Cross-border spillovers from reducing non-performing loans

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Summary

Authorities in many countries recently deployed policies to reduce non-performing loans (NPL). This paper investigates whether such policies have cross-border spillovers, in particular, whether they affect foreign affiliates of banks. It uses a novel dataset on policies deployed to address high levels of NPLs in a large number of countries over the period 1990-2015 and bank-level data from Bankscope database. A combination of establishment of asset management companies with the view to develop a secondary market for impaired loans and availability of public funds for bank recapitalisations is found to have sizable impact on foreign affiliates of banks. This finding is insightful in two ways. First, it suggests that the welfare benefits of policies to reduce NPLs are larger than previously thought -- on account of positive cross-border spillovers. Second, estimates can be seen as the lower bound of the effectiveness of such policies in the jurisdiction where policies are adopted. Such estimates have the benefit of exploiting arguably exogenous variation in deployment of policies and their timing. The cross-border effects of policies targeting NPLs are driven primarily by application of consolidated supervision and, to some extent, by the exchange of knowledge within banking groups and the workings on internal capital markets.

Keywords: non-performing loans, economic growth, bank lending, asset management companies

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1. Introduction

A decade after the global financial crisis of 2008-09 balance sheets of banks in many advanced economies and emerging markets remained clogged by non-performing loans (NPLs) – broadly understood as loans that are at least 90 days in arrears. Persistence of NPLs after the 2008-09 crisis has brought the issue of NPL resolution to the forefront of policy debate, with countries from Italy to India belatedly putting forward packages aiming to reduce NPL ratios. Such packages may include establishment of Asset Management Companies (AMCs) specialising in dealing with NPLs, provision of public sector funds for bank recapitalisation with the view to facilitate management and write-off of NPLs, changes to loans classification and provisioning rules and amendments to tax treatments of NPLs, among others.

Financial sector shocks and policy changes have been shown to affect banks across borders. Foreign bank affiliates respond to financial shocks in home territories of parent banks (Peek and Rosenberg, 1997, 2000; Schnabl, 2012; Cerutti and Claessens, 2017) reflecting the workings of internal capital markets of banking groups (De Haas and Van Lelyveld, 2010; Ongena et al., 2013). Macroprudential measures can also significantly affect behaviour of bank affiliates abroad (Aiyar et al., 2014a, 2014b; Ongena et al., 2013; Berrospide et al., 2017) and monetary policy is transmitted internationally (Hills et al., 2017).

This paper investigates whether policies aimed at reducing NPLs have cross-border spillovers and, in particular, whether they affect foreign affiliates of banks. This question is of major interest for two reasons.

First, policy packages aimed at reducing NPLs tend to be costly, at least in the short-to-medium term. Cross-border spillovers of such policies imply higher welfare benefits of policy actions. In certain setting, for instance in the context of the European Union (EU), such cross-border effects can be internalised in decision making strengthening the case for more forceful (and, perhaps, more centralised) approach to addressing high NPLs.

Second, cross-border estimates can be seen as the lower bound of the effectiveness of NPL policies in the jurisdiction where they are deployed. Estimating the effectiveness of NPL policies within jurisdictions with precision is difficult (see Balgova et al., 2017) and much of the evidence to date is based on case studies of various episodes (see Baudino and Yun, 2017, for a recent summary of lessons learned). The use of policies in response to high and rising NPLs and the timing of such policies is arguably non-random. As a result, effective policies

adopted early in the crisis may look ineffective due to the severity of economic downturn, and vice versa.

In contrast, estimates of cross-border effects of NPL reductions exploit arguably exogenous variation in deployment of policies. Identification comes from comparing evolution of NPLs in domestic banks and in affiliates of foreign banks in the same year in the same jurisdiction. This approach accounts for the relevant differences in macroeconomic conditions and policy environments across countries and across time.

To conduct these estimations, we use a novel dataset on policies deployed to address high levels of NPLs in a large number of countries over the period 1990-2015 and bank-level data from Bankscope database. This dataset is combined with bank-level data on ownership of banks (Claessens and van Horen, 2015) including detailed information on bank owners in Central and South-Eastern Europe (CESEE) based on De Haas et al. (2015).

The paper contributes to two distinct strands of literature. The first, briefly touched upon above, examines cross-border transmission of various financial sector shocks through bank ownership networks. This paper extends the analysis of cross-border policy spillovers by looking specifically at evolution of non-performing loans and a broader set of policy measures. The second strand looks at the aftermaths of the banking crises and, more specifically, at approaches to dealing with the overhang of non-performing loans in the banking sector and their effectiveness.

The analysis reveals that the establishment of Asset Management Companies (AMCs) specialising in dealing with NPLs supported by availability of public funds for bank recapitalisations has an impact on NPL resolution in banks' foreign affiliates. We estimate that this policy package deployed at the jurisdiction of a parent bank reduces the stock of NPLs on the balance sheets of foreign subsidiary banks by an additional 0.13 percentage points per annum compared with domestic banks in the same jurisdiction. This transmission appears to be driven largely by consolidated supervision, and to some extent by the transfer of knowledge in the area of NPL resolution and the workings of internal capital markets within banking groups.

In contrast, financial sector bailouts not accompanied by establishment of AMCs appear to have a weak impact on NPL ratios, if any. Changes in loan classification stringency, revisions to provisioning rules or macroprudential policy tightening do not appear to have significant

cross-border effects on NPL ratios or credit availability. These results are validated using detailed ownership data on banks located in the CESEE region that enables us to track transmission of responses to NPL policies between parent and subsidiary banks.

