapidly expanding literature on cross-border regulatory cooperation. Loranth and Morrison (2007) discuss the implications of capital requirements and deposit insurance for cross-border banks and show that capital requirements set at a level to offset the safety net subsidy of deposit insurance result in too little risk-taking in the case of multinational banks. Dell’Arricia and Marquez (2006) show that competition between national regulators can lead to lower capital adequacy standards, since national regulators do not take into account the external benefits of higher capital adequacy standards in terms of higher stability in other countries. Acharya (2003) argues that coordinating capital adequacy ratios across countries without coordinating on other dimensions of the regulatory framework, such as resolution policies, can have detrimental effects. Freixas (2003) and Goodhart and Schoenmaker (2009) show that ex-post negotiations on recapitalization of failing cross-border banks can lead to underprovision of the necessary resources and identify an advantage of ex-

ante burden sharing agreements in helping overcome coordination problems between regulators. Holthausen and Ronde (2002) consider cooperation between home and host country supervisor on the intervention decision for a multinational bank.

Given that national regulators represent national interests, a misalignment of interests leads to suboptimal exchange of information and distorted intervention decisions. Niepmann and Schmidt-Eisenlohr (2013) show that decisions of national governments on recapitalization of failing banks are inefficient if national banking systems are linked through the interbank markets. More closely related to our paper, Calzolari and Loranth (2011) analyze how the organizational structure of multinational banks can influence regulatory behavior. Specifically, organization of foreign presence through branches leads to higher incentives to intervene as the home country regulator can draw on all assets. At the same time, it can reduce intervention incentives if the regulator is responsible for repaying all deposits, including in foreign branches. However, there is no heterogeneity that induces costs for supranational regulation and hence no tension between the optimality of domestic and supranational regulation, which is the focus of our analysis. Beck, Todorov and Wagner (2013) show that different dimensions of cross-border banking (deposit collection, investment and ownership) distort regulatory interventions in different directions. The paper also provides evidence on intervened banks from the recent crisis, supporting the theoretical analysis in that intervention decisions in foreign banks are distorted.

Our paper also speaks to the current policy discussion on cross-border regulatory cooperation. After an exercise of subjecting the largest 125 banks in the Eurozone to asset classification regime and stress tests, the Single Supervisory Mechanism has started its work in late 2014. In 2015, the Single Resolution Mechanism was put into operation, linked to a Single Resolution Fund, to be built up over the next few years. One –of several– outstanding issue is the relationship of non-Euro zone EU countries to the banking union, a topic our empirical analysis speak to. Significant progress is also made in other regions of the world, in particular in terms of cross-border regulatory cooperation. The Nordic-Baltic groups have moved towards a cooperation arrangement that includes resolution authorities and ex-ante burden sharing arrangements. The

East African Community has initiated a regulatory convergence process with closer cooperation between regulatory authorities of all member states.

The remainder of the paper is structured as follows. The next section discusses the theoretical background to our analysis, based on Beck and Wagner (2016). Section 3 describes the construction of our empirical measures of externalities and heterogeneity. Section 4 contains our empirical findings. We first use regression analysis to assess the importance of the externality and heterogeneity measures in predicting actual cooperation arrangements. Following this, we present graphs that document how countries vary according to the externality and heterogeneity measures. Section 5 concludes.

2 The Externality-Heterogeneity Trade-Off

The discussion on the optimal international financial architecture is a complex one and often gets mired in details. Beck and Wagner (2016) (BW henceforth) argue that it can be broken down to a basic trade-off. The decision on whether banking policies are to be delegated to the supranational level and when they remain national should be driven by two factors, first, cross-border externalities arising from cross-border exposure of domestic banks and, second, country heterogeneity arising from differences in the cost of bank failures.¹

2.1 Cross- Border Externalities

The *raison d'être* for financial regulation is externalities from bank failure. After all, in the absence of such externalities, bank governance can be left in the hands of shareholders and other stakeholders – as is the case for non-financial corporations. Externalities from bank failures partly materialize at the domestic level, for example, by causing a credit crunch in the domestic economy. Such externalities do not create a rationale for international regulation since a domestic supervisor will be best equipped to deal with them. However, the failure of banks in a country also causes substantial externalities

¹The externality-heterogeneity trade-off mirrors a similar discussion in the literature on fiscal decentralization (see, for example, Oates, 1972). This literature argues that the comparative advantage of centralization increases with the size of interjurisdictional externalities but decreases with preference heterogeneity.

for other countries – and increasingly so, due to the fact that the financial systems of countries have become more interconnected in recent decades, along several dimensions.

Externalities most directly arise from cross-border activities of specific financial institutions. For example, the failure of a bank that has foreign assets will incur costs abroad, among others by leading to lower credit availability to foreign firms. Such costs will not be taken into account by a domestic supervisor, leading to inefficient decisions. A case in point is Iceland (which from the perspective of the Icelandic supervisor had substantial foreign assets and deposits) where it can be argued that supervisors had insufficient incentives to control bank risk. Moreover, in a financially integrated world, there are plenty of other channels through which a shock arising from failure of one bank can spill over to other countries. This includes fire-sale externalities and common asset exposures, informational contagion among investors, direct interbank exposures or counterparty risk. For such externalities and contagion effects to materialize, no direct cross-border links have to exist between two banking systems. Specific externalities arise within a monetary union because a country cannot simply devalue its currency to regain competitiveness following a shock and hence may need to tap – in some form or other – the resources of other countries. The costs from asymmetric shocks are thus much higher in monetary unions. Further, relying on a common lender of last resort might result in a tragedy of commons problem, as it is in the interest of every member government with fragile banks to share the burden with the other members.

2.2 Heterogeneity

If all countries were identical ex-ante, it would be easy to agree on the right structure for international regulation and implementation would be straightforward. However, countries differ in practice along various dimensions, which increases the cost of closer cooperation and convergence. Countries differ in their legal and regulatory systems, which makes it hard to specify a common set of rules and standards, forcing adaptation of general principles to local circumstances. For example, while some countries are moving towards a universality approach where international insolvency is treated as a single case, many countries adopt a territorial approach where each country looks

out for its own creditors before contributing assets to pay creditors in other countries. A second source of heterogeneity arises from preferences. Countries may differ for example in how they view the role of the government in the economy (one consequence being differences in state ownership), focus on fiscal independence or with respect to their risk tolerance. For example, a basic trade-off in banking (and finance more generally) is between risk and return; e.g., lightly regulated institutions may perform better under normal conditions but may be more prone to fragility, while heavy-handed regulation reduces the risk but may also depress banks' profitability and their contribution to economic growth. Differences in risk tolerance can also lead to differences in the costs of bank failure. Heterogeneity can also result from informational asymmetries. Such asymmetries arise with respect to the health of another country's banking system but also regarding the most suitable approach to resolving problems under local conditions. Informational asymmetries tend to be compounded in the presence of cultural differences or a lack of geographical proximity.

2.3 A model of optimal supranational delegation

BW introduce a simple model that incorporates the externality-heterogeneity trade-off. The model considers the supervisory task of intervening and closing a troubled bank. It analyses the circumstances under which supervision should be delegated to the supranational level and when it should remain national. The baseline version of the model considers two countries. Each country has a bank, which can, however, operate across borders. The banks first invest in projects. At an interim stage, information about the likelihood of success of the project arrives. At this stage, the supervisor has to decide whether to let the bank continue, or whether to intervene in the bank. The decision to intervene trades-off the cost of bank failure at later stage when the project does not succeed, with the cost of liquidating the bank now and foregoing potential higher returns in the future.

The model considers alternatively domestic supervisors who maximize welfare for their respective countries and a supranational supervisor who maximizes the world welfare. Both forms of supervision are shown to be subject to a cost. On the one hand,

a domestic supervisor does not make efficient intervention decisions due to the cross-border nature of banks. She does not take into account the repercussions of its decision on the other country. In particular, when a share of the activities of the domestic bank is carried out in the other country, the regulator may become too lenient in its intervention decision, as she does not internalize the foreign costs when the bank fails.² The supranational regulator does not suffer from this problem as he explicitly also considers the welfare of the other country. However, the latter also faces a cost. Arising from differences in financial structure, both banks differ in their optimal intervention points (in the model, this arises due to differences in the cost of liquidations). A supranational regulator is assumed to be constrained in its policy-making in that he cannot treat banks in different countries differently. This may be because of political considerations or an inability to correctly observe local conditions. She thus has to develop a common intervention policy. This is inefficient since due differences in liquidation costs, interventions for one bank should always be more stringent than for the other bank.

There is hence a trade-off between both forms of supervision. When solving the model, supranational supervision emerges as the better alternative when, for given heterogeneity (measured by differences in liquidation costs), cross-border externalities are sufficiently high. Figure 1 depicts the trade-off, where dc denotes the differences in liquidation costs, and β measures the externality in terms of the share of a banks' operation that is located abroad. The line in the figure depicts combinations of externalities and heterogeneity where equal welfare is obtained under either form of supervision. Above the indifference curve, supranational regulation dominates, as the effect of the externality is then sufficiently large relative to the heterogeneity. Conversely, south of the curve, domestic supervision is preferred. The analysis in BW shows this results to be robust to a number of modifications to the baseline model.

The theoretical analysis delivers empirical predictions. Specifically, the degree of regulatory cooperation between two countries should increase in the degree of externalities that financial sector shocks in one country has on the other country, while it should

²Beck, Todorov and Wagner (2013) analyse actual intervention in cross-border banks during the crisis of 2007-2009 and show that they are distorted in the presence of foreign operations. In particular, regulators intervene at a later stage in banks (that is, when their health has already deteriorated significantly) that have more foreign investments.

decrease in the degree of heterogeneity between legal and regulatory frameworks in the two countries. In this paper we will employ the theoretical framework to see whether patterns of cross-border regulatory cooperation vary systemically with indicators of externalities and heterogeneity.

3 Methodology

3.1 Heterogeneity

We calculate an aggregated heterogeneity measure using a set of variables at the country-pair level. In order to quantify heterogeneity, we compute a dissimilarity matrix (similar to what is used in cluster analysis). For calculating these dissimilarities, one needs to define a methodology to calculate the distances between each pair of observations, where higher distance implies more heterogeneity. We use the Gower definition of distance, as this allows combining continuous and binary variables. Specifically, the distance between country i and country j is defined as follows:

$$H_{ij} = \frac{\sum_v \delta_{ijv} d_{ijv}}{\sum_v \delta_{ijv}} \quad (1)$$

where δ_{ijv} is an indicator equal to 1 whenever both observations are not missing for countries i and j for variable v , and zero otherwise. The term d_{ijv} ($d_{ijv} \in (0, 1)$) is defined as follows:

For binary variables v

$$d_{ijv} = \begin{cases} 0 & \text{if } x_{iv} = x_{jv} \\ 1 & \text{if otherwise} \end{cases}$$

and for continuous variables v ,

$$d_{ijv} = \frac{|x_{iv} - x_{jv}|}{\max_k(x_{kv}) - \min_k(x_{kv})} \quad (2)$$

Thus, we take the differences between each country pair's observations for the dif-

ferent variables, and normalize this number by the difference between the maximum and minimum of the corresponding variable. This normalization serves two objectives. First, it transforms these differences into a common scale; and second, it yields a heterogeneity measure bounded between 0 and 1. We take these dissimilarities to be our heterogeneity measure.

3.2 Externality

To gauge externality between two countries - i.e. spill-over effects from financial sector shocks in one country to financial sector stability in another country -, we construct a weighted index based on a set of variables. We cannot apply the dissimilarity matrix calculation directly to the latter measure, since the variables used for this calculation are country pair specific. In contrast, the variables used for the heterogeneity measure are single country specific.