The rest of the paper is structured as follows. Section 2 discusses the adverse economic effects associated with high NPLs as well as financial sector policies that can help reduce NPL ratios. Section 3 explores possible transmission of such policies across borders. Section 4 discusses the identification strategy and presents the data. Section 5 presents the results of the empirical analysis. Section 6 concludes.

2. Policies to reduce NPLs and their potential cross-border effects

2.1. Adverse effects of non-performing loans

High ratio of non-performing loans to total loans tends to have a negative impact on bank lending and economic activity. High NPLs require greater loan loss provisions, reducing capital resources available for lending, denting bank efficiency and profitability (see Berger and DeYoung, 1997; Keeton and Morris, 1987; Salas and Saurina, 2002; Jimenez and Saurina, 2005). The NPL exposure focuses bank's internal resources on loan recovery work, including repossession of collateral and its disposal. These efforts are costly (Townsend, 1979) and come at the expense of expanding business.

Undercapitalised banks may take excessive risk in a gamble to boost profitability (Jensen and Meckling, 1976), which may exacerbate the NPL problem further. Recent studies find a positive correlation between banks' leverage ratios or loan-to-asset ratios and NPLs (Klein, 2013; Garrido et al., 2016). High NPLs ultimately predict bank failures (Gonzales-Hermosillo et al., 1997).

High NPLs may also result in a misallocation of resources in an economy. Zombie lending – channelling new credit predominantly to the troubled companies – may help to prevent second-round business failures but at the expense of starving more productive parts of the economy of credit (see Peek and Rosengren, 2005; Caballero et al., 2008). Breaking this vicious cycle requires large capital injections (Giannetti and Smirnov, 2013). Reducing NPLs can thus be associated with a sizable growth dividend (see Balgova et al., 2017).

2.2. Dealing with non-performing loans

Recognising adverse effects of NPLs policymakers adopted a number of measures aimed at accelerating NPL reductions. The first step is to transparently assess the quality of bank assets and build up provisions against expected losses. Relying on banks' voluntary efforts in this area may not be sufficient and regulators may need to guide banks with respect to loan classification and provisions as well as assist banks with developing special capacity to deal with NPLs. When judicial capacity to deal with NPLs case-by-case is lacking, creating a sound legal framework for timely corporate restructuring is crucial. For instance, centralised out-of-court debt workout programmes were actively used in Korea, Thailand, Indonesia and Malaysia in the 1990s (Woo, 2000).

In this paper, we consider five types of financial sector policies that can influence NPL ratios: the establishment of an asset management companies, provision of bailouts to the financial sector (for instance, public funds for bank recapitalisation), changes to macroprudential regulation, changes to loan classification and changes to provisioning stringency.

2.2.1. Asset management companies

Establishment of "bad banks" or asset management companies encourages development of a secondary market for NPLs. It enables commercial banks to transfer NPLs to a specialised entity at a fair (market) value. The AMCs can securitise and resell impaired loans in a secondary market, use their expertise to partially recover bad loans or initiate foreclosure with the view to monetise collateral attached to bad loans. AMCs have additional advantages: unlike individual banks, they may internalise the effect of foreclosure on value of housing collateral in the portfolio and are not subject to capital regulation (Favara and Giannetti, 2017).

AMCs were deployed, for instance, in Sweden and Mexico in the 1990s (Macey, 1999; Krueger and Tornell, 1999). AMCs established following the Asian financial crisis assembled assets valued at up to 20 percent of GDP and achieved a significant degree of value recovery (Fung et al., 2004). In 2016, the Italian government reached a deal with the European Union (EU) to attach a government guarantee to a subset of NPLs. Such guarantees help to bridge the difference between the asking price of NPLs and the price potential buyers are willing to pay that arises due to asymmetric information (see Avgouleas and Goodhart, 2017, for a recent discussion of issues related to the design of AMCs).

Reflecting information asymmetry and high risks, majority of AMCs are funded publicly. In other cases, banks establish internal AMCs ring-fencing own funds for a special workout unit. Internal AMCs have the same objective – to maximise recovery value from a portfolio of impaired assets. Occasionally, deposit insurance funds are directly used to acquire non-performing assets. Such instances are less common, however, as this approach may weaken the ability of deposit insurers to perform their core duties.

For the empirical analysis data on AMCs is taken from the Building Better Bad Banks project by Hallerberg and Gandrud (2015). Where the data on AMC closure is not available, an AMC is assumed to have a life span of 8 years, the sample across the sample. The database contains information on 139 AMCs (109 public, 20 internal, 8 backed by deposit insurance and 2 unclassified) across 62 countries during the period 1990-2016. Examples of public AMCs include UK Asset Resolution Ltd, the Bank Asset Management Company in Slovenia, the Asset Management Corporation of Nigeria and the Korean Asset Management Company. The use of AMC covers all years of our observations, regions and level of country development.

2.2.2. Public bank recapitalisation

Public funds can also be used to directly recapitalise ailing banks. Such bailouts enhance banks' ability to provision non-performing exposures, write them off or sell them at a discount. Policy packages often combine establishment of AMCs with the use of public funds for bank bailouts. In the long term, government interventions can exacerbate moral hazard: banks counting on a potential bailout may take greater risks (Dam and Koetter, 2012). Our analysis is focused on the short-term effect of bailouts on bank NPLs and abstracts from their possible negative implications over the longer term.