We compute our externality measures as

$$E_{ij} = \frac{\sum_v \delta_{ijv} d_{ijv}}{\sum_v \delta_{ijv}} \quad (3)$$

where δ_{ijv} is an indicator equal to 1 whenever the observation is not missing for a given country-pair, countries i and j for variable v , and zero otherwise. The term d_{ijv} ($d_{ijv} \in [0, 1]$) is defined as follows,

$$d_{ijv} = \frac{x_{ijv} - \min_k(x_{kv})}{\max_k(x_{kv}) - \min_k(x_{kv})} \quad (4)$$

Thus, analogously to the heterogeneity measure, we take the differences between each country-pair observation and the minimum of that variable for all the different variables. We again normalize by the difference between the maximum and the minimum of the corresponding variable.

We take this variable to be our measure for the externalities between two countries. A higher value of this measure corresponds to higher externalities between two countries.

3.3 Data

This section describes our proxies for the heterogeneity and externality measures. A full description of the variables and their sources is given in Appendix A. We consider all countries, and we take data from 2013 when available. If not available, we take the most recent available year before 2013. Our final sample considers 179 countries and 30,823 country pairs.

Data for the heterogeneity measures comes from several sources. Our first set of variables is collected from the World Bank database. From this source, we obtain the *Bank Credit/GDP* which corresponds to the resources provided to the private sector by domestic money banks as a share of GDP; the assets of the three largest commercial banks as a share of total commercial banking assets, *Bank concentration*; the gross domestic product divided by midyear population, *GDP per capita*; and the general government final consumption expenditure as a share of GDP, *Government Expenditures/GDP*. A higher difference between countries in financial and socio-economic development implies higher differences in the costs of bank failure and thus, lower gains from supra-national cooperation.

We complement this data with the Database of Political Institutions (Beck et al., 2001). From this database, we construct a dummy variable *Federalism* which is equal to 1 if there are autonomous regions, and *Political structure* which is an indicator that ranges from 1 to 9 depending on different characteristics of the political environment. In particular, this variable captures the number of veto players in a political system, adjusted by whether these veto players are independent of each other, based on the level of electoral competitiveness in the system, their respective party affiliation and the electoral rules. Different political structures increase coordination barriers between two countries.

We also include a set of variables from the Bank Regulation and Supervision Survey. These variables are: whether the country has the central bank as the main supervisor, *CBsupervisor*, and whether there is an insolvency framework for banks different from that of non-financial firms. Differences in regulatory framework again increase the cost of regulatory cooperation across borders.

We also include the country’s *Legal Origin*. This variable indicates whether the legal origin of a given country is *English, French, German, Socialist* or *Scandinavian* (LaPorta et al. (2008)). We also consider the colonizer of a given country (Klerman et al. (2011)), *Colonizer*, and the *Language* spoken in the country. Finally, location is also an important factor for determining dissimilarities. Therefore, we also include each country’s *Latitude* and *Longitude*. Countries with shared history, legal tradition or geography might face lower discrepancies in their bank resolution frameworks.

We turn next to the variables used for computing the externality measure. We consider three variables to construct this measure. First, we obtain from the Claessen and Van Horen (2009) database the share of the number of banks from country j operating in country i , *Bank foreign share*. Second, we use the *correlation* between country’s i and country’s j MSCI Market Index using data between 2009–2013. Finally, we also include a dummy variable *Currency* that indicates whether country i and country j have the same currency or their currency is fixed with respect to the other (Euro or Dollar). These three variables capture three different dimensions of externalities discussed above in section 2. Specifically, Foreign Bank Share proxies for spill-overs of a bank’s failure on countries where it has subsidiaries. The correlation between stock market indices proxies for financial market connections that might result in spill-overs due to common asset exposures. Exchange rate pegs or common currency areas proxy for policy constraints and tragedy of common problems.

Using these variables, we compute the heterogeneity and externality measures based on the methodology described in the previous section. The descriptive statistics for these two measures are presented in Table 1. The mean of the heterogeneity measure is 0.06 and takes values between 0.0006 and 0.122. At the same time, the externality measure has a mean of 0.11 and ranges between 0 and 0.994.

We check the robustness of our measures in Table 2. We present in this table the correlation matrix of different externality and heterogeneity measures when excluding sets of variables from the calculation. Specifically, we calculate this index including: 12 variables (the baseline case), 9 variables (excluding: *Political structure, Federalism* and *CB supervisor*), 6 variables (additionally excluding: *Location, Insolvency framework*

and *Language*), and 3 variables (additionally excluding: *Bank private credit/GDP*, *Bank concentration* and *Colonizer*). We see in this table that the correlations between the different heterogeneity measures are very high. The lowest correlation is 0.63, which results when comparing our baseline measure (12 variables) with the measure based on only 3 variables. These results confirm the robustness of our proxy. We obtain the same result when testing the robustness of the externality measure. For this test, we compute our measure restricting our calculations to: 3 (the baseline case), 2 (excluding *Bank foreign share*) and 1 variable (additionally excluding *Stock correlation*). We can see that the lowest correlation arises when we compare our current measure with the one based on only one variable. However, this correlation is equal to 0.73, which is still very high.

4 Empirical findings

4.1 Positive analysis of supranational cooperation

In this section, we analyze whether the externality-heterogeneity trade-off is able to predict the actual formation of supranational arrangements. The idea is that if externalities are indeed a key benefit to forming agreements, and heterogeneities a cost, notwithstanding political and other constraints we should observe that there is a higher propensity to form arrangements among countries with high externalities and low heterogeneity.

We carry out a probit analysis at the country-pair level. The dependent variable is a dummy variable indicating that there is a cooperation agreement in place between two countries in our sample. These cooperation agreements were hand collected and indicate either that a Memorandum of Understanding exists between the two countries or that a College of Supervisors for joint supervision for specific multinational institutions has been formed. The mean of this variable is 0.33 and has a standard deviation of 0.47. The explanatory variables are the different indicators of heterogeneity and externalities discussed in section 3. Descriptive statistics for these variables are shown in Table 3.

Table 4 contains the results. We report results for samples of African, European

and Latin American countries (these are the regions for which we have good data coverage). In each case, we first report a regression with the aggregate indicators of externalities and heterogeneity, before using the individual indicators for externalities and heterogeneity, respectively. All columns in this table report the marginal effects of the explanatory variables.

Column (1) first reports the results for a sample that simply pools the three regions (individual observations are thus exclusively intra-regional pairs). Country heterogeneity is negatively and significantly related to the likelihood of a cooperation arrangement between two countries (note that such an arrangement may be either a bilateral one, or because two countries are part of a larger arrangement, such as the Eurozone). In addition, externalities between two countries are positively and significantly related to the likelihood of cooperation. This provides strong empirical support for the externality-heterogeneity trade-off theory. The effect is also economically significant; one standard deviation increase in the heterogeneity measure decreases the probability of cooperation in 4.9 percentage points, whereas one standard deviation increase in the externality measure increases the probability of cooperation in 18 percentage points. These effects are considerable, given that the average cooperation propensity in the sample is 33%.

Column (2) analyses next the effect of the three individual components of externalities (cross-border banking, financial market integration and exchange rate linkages). We find that each of them is significantly related to the existence of regulatory cooperation and with the sign that is predicted by theory (positive). Column (3) considers the different components of the externalities. Only some of them enter significantly in column 3. Specifically, higher differences in banking market structure (as proxied by bank concentration), government consumption as well as different legal tradition and geographic distance reduce the likelihood that two countries have a regulatory cooperation agreement. Also, countries that have similar federal structures are more likely to have a regulatory cooperation agreement. Somewhat surprisingly, the likelihood of regulatory agreement increases the higher the difference in economic (GDP per capita) and banking sector development (Bank Credit to GDP).

We next analyze the European Union and Africa (we do not report separate results

for Latin America, as we only have 28 observations for this region). Columns (4) to (6) find that results are similar for the European Union. Specifically, the indices for both heterogeneity and externalities enter significantly, positively in the case of externality and negatively in the case of heterogeneity (column 4). All three dimensions of externalities enter positively and significantly (column 5). Column (6) shows that countries with higher differences in bank concentration, government consumption, different legal traditions, different roles for the central bank as bank supervisor and higher geographic distance are less likely to have a cooperation agreement. Countries with similar federal structures and insolvency frameworks, on the other hand, are more likely to have a cooperation arrangement. In unreported robustness tests, we also ran these three regressions on the sample of non-banking union/Eurozone countries and find similar though less significant results.

Columns (7) to (9) confirm our findings for Africa. For this region, only the externality enters significantly (column 7) as do all of its subcomponents (column 8). Among the different dimensions of heterogeneity, we find that differences in government consumption, federal structure, in banking sector development, insolvency frameworks, language, colonial heritage and geographic distance reduce the likelihood of having a regulatory arrangement. On the other hand, we find that higher differences in bank concentration, roles for the central bank as bank supervisor and common legal origin (though highly correlated with common colonial history) now enter positively and significantly.

Our models above are also very successful in predicting cooperation agreements. They correctly predict more than 66% of the cases, confirming the relevance of the externality-heterogeneity trade-off for actual cooperation agreements.

4.2 The externality-heterogeneity trade-off for different regions

The results of the previous section confirm theoretical considerations in that externalities are a benefit to supranational cooperation, while country heterogeneity is a cost. In this section we take this trade-off for granted, and carry out a normative analysis,

focusing on regions. The idea is that the extent to which a region displays externalities and heterogeneity among its countries determines whether it is a good candidate for having common institutions and rules regarding banking supervision. We first analyze how the two factors determining the trade-off vary across regions. For this, we construct average heterogeneity and externality measures for a region as follows: we calculate for each country in a region its externalities and heterogeneity vis-a-vis all other countries in the region, following this, we obtain a region average by taking averages across all the country-pair measures belonging to that region.

Figure 2 presents the results, where each bubble represents a region (the size of the bubble equals the GDP of the region). The figure compares a diverse set of countries, both large geographic areas (e.g., Latin America) as well as regions that have recently achieved closer regulatory cooperation, such as the East African Union. To recall from the theoretical analysis, areas in the upper-left of the figure (high externality and low heterogeneity) indicate that forming cooperation is desirable, while regions located in areas in the lower-right should consider only limited forms of cooperation, if any.

Figure 2 shows that there is wide variation across regions. The European Union (EU) has a very high degree of externalities, which would make it an ideal candidate for a common supervision. However, the European Union also has a very high heterogeneity, which should not come as a surprise given the recent experience of the European crisis. In total, the European Union has the highest value for both measures among all our regions. It is thus not an ideal area for intense cooperation. This is in particular true since Figure 1 suggests that the externality-heterogeneity trade-off is not a linear one: at large levels of heterogeneity, very high externalities are needed to create positive gains. When judging the results it should also be kept in mind that the European Union consists of a large number of countries, and hence it is a priori more difficult to have high homogeneity.

Turning to the Nordic-Baltic group (the five Scandinavian and three Baltic countries) we find that it has similarly high externality and heterogeneity measures, although both are slightly lower than the European Union. This suggests similar net benefits as in the European Union. At the other end of the spectre, Latin America is a region with

both relatively low externality and even lower heterogeneity. In this case, net benefits are again probably low, but for opposite reasons. Within Latin America, however, the Caribbean Community and Common Market (CARICOM, fifteen states in total) has high externalities while displaying a similarly degree of heterogeneity as Latin America in total. CARICOM thus appears to be a good case for integration of banking supervision. The Central American Common Market (CACM, states in Central America plus Dominican Republic) displays similarly high externalities (even though a bit lower than CARICOM) but much higher heterogeneity. It is thus, in principle, less suited for integration of supervision, but the trade-off seems to be more favorable than for the majority of other regions.

The African Union (AU) has relatively low externalities among its members, reflecting the limited financial integration across Africa as well as very high heterogeneity. This contrast is even stronger for East Africa, though less strong for the West African Monetary Zone (WAMZ), which shows a high degree of externalities as well as high homogeneity.