The data on financial sector bailouts is taken from Bova et al. (2016) and covers 95 interventions, both during systemic banking crisis and stand-alone cases, spanning 66 countries. Estimates of fiscal cost of recapitalisation (available for 83 of those episodes) average 9.4 percent of GDP. The dataset also records public bailouts and recapitalisations in the non-financial sector (for instance, with respect to public-private partnerships, subnational governments or state-owned enterprises). These are used in placebo test.

2.2.3. Macroprudential policies

The third block of policies comprises macroprudential measures. These measures target behaviour of financial institutions through limits on leverage, maximum interbank exposures,

risk concentration ratios, capital surcharges on systemically important financial institutions or reserve requirements. Macroprudential measures can also target borrowers by limiting loan-to-value or debt-to-income ratios. While macroprudential tightening may limit build-up of NPLs over the economic cycle their short-term impact on the stock of existing NPLs is likely to be limited. The long-term impact is also debated as tightening in one area, for instance mortgage lending, can prompt banks to take extra risks in other areas such as corporate lending or securities trading (Acharya et al., 2017).

The data on macroprudential policies come from Cerutti et al. (2015). The database covers 119 countries from 2000 to 2013 and identifies 135 cases of macroprudential tightening in 76 countries. The cases of macroprudential loosening are limited to Bulgaria in 2008 and Serbia in 2013 and are not explored further.

2.2.4. Changes in loan classification and provisioning stringency

Changes in the stringency of loan classification and provisioning may also have an impact on NPL resolution. Forcing banks to recognise and fully provision NPLs strengthens incentives to promptly resolve non-performing assets. At the same time, a move towards stricter loan classification may result in an initial increase in reported NPL ratios.

Data on stringency of loan classification and provisioning is taken from Barth et al. (2014). The stringency of loan classification is proxied by the total number of days of delinquency after which a loan is classified as sub-standard, doubtful or lost (combining the three categories). The data comes from surveys of 127 central banks conducted in 1999, 2003, 2007 and 2011 (values are carried forward in other years). The indicator ranges from 4 months to over 3 years, with an average of 18 months. The provisioning stringency is proxied by the sum of the minimum required provisions as loans become substandard, doubtful and loss (this sum averages 120 percent).

This list of policies is not exhaustive. Examples of other relevant measures include changes in tax treatments of NPLs that remove disincentives in terms of writing bad loans off for banks and borrowers, judicial and legal reforms to accelerate the foreclosure process and improvements in out-of-court resolution mechanisms (see ECB, 2017). At the same time, the five types of measures outlined above account for a bulk of actions historically taken to reduce

NPL ratios. One or more of these measures were deployed in close to 90 percent of cases of high NPLs as identified in Balgova et al., 2017.

3. Cross-border transmission of NPL policies

3.1. Cross-border transmission of financial sector policies

Various spillover effects of financial-sector policies have been documented by earlier studies. For instance, foreign bank affiliates have been shown to respond to financial shocks in home territories of parent banks (Peek and Rosenberg, 1997, 2000; Schnabl, 2012) reflecting the workings of internal capital markets of banking groups (De Haas and Van Lelyveld, 2010; Ongena et al., 2013). This response tends to be partial, affected by frictions in internal capital markets (Cerutti and Claessens, 2017). It is higher when foreign affiliates are financed by intra-group funding rather than by local deposits (De Haas and Van Lelyveld, 2014). As a result, foreign banks can be a stabilising force with respect to local shocks in a host economy yet amplify the transmission of global shocks (De Haas et al., 2015).

Macroprudential measures significantly affect behaviour of bank subsidiaries abroad. Conversely, changes to macroprudential regulation and capital requirements may have little impact on lending behaviour of foreign-owned banks operating in a jurisdiction where such changes are introduced (Aiyar et al., 2014a, 2014b; Ongena et al., 2013; Berrospide et al., 2017).

Several transmission channels may similarly give rise to cross-border transmission of policies aimed at reducing banks' NPL ratios. The main potential channels – consolidated supervision, the workings of internal capital markets and transfer of knowledge on how to work with impaired exposures – are discussed in turn.

3.2. Consolidated supervision

Over time, global financial markets have become increasingly complex and intertwined. In response, bank supervisors moved to supervision regimes on consolidated basis, whereby supervisors examine the prudential risks of an institution and all its international establishments, including branches and subsidiaries. This holistic view gives home country supervisors indirect oversight over banks' subsidiaries operating in foreign jurisdictions. The principles of consolidated supervision were formalised by the Basel Committee on Banking Supervision in *Concordat* in 1975 (Goodhart, 2011) with further refinements in 1983 and 1992

when the Minimum Standards for supervisory cooperation between Basel member countries were established.

The guidance and moral suasion that supervisors use to address high and rising NPL ratios can apply to the supervised subsidiaries. For example, NPL Guidance first issued by the European Central Bank's (ECB) Single Supervisory Mechanism in March 2017 and by the European Commission in March 2018 is applicable to all significant institutions including their international subsidiaries and branches. The guidance also calls for harmonisation of NPL definitions at a group level. It is not legally binding but high-NPL banks deviating from the reduction targets may see additional capital add-ons imposed (ECB, 2017b).

In sum, consolidated supervision both imposes additional implicit costs associated with NPLs in subsidiaries and prompts banks to harmonise approaches to dealing with NPLs across the banking groups. Under certain circumstances, a parent bank burdened with high NPLs and operating in an economy with a relatively weak growth outlook (such as Greece or Italy in the mid-2010s) may find it more cost-effective to prioritise NPL reduction in its subsidiaries abroad.