While Figure 2 represents average measures for a given region, it does not tell us how individual countries contribute to the overall region. Understanding this helps us gaining insights into as to which countries would fit best into a supranational agreement within a region, and which not. We next analyze country-specific contributions focusing on two regions, the Nordic-Baltic cooperation and one for the European Union.

The Nordic-Baltic agreement on regulatory cooperation goes beyond that of other country pairs and groups by including resolution authorities into the college structure and by including a simple ex-ante burden-sharing agreement into the Memorandum of Understanding, signed by the different member countries. The closer cooperation between these eight countries can be justified with the high cross-border presence of banks within this group, while it might have been made easier because of common political history and other similarities, including geographic proximity.

Figure 3 depicts the contribution of individual countries to the Nordic-Baltic agreement. The blue dots represent countries that participate in the arrangement. An individual dot gives us the average of pairwise heterogeneity and externality measure

of this country vis-a-vis all other countries in the agreement. Thus, it represents the marginal contribution (in terms of net gains) of this country to the agreement. In addition to the existing members, we also consider members of the European Union (outside the Nordic-Baltic region) in this graph, represented by red dots. In this case, a dot is the average of the bilateral measures between the specific country and all countries in the Nordic-Baltic region. This informs about the potential marginal contribution to the agreement, which we can view as representing who would be best suited to join an arrangement with the Nordic-Baltic Union.

As can be seen, Denmark, Estonia, Finland and Lithuania have a high externality vis-a-vis the other countries, more than most other members of the European Union. At the same time, Denmark, Sweden, Norway, Estonia and Latvia have also lower average degrees of heterogeneity vis-a-vis the other countries represented in the graph than most other EU members. It is interesting to note that, on average, countries within the Nordic-Baltic Union are more clustered in the upper-left part of the Figure, relative to the other countries. This indicates that the Nordic-Baltic Union is well designed in the sense that it comprises the right countries. However, the graph also points to several countries that would fit well into the Nordic-Baltic agreement, such as Germany, Austria and France, with very high externalities vis-a-vis all other Nordic-Baltic countries and relatively low heterogeneity.

Figure 4 analyses the European banking union. While the banking union was originally set up for Eurozone members, other EU countries have the option of joining as well. Figure 4 helps us assessing which countries would be the best potential entrants. Similar to Figure 3, blue dots now represent averages of a Eurozone country vis-a-vis all other Eurozone countries, while red dots represent averages of a non-Eurozone country vis-a-vis all Eurozone countries. Interestingly, we find a relatively clear split between the Eurozone's members and other EU members, with the former showing much higher externalities. We also note some exceptions: Croatia, Denmark and Bulgaria have a similarly high level of externalities vis-a-vis the other countries as the banking union members. There is also a high variation among banking union members in the degree of heterogeneity, which might explain the long-drawn out political process to achieve

the rudimentary banking union. Specifically, diverse countries as Finland, Slovenia and Cyprus show very high degrees of heterogeneity, though for different reasons. Germany, on the other hand, often seen as stumbling block to the completion of the banking union, shows a relatively low degree of heterogeneity vis-a-vis the other EU countries.

5 Conclusion

In the aftermath of the Global Financial Crisis, which to a considerable extent was driven by cross-border issues, significant efforts have been made to design an appropriate international financial architecture into which to embed large and internationally operating banks. While substantial progress has been made, little is known about the optimal form of cooperation among countries as regarding their banking regulation and supervision, and in particular, whether a one-size-fits-all approach suffices, or whether regional – or even country-specific – approaches are needed.

Previous literature (Beck and Wagner, 2016) has suggested two factors that determine the optimality of cross-border cooperation. First, cross-border externalities imply that uncoordinated domestic policies will result in inefficient supranational outcomes. They hence constitute a benefit to cooperation that allows for policies that internalize externalities. Second, heterogeneity across countries posits a cost to cooperation as it is then more difficult to implement policies that are beneficial to all parties. In this paper, we have shown that actual cooperation arrangements among countries are consistent with the gains predicted by the two factors. Using regression analysis, pairs of countries with high bilateral externalities were found to be more likely to have formed cooperation. By contrast, the propensity to cooperate declines with various measures of country heterogeneity. Among others, this suggests that the wide range of degrees to which countries cooperate are not simply the result of non-economic factors (such as history and political consideration), but also reflect differences in cooperation gains. Beyond the regression analysis, we have also documented how the benefits and costs to cooperation vary among regions and countries. We have found the gains to differ significantly, and sometimes in unexpected ways. Taken together, our results provide a cautionary tale towards using one-size-fits-all approach to banking cooperation. Such

an approach may be suboptimal as it ignores that not all countries benefit equally from closer cooperation.

References

- [1] Acharya, V. (2003), Is the International Convergence of Capital Adequacy Regulation Desirable?, *Journal of Finance* 58, 2745–2781.
- [2] Beck, T., Clarke, G., Groff, A., Keefer, P. and Walsh, P. (2001), New tools in comparative political economy: The Database of Political Institutions, *World Bank Economic Review* 15, 165–176.
- [3] Beck, T., Todorov, R. and Wagner, W. (2013), Bank Supervision Going Global? A Cost-Benefit Analysis, *Economic Policy* 28, 285–44.
- [4] Beck, T. and Wagner, W. (2016), Supranational Supervision: How Much and for Whom?, *International Journal of Central Banking*, forthcoming.
- [5] Calzolari, G. and Loranth, G. (2011), Regulation of Multinational Banks: A Theoretical Inquiry, *Journal of Financial Intermediation* 20, 178–98.
- [6] Claessens, S. and Van Horen, N. (2015), The impact of the global financial crisis on banking globalization, *IMF Economic Review*, forthcoming.
- [7] Dell’Ariccia, G. and Marquez, R. (2006), Competition Among Regulators and Credit Market Integration, *Journal of Financial Economics* 79, 401–30.
- [8] Freixas, X. (2003), Crisis Management in Europe. In *Financial Supervision in Europe*, ed. J. Gremers, D. Schoenmaker, and P. Wierds, 102–19. Cheltenham: Edward Elgar.
- [9] Goodhart, C. and Schoenmaker, D. (2009), Fiscal Burden Sharing in Cross-Boarder Banking Crisis, *International Journal of Central Banking* 5, 141–65.
- [10] Holthausen, C. and Ronde, T. (2002), Cooperation in International Banking Supervision: A Political Economy Approach, *ECB Working Paper 315*, European Central Bank.
- [11] Klerman, D., Mahoney, P., Spamann, H. and Weinstein, M. (2011), Legal Origin or Colonial History?, *Journal of Legal Analysis* 3, 379–409.