3.3. Internal capital markets

Parent banks and foreign subsidiaries are linked through internal capital markets enabling banking groups to reallocate capital with the view to maximise growth opportunities and better manage solvency risk at the holding level. In addition, liquidity can be injected in subsidiaries through short-term or long-term loans. Capital and liquidity can flow internally in both directions. When positions of parent banks are strong, they tend to support their subsidiaries at times of adverse shocks in host economies. Conversely, when parents experience an adverse shock, lending in subsidiaries tends to be negatively affected as parents refocus their resources on the home markets (the so-called *substitution effect*, see De Haas and Lelyveld, 2010).

An adverse NPL shock experienced by a parent bank is likely to propagate to its subsidiary through the funding substitution effect. This weakens the ability of the subsidiary to deal with NPLs through timely provisioning and write-offs. In some circumstances, the incentives of subsidiary's management to improve performance may be reduced, while adverse incentives to take on extra risk may become stronger.

A successful policy designed to reduce NPL ratios can put this chain into reverse. Availability of bailout funds in the parent's jurisdiction or sales of NPLs to AMCs can free up capital

resources that are, in turn, redistributed through internal capital markets. The resulting *support effect* enhances subsidiary's ability to address NPLs and strengthens management incentives to pursue strong financial results. In addition, NPL resolution at the parent bank level may free up management resources to focus on performance of subsidiaries.

3.4. Transfer of knowledge and management expertise

The existence of multi-national banking corporations can be partially explained by the value of replicating certain practices and techniques in foreign markets. Such replication involves flow of information from the parent to the subsidiary. The competitive allocation of resources through internal markets and use of common technological platforms foster such knowledge transfer (Ozsomer and Gencturk, 2003; Ambos and Ambos, 2009).

The transfer of knowledge is common in credit risk management (for example, when it comes to credit scoring). It extends to dealing with impaired exposures – in terms of identifying substandard loans, monitoring collateral valuation, modelling provisions and making decisions about sales of non-performing assets at a discount, repossession or loan write-offs. If a parent bank adopts new ways of managing NPLs such as sales to AMCs, subsidiary banks may follow the new practice.

The extent of successful knowledge transfer may depend on the value of knowledge (which may be higher when NPLs are high), motivation to share knowledge (which may be enhanced in the presence of consolidated supervision), richness of transmission channels (for instance, the extent of IT integration) and absorptive capacity of the knowledge acquirer. The latter may be higher where subsidiary staff are offered regular trainings by the parent (see Gupta and Govindarajan, 2000, for a general discussion of knowledge transfer).

4. Identification and data

4.1. Identifying cross-border effects of NPL policies

The basic approach to estimating the impact of NPL policies on NPL ratios involves linking country-level outcomes (the average NPL ratio of a banking system) or bank-level outcomes (a bank's NPL ratio) to adoption of specific policies using country-year or bank-year data. When interpreting these estimates, it is important to remember that the policymakers' decision to intervene, the timing of intervention and the choice of policy instrument are likely to be non-

random, influenced by external circumstances. The estimates of the effect of policies may thus be subject to endogeneity bias. For instance, if a certain policy comes into effect late in the economic cycle, on the back of improving economic conditions, its impact may be overestimated. If policies are adopted at the height of a crisis when the health of the financial sector is deteriorating rapidly, their impact may be underestimated. In this sense, evaluating NPL policies is akin to evaluating a medical intervention to treat a serious illness.

When estimating cross-border effects of measures aimed at reducing NPLs, we look at an exogenous source of timing of adoption of various policies. In particular, we focus on the performance of foreign-owned banks and policy changes in jurisdictions where the corresponding parent holding bank operates. We compare changes in behaviour of foreign-owned subsidiaries with changes in behaviour of locally-owned banks operating in the same jurisdiction as well as subsidiaries of foreign banks whose parents are not affected by the policy intervention. The two groups of banks are subject to the same set of economic conditions and domestic policy environment – except certain foreign-owned banks are also indirectly exposed to changes in policy and economic environment affecting their parents.

The introduction of policies targeting NPL reduction in the home country where a parent bank operates may have a *direct* effect on behaviour of banks in that jurisdiction and a *cross-border effect* on NPLs of subsidiary banks located in a foreign jurisdiction (see Figure 1 for a schematic representation). In a typical host country, we find foreign-owned subsidiaries with parents located in different home jurisdictions that are subject to different policy environment. For example, the Greek banking sector in 2005 comprised 32 domestic banks and 4 foreign subsidiaries with parents located in Cyprus, Germany, France and Portugal. At the same time, Greek banks owned subsidiaries in nine jurisdictions ranging from South Africa to Bulgaria. Such multiplicity of cross-border links strengthens the difference-in-difference identification strategy.