- [12] La Porta, R., Lopez-de-Silanes, F. and Shleifer, A. (2008) The Economic Consequences of Legal Origins, *Journal of Economic Literature* 46, 285–332.
- [13] Loranth, G. and Morrison, A. (2007), Deposit Insurance, Capital Regulations and Financial Contagion in Multinational Banks, *Journal of Business Finance & Accounting* 34, 917–49.
- [14] Niepmann, F. and Schmidt-Eisenlohr, T. (2013), Bank Bailouts, International Linkages, and Cooperation, *American Economic Journal: Economic Policy*, *American Economic Association* 5, 270–305.
- [15] Oates, W. (1972), *Fiscal Federalism*, *Harcourt-Brace, New York*.

Figures

Figure 1: The externality-heterogeneity trade-off

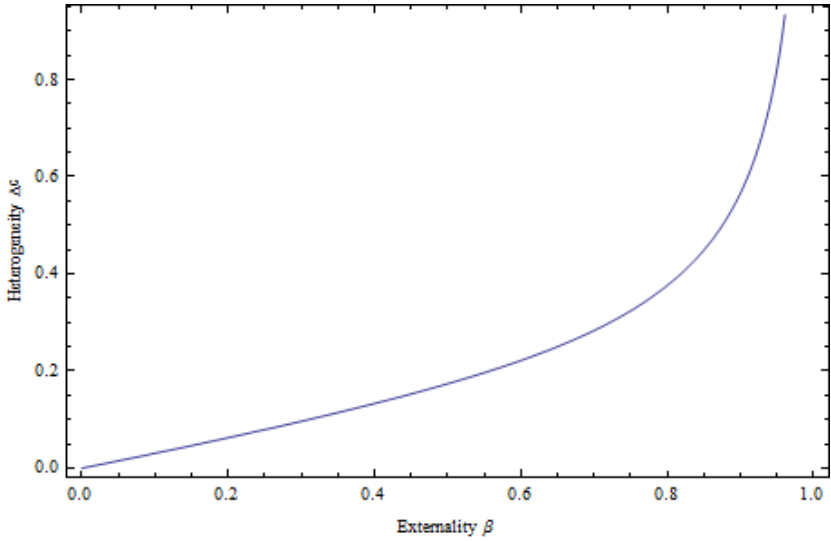


Figure 2: Externality and heterogeneity in different regions

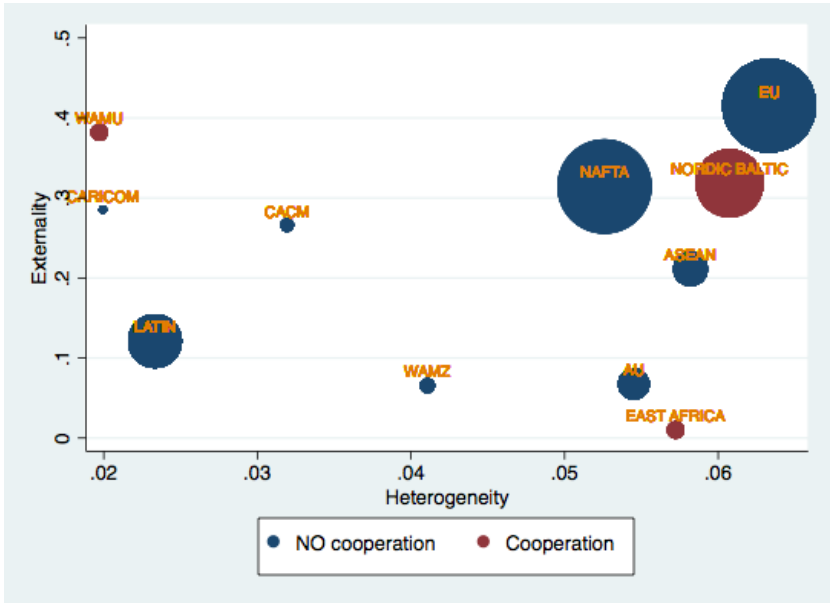


Figure 3: Nordic Baltic Region

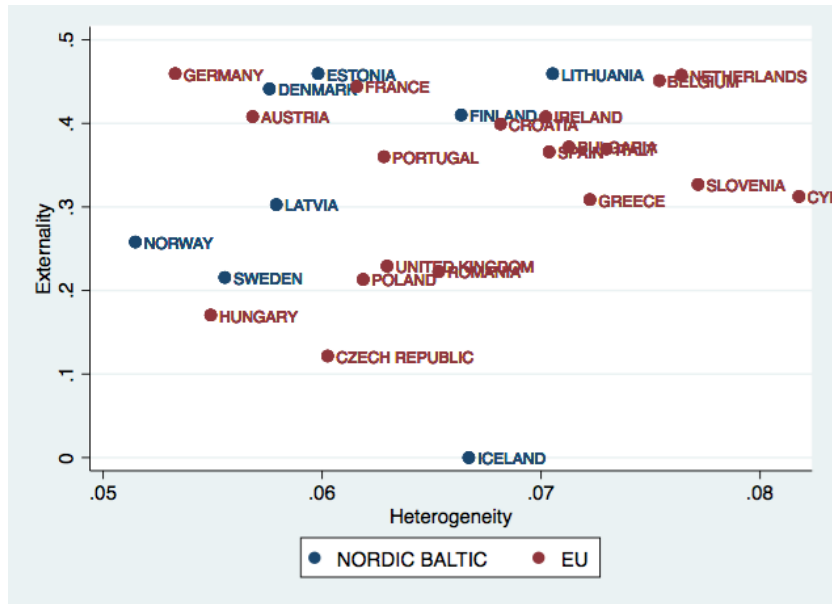
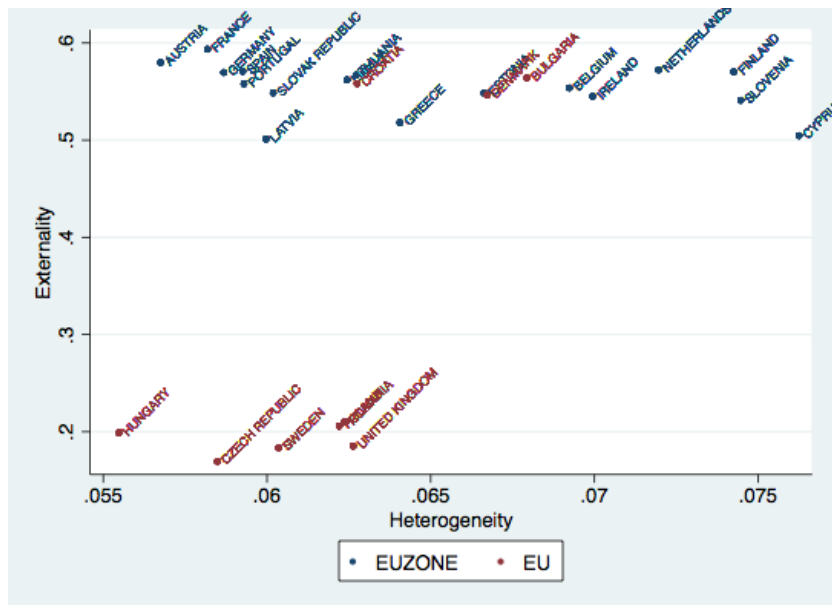


Figure 4: European Union



Tables

Table 1: Descriptive statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Heterogeneity	0.063	0.018	0.0006	0.122	42,996
Externality	0.117	0.189	0	0.994	30,823

Table 2: Correlation among different externality and heterogeneity measures

<i>Heterogeneity</i>				
Heterogeneity	Het($V=12$)	Het($V=9$)	Het($V=6$)	Het($V=3$)
Het($V=12$)	1			
Het($V=9$)	0.869	1		
Het($V=6$)	0.776	0.894	1	
Het($V=3$)	0.636	0.723	0.822	1
<i>Externality</i>				
Externality	Ext($V=3$)	Ext($V=2$)	Ext($V=1$)	
Ext($V=3$)	1			
Ext($V=2$)	0.952	1		
Ext($V=1$)	0.727	0.749	1	

Table 3: Descriptive Statistics Probit Models' Variables

Variable	Mean	Std. Dev.	Min.	Max.	N
Cooperation	0.338	0.473	0	1	3035
Heterogeneity _{ij}	0.063	0.018	0.001	0.123	16038
Externality _{ij}	0.359	0.194	0.001	0.99	2828
Bank foreign share _{ij}	0.027	0.076	0	1	3054
Correlation _{ij}	0.125	0.306	-0.869	1	20701
Currency _{ij}	0.139	0.346	0	1	16038
ΔBank concentration _{ij}	22.45	15.752	0	72.900	9763
ΔPolitical structure _{ij}	1.587	1.285	0	8	14021
ΔFederalism _{ij}	0.25	0.433	0	1	14717
ΔGovernment Expenditures/GDP _{ij}	6.72	7.354	0.005	81.428	14818
ΔBank private credit/GDP _{ij}	51.101	52.111	0	285.3	14622
ΔInsolvency Framework _{ij}	0.426	0.495	0	1	14033
ΔLegal Origin _{ij}	0.6	0.49	0	1	15627
ΔGDP per capita _{ij}	8943.472	10639.47	0.575	52200.91	15729
ΔCentral Bank supervisor _{ij}	0.463	0.499	0	1	15729
ΔLatitude _{ij}	60.608	48.906	0.017	277.55	16038
ΔLongitude _{ij}	28.472	20.518	0.017	101.633	16038
ΔLanguage _{ij}	0.853	0.354	0	1	16038
ΔColonizer _{ij}	0.864	0.342	0	1	16038

Table 4: Cooperation

	All	EU	AU
Heterogeneity _{ij}	-2.117** (0.890)	-2.851* (1.694)	-1.981 (1.745)
Externality _{ij}	0.616*** (0.0552)	0.570*** (0.0770)	0.726*** (0.186)
Bank foreign share _{ij}	1.026*** (0.298)	3.730** (1.763)	0.708** (0.288)
Correlation _{ij}	0.215*** (0.0423)	0.198*** (0.0515)	0.175** (0.0837)
Currency _{ij}	0.436*** (0.0351)	0.347*** (0.0433)	0.692*** (0.0560)
ΔBank concentration _{ij}	-0.00153* (0.000857)	-0.00546*** (0.00164)	0.00166*** (0.000450)
ΔPolitical structure _{ij}	0.0193 (0.0132)	0.0338 (0.0207)	0.0153 (0.00935)
ΔFederalism _{ij}	0.0624** (0.0285)	0.0990** (0.0412)	-0.147*** (0.0122)
ΔGovernment Expenditures/GDP _{ij}	-0.0260*** (0.00338)	-0.0318*** (0.00583)	-0.00708*** (0.00201)
ΔBank private credit/GDP _{ij}	0.00133*** (0.000267)	0.000265 (0.000369)	-0.00194*** (0.000690)
ΔInsolvency Framework _{ij}	0.0145 (0.0252)	0.0786* (0.0424)	-0.0443*** (0.0170)
ΔLegal Origin _{ij}	-0.117*** (0.0295)	-0.162*** (0.0482)	0.297*** (0.0108)
ΔGDP per capita _{ij}	6.81e-06*** (1.78e-06)	-2.31e-06 (2.62e-06)	-5.39e-06 (6.69e-06)
ΔCentral Bank supervisor _{ij}	0.0555** (0.0270)	-0.0752* (0.0433)	0.103*** (0.0213)
ΔLatitude _{ij}	-0.00664*** (0.000819)	0.000952 (0.00198)	-0.00512*** (0.000519)
ΔLongitude _{ij}	-0.0114*** (0.00150)	-0.00922*** (0.00341)	-0.00550*** (0.00101)
ΔLanguage _{ij}	-0.0161 (0.0410)	0.113 (0.118)	-0.330*** (0.0278)
ΔColonizer _{ij}	-0.0551 (0.0399)	-0.0406 (0.137)	-0.491*** (0.0333)
Observations	593	401	164
pseudo- R^2	0.104	0.079	0.121
% correctly predicted	69.65	66.33	73.78
	593	401	164
	0.176	0.161	0.296
	70.15	70.82	75.0
		70.40	97.46