Figure 1. Identification strategy
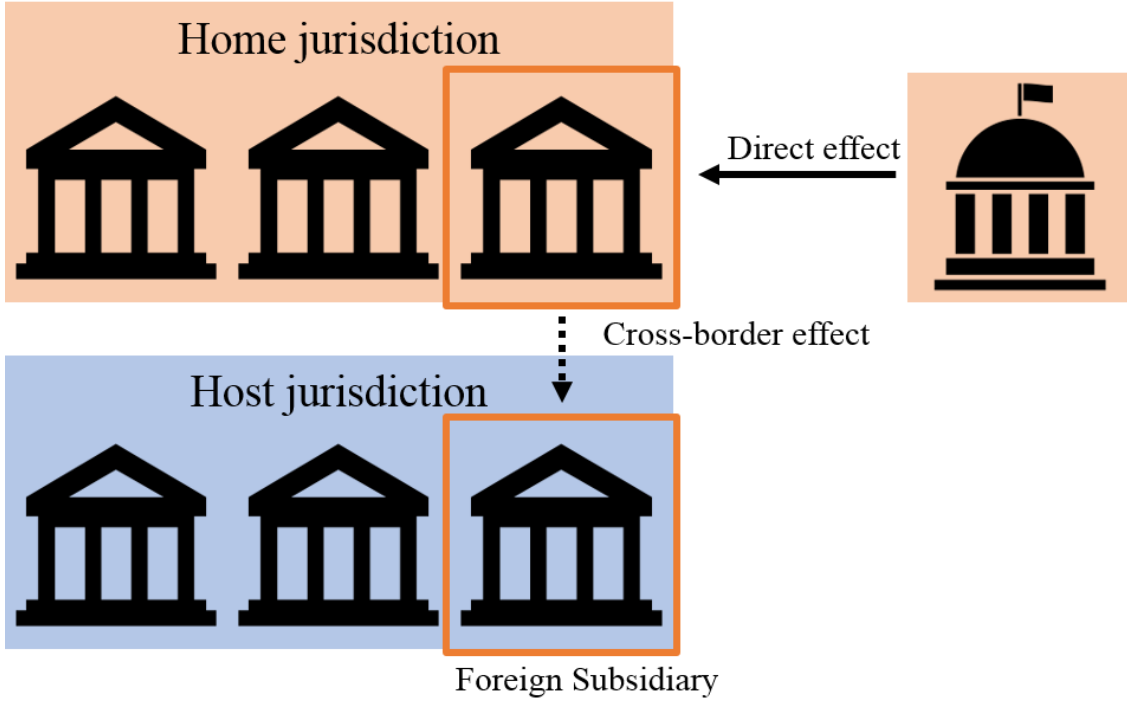
4.2. Basic empirical specification

The basic specification is derived for a large sample where we do not observe exact ownership links beyond the country of origin. In this context we are unable to link NPL levels of an affiliate bank to that of its parent. Instead, we estimate a reduced-form model where NPL policies can have an impact on bank affiliates abroad.

The dependent variable in the basic model (equation (1)) is the change in the ratio of NPLs to total loans for bank *i* between years *t – 1* and *t*. Bank *i* operates in domestic jurisdiction *d* but may be owned by a parent bank operating in a foreign jurisdiction *f*. The specification further includes interaction terms between the foreign ownership dummy (F_i) and a set of dummy variables capturing policies in place in the home jurisdiction *f* of the respective parent banks in year *t* (denoted POL_l^F). For instance, an AMC dummy variable is equal to one if an asset management company was in operation in the past 3 years in the jurisdiction of the parent holding bank. The coefficients on these interaction terms (β_l^F) capture the cross-border effects of policies on the subsidiaries of foreign parent banks.

$$\Delta NPLR_{itdf} = \sum_{l=1}^{L} \beta_l^F F_{it} * POL_{lt}^F + \lambda F_{it} + \gamma Z_{it} + \theta_1 F_{it} * MF_{ft}^F + \delta_i + \delta_{dt} + \varepsilon_{it} \quad (1)$$

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Bank fixed effects, δ_i, control for all time-invariant bank characteristics. They also subsume country fixed effects thus accounting for time-invariant differences between countries such as the origin of the legal system. They subsume foreign ownership except for banks that changed ownership during the sample period. The coefficient on the foreign ownership dummy thus reflects the average movement in NPLs upon a bank changing ownership from domestic to foreign or vice versa. Time-varying bank controls (Z) include return on average bank assets, total asset growth, deposits growth and the ratio of government debt holdings to total assets, all lagged by one year. They account for movements in NPL ratios in response to changes in a bank's financial health and the size of its loan book. Certain specification exclude bank-level controls but benefit from a considerably larger sample.

Certain specification include macro-level controls (MF^F) such as the growth rate of GDP per capita measured at purchasing power parity (PPP), inflation rate and changes gross capital formation, expressed in percentage points of GDP. These variables capture potential changes in demand for credit in the foreign jurisdiction and macroeconomic environment that could affect the NPL evolution.

Country-year fixed effects, δ_{dt}, further account for all economic conditions that are common to domestic and foreign banks in a given jurisdiction *d*. These fixed effects capture both changes in demand for credit and any changes in domestic policies that apply to all banks. Standard errors are clustered at the domestic country level to allow for autocorrelation and heteroscedasticity within jurisdiction. The baseline specification allows us to capture the difference in NPL evolution of foreign banks that were subject to policy change at home versus all domestic banks operating and non-treated foreign banks operating within the same jurisdiction.

4.3. Data on bank performance

We use a panel of 27,500 banks located in 190 countries. For these banks we observe NPL ratio over the period 1990-2015. Under the Basel definition a loan is classified as non-performing when a borrower is 90 days or more behind on their contractual payments or whenever a debtor is considered "unlikely to pay its credit obligations to the banking group in full, without recourse by the bank to actions such as realizing the security". The exact definition can vary from country to country and certain jurisdictions may not report the quality of loans meaningfully. Our analysis is thus conditional on a country willing to acknowledge the problem

of high NPLs in the first place. Consistent underreporting of NPLs, if anything, would lead to the effectiveness of NPL policies being underestimated in our analysis.

The yearly bank balance sheet and income statement data comes from Bankscope[1]. We exclude banks with less than US$100,000 in total assets, those that report multiple financial statements within the same calendar year and those whose core activity does not include granting credit.[2] Descriptive statistics are reported in Table 1.

Data on foreign ownership of banks is taken from Claessens and van Horen (2015). A bank is identified as foreign-owned when at least 50 percent of bank's shares are held by foreigners. The corresponding foreign policy in regressions is set to reflect the policy changes in the home country of the largest foreign shareholder. The ownership data is available for 5,102 banks in 140 countries. In approximately 9 percent of cases foreign ownership status of a bank changed during 1995-2013.

The foreign ownership dataset only indicates the country of ownership but not the exact owner. An extension of the analysis looks at actual ownership links for subsidiary banks in 19 countries in Central, Eastern and Southern Europe using the dataset collected by De Haas et al. (2015). In this sample we are able to link NPL dynamic of a foreign-subsidiary banks to NPL levels of a parent and use NPL policies as an instrument (in what is effectively a two-stage procedure whereby NPL policies impact the parent bank and the financial health of the parent bank impacts its affiliates).

5. Results

5.1. Impact of policies on non-performing loans ratio

We now turn to the results, first looking at the estimated effects of establishing an AMCs and using public funds for bank recapitalisations in a large international sample of banks (Table 3). The estimation distinguishes between three scenarios: establishment of AMCs only; use of public funds for bank bailouts in the absence of AMCs; and the two policies combined.

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[1] Banscope does not cover the population of all banking institutions worldwide but is reported to have reasonable coverage. For example Cunningham et al. (2001) report that Bankscope covered approximately 90 per cent of bank in 19 middle-income countries in 1999.

[2] The Bankscope sample contains bank holding companies, commercial, cooperative and savings banks, non-banking credit institutions, mortgage and investment banks.

Establishment of AMCs is associated with an average NPL ratio reduction of 0.4 percentage points per annum (column 1) although the coefficient is not statistically significant. The provision of bailouts is associated with a small and statistically insignificant change in NPLs. In the absence of structural reforms aimed at creating market for distressed debt, bailouts may do little to strengthen incentives for resolving non-performing loans. In some circumstances, bailouts may encourage greater provisioning (and thus recognition) of bad debts in the hope of increasing the amount of public funds being made available. The overall impact on NPLs may thus be ambiguous. Furthermore, bailouts may also encourage banks to pursue riskier new borrowers in search of higher upside expecting the downside risk to be limited. As this study focuses on relatively short-term impact of various financial sector policies, no inference can be made about the long-term effects of financial sector bailouts on banks' risk appetite.

When combined as a package, establishment of AMCs coupled with availability of public funds for recapitalisation is estimated to have a stronger and more robust cross-border impact in terms of lowering NPL ratios, estimated at 0.6 percentage points per annum.

The coefficients on control variables are by and large intuitive. Higher return on assets, potentially a proxy for higher risk appetite, is associated with higher NPL ratios. The negative coefficient on total assets growth reflects the fact that NPL ratios tend to decline at times of fast credit growth. Larger banks appear to be on average better at managing risks and/or attracting more creditworthy clients. Banks with larger sovereign bondholding tend to have lower NPL ratios, consistent with revealed preference for low-risk assets. A change in bank ownership from domestic to foreign is associated with a 1-2 percentage point increase in NPLs ratio, likely as a result of more rigorous evaluation of asset quality and application of more stringent reporting standards (IFRS). The significance of the economic cycle in the jurisdiction of the parent bank is in line with the findings of De Haas and van Lelyveld (2010), who show that global banking networks can transmit idiosyncratic shocks from abroad while improving resilience in response to idiosyncratic domestic shocks.

Table 4 further presents the estimated impacts of changes in loan classification, provisioning stringency and macroprudential tightening on NPL ratios of affiliates. We find no evidence of cross-border effects of these policies, perhaps reflecting the fact that international banking groups may already apply stricter loan classification and provisioning standards than the minimum required in their home jurisdictions.

5.2. Stock of NPLs versus credit growth

NPL policies typically target the stock of NPLs (the numerator of the ratio) with the view to ultimately achieve a revival in credit growth (the denominator). To decompose the impact of policies on NPL ratio into their impact on the numerator and that on the denominator, we repeat the exercise using the change in the logarithm of the stock of NPLs as the dependent variable. Movements in the stock of NPLs can reflect loan write-downs, loan recovery or loans newly classified as non-performing.

The analysis presented in Table 5 confirms that the cross-border effect of establishment of AMC combined with availability of public funds for recapitalisation is achieved largely through reduction in the stocks of NPLs of affiliate banks (which grow by at least 13 percentage points less than those of non-treated banks in the same jurisdiction). As before, no cross-border transmission is detected for provision stringency or other policies (Table 6).

Next, we check the impact of the same policies on the denominator of the ratio, where the dependent variable is the change in the logarithm of gross loans, winsorised at the 1st and 99th percentiles (see Table 7). Some of the specifications also include change in NPL stock, which is negatively correlated with the changes in total credit (non-performing loans consume bank capital and restrict its ability to expand fresh credit). We find that the presence of bailouts in the jurisdiction of the parent bank is associated with a four percentage points slower credit growth at a subsidiary, possibly because of formal and informal conditions attached as part of bailout packages and the associated crowding out effect within banking groups. This indirectly contributes to higher NPL ratios of affiliate banks.