The dependent variable in these models is the country-pair indicator of cooperation between two countries. All regressions report marginal effects and are estimated with robust standard errors (in parentheses). ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Appendix A: Variable definitions

Variable	Definitions	Source
Cooperation _{<i>i,j</i>}	Dummy variable that indicates whether there exists a Memorandum of Understanding or College of Supervisors agreement signed between country <i>i</i> and country <i>j</i> regarding cooperation in cross-boarder supervision.	Central Banks' and Supervisory authorities' websites and other sources.
<i>Heterogeneity</i>		
Bank private credit/GDP _{<i>i</i>}	The financial resources provided to the private sector by domestic money banks as a share of GDP.	World Bank
Bank concentration _{<i>i</i>}	Assets of the three largest commercial banks as a share of total commercial banking assets.	World Bank
GDP per capita _{<i>i</i>}	GDP per capita is gross domestic product divided by midyear population.	World Bank
Government Expenditures/GDP _{<i>i</i>}	General government final consumption expenditure (formerly general government consumption) as a share of GDP.	World Bank
Federalism _{<i>i</i>}	Dummy federalism equals one if there are autonomous regions. An autonomous region is recorded if a source explicitly mentions a region, area, or district that is autonomous or self-governing. Furthermore, they must be constitutionally designated as autonomous or independent or special.	DPI database. Beck, et al. (2001)
Political structure _{<i>i</i>}	This variable equals one in countries where legislatures are not competitively elected, which is considered as countries where only the executive wields a check. This is incremented by one: if there is a chief executive, if the chief executive is competitively elected, if the opposition controls the legislature. In presidential systems it is incremented by one: for each chamber of the legislature unless the president's party has a majority in the lower house and a closed list system is in effect. And, for each party coded as allied with the president's party and which has an ideological orientation closer to that of the main opposition party than to that of the president's party. In parliamentary systems, it is incremented by one: for every party in the government coalition as long as the parties are needed to maintain a majority. And, for every party in the government coalition that has a position on economic issues closer to the largest opposition party than to the party of the executive. And, in parliamentary systems, the prime minister's party is not counted as a check if there is a closed rule in place, the prime minister is presumed in this case to control the party fully.	DPI database. Beck, et al. (2001)
Legal Origin _{<i>i</i>}	Set of dummies that indicate whether the legal origin is English, French, German, Socialist or Scandinavian.	LaPorta, et al. (2008).
Colonizer _{<i>i</i>}	Set of dummies for the different colonizers.	Klerman, et al. (2011)
Latitude _{<i>i</i>}	Indicates the latitude coordinates of the capital.	Nationmaster
Longitude _{<i>i</i>}	Indicates the longitude coordinates of the capital.	Nationmaster
Language _{<i>i</i>}	Set of dummies that indicate the language(s) spoken at the country.	CIA World Factbook
Central Bank supervisor _{<i>i</i>}	Dummy that equals one if the Central Bank is the supervisor for prudential purposes.	Bank Regulation and Supervision Survey
Insolvency Framework _{<i>i</i>}	Dummy that equals one if there is an insolvency framework for banks different from that of non-financial firms.	Bank Regulation and Supervision Survey
<i>Externality</i>		
Stock correlation _{<i>i,j</i>}	Corresponds to the correlation between country's <i>i</i> MSCI Market Index and country's <i>j</i> MSCI Market Index	MSCI market index.
Currency _{<i>i,j</i>}	Indicates whether country <i>i</i> and country <i>j</i> have the same currency or their currency are fixed with respect to the other (Euro or Dollar).	IMF
Bank foreign share _{<i>i,j</i>}	Indicates the share of number of banks from country <i>j</i> operating in country <i>i</i> .	Claessens and Van Horen (2009)

Appendix B: Regions

Region	Countries
ASEAN	Indonesia, Lao, Malaysia, Philippines, Singapore, Thailand, Vietnam
AU	Algeria, Angola, Benin, Burkina Faso, Burundi, Cambodia, Botswana, Cape Verde, Cameroon, Comoros, Cote D'Ivoire, Dem. Rep. Congo, Rep. Congo, Egypt, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe.
CACM	Belize, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua, Panama
CARICOM	Barbados, Belize, Grenada, Guyana, Jamaica, St. Lucia, Trinidad and Tobago, The Bahamas
EAST AFRICA	Burundi, Kenya, Rwanda, Tanzania, Uganda
EU	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom.
LATIN	Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Honduras, Mexico, Panama, Paraguay, Peru, Uruguay, Venezuela.
NAFTA	Canada, Mexico, United States.
NORDIC BALTIC	Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Norway, Sweden.
WAMU	Benin, Burkina Faso, Cote D'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, Togo.
WAMZ	Ghana, Gambia, Guinea, Liberia, Nigeria, Sierra Leone.