5.3. Transmission channels

In a subset of countries, we can match parent and subsidiary banks using the dataset compiled by De Haas et al. (2015). This dataset maps out ownership links between subsidiary banks located in Central, Eastern and Southern-Eastern Europe (CESEE) and international parent banks. Overall, we observe 468 banks that are subsidiaries of global parent banks and 1,834 domestic banks in the region between 1999 and 2010. Parent banks come from a total of 43 countries.

First, we look at years in which subsidiary banks experienced a drop in NPL ratios of 2 percentage points or more. These episodes, by and large, coincided with sizable

reductions in NPL ratios of parent banks (see

Figure 1 Evolution of parent's bank NPL following 2pp or bigger drop in subsidiary bank's NPLs (year 0 is the year when subsidiary reduced NPLs by 2pp or more)

Prior to that, capital ratios increase in both the parent and the subsidiary bank (see Figure 5, Panel A), consistent with banking-group-wide efforts to improve capitalisation creating conditions supportive of cleaning up the balance sheets.

, where the timeline is centred on year zero of every such episode). The average reduction in NPL ratios of parent banks over a two-year window around the start of a significant reduction in NPLs of a subsidiary bank is statistically significant at the 5 percent level.
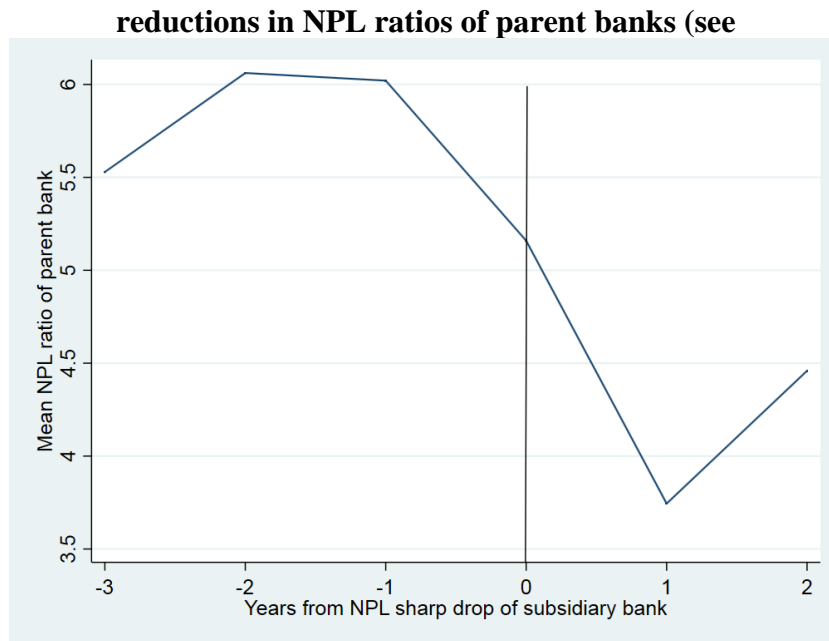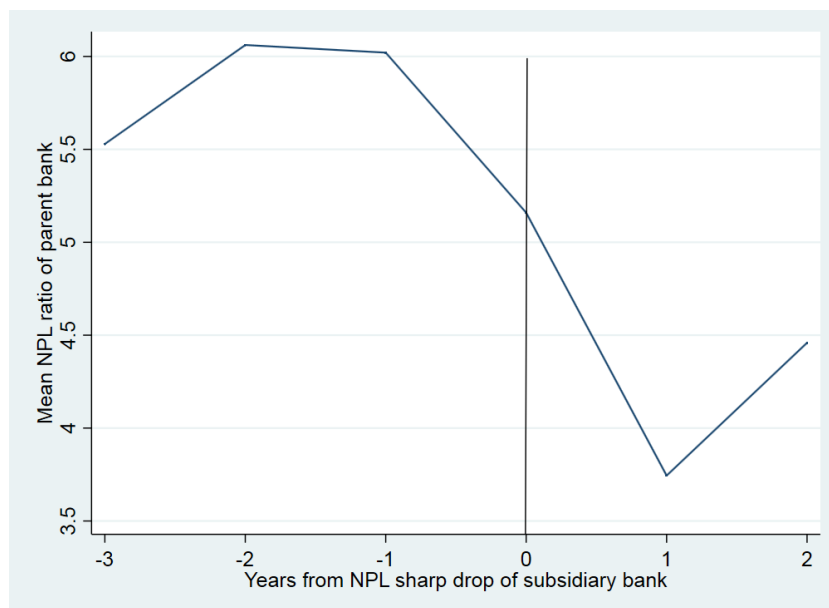

Figure 1 Evolution of parent's bank NPL following 2pp or bigger drop in subsidiary bank's NPLs (year 0 is the year when subsidiary reduced NPLs by 2pp or more)

Prior to that, capital ratios increase in both the parent and the subsidiary bank (see Figure 5, Panel A), consistent with banking-group-wide efforts to improve capitalisation creating conditions supportive of cleaning up the balance sheets.
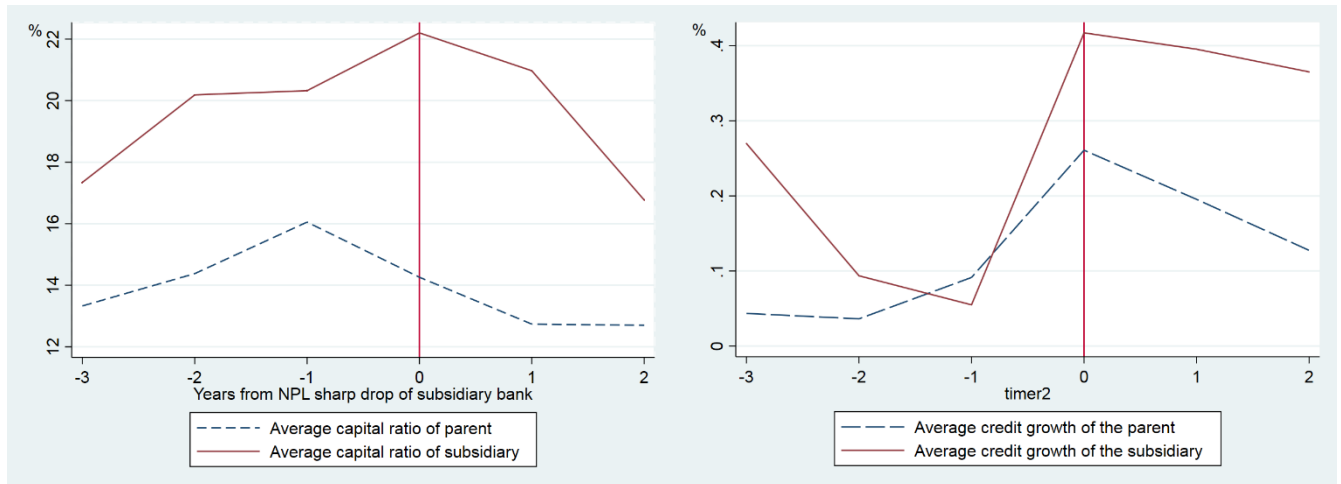
Figure 2 Evolution of parent's and subsidiary's capital ratio (Panel A) and credit growth (Panel B) before and after the 2pp or bigger drop in subsidiary's NPL ratio (year 0 is the year when subsidiary reduced NPLs by 2pp or more).

The difference-in-difference regressions looking at the determinants of NPL ratios can now be extended to include interaction between foreign-ownership dummy (F_{it-1}) and the NPL ratio of the parent bank ($NPLR_{t-1}^{PB}$), both lagged one year, as well as interaction between foreign ownership dummy and the total capital ratio of the parent (TCR_{t-1}^{PB}).

$$NPLR_{itdf} = \beta_1 F_{it-1} * NPLR_{t-1}^{PB} + \beta_2 F_{it-1} \: x \: TCR_{t-1}^{PB} + \beta_3 NPLR_{it-1} + \gamma Z_{it-1} + \theta F_{it} * MF_t^F + \delta_i + \delta_{dt} + \varepsilon_{it} \tag{4}$$

The results reported in Table 9 suggest that NPL ratios of subsidiary banks are strongly correlated with the NPL ratios of parent banks. A one percentage point reduction in the NPL ratio of a parent bank is associated with an approximately 0.5 percentage point reduction in the NPL ratio of the subsidiary bank with a lag of one year; the corresponding coefficient is statistically significant at the one percent level. Inclusion of domestic country-year fixed effects provides assurances that this result is not driven by the global economic cycle, which equally affects domestic banks. If macroeconomic conditions in parent bank jurisdictions (MF^F) are controlled for, the coefficient on the parent bank's NPL ratio, if anything, increases. The coefficient on the parent bank capital ratio is negative, as expected, but not statistically significant.

Next. parent's bank NPL ratio can be further instrumented with variables capturing policies deployed in the parent's jurisdiction, and in particular the establishment of AMCs and availability of public funds for bank recapitalisation. The instrumental variable approach helps us to establish a causal link underpinning the cross-border policy transmission of NPL policies via a parent bank. NPL policies are expected to impact NPL ratios of banks operating in the jurisdiction where they are deployed but not *directly* affect banks in other jurisdictions, potentially making them a suitable instrument to estimate the relationship between NPL ratios of parent banks and their subsidiaries.

Using this instrument, the estimated coefficient on the parent bank's NPL ratio increases to close to one (Table 10). These high estimates are consistent with the fairly sizable impact of certain NPL policy packages on subsidiaries of foreign banks obtained earlier. The coefficient on the capital ratio of the parent is negative and statistically significant at the 10 percent level, hinting at the role of internal capital markets in facilitating cross-border transmission of NPL reductions. The results of standard tests are consistent with the instruments being valid and relevant.

Next, we investigate the importance of consolidated supervision for international spillovers of NPL policies and, in particular, if the spillover are stronger when parent banks reside in member countries of the Basel Committee for Banking Supervision (BCBS).The holistic supervisory approach at the heart of the BCBS work is based on the banking supervisors' multinational cooperation. It requires multinational banks to apply consistent approach to NPL recognition and management across their subsidiaries. If a parent bank is domiciled in a country where banking supervisor is a member of BSBC, its foreign subsidiaries are subjected to indirect supervision in the home jurisdiction. Our sample starts in the 1990s when 11 countries were members of the Basel committee. The membership subsequently grew to include the European Union as well as 18 jurisdictions outside the EU.

The results reported in

Table 11 are consistent with consolidated supervision playing an important role in facilitating cross-border spillovers of policies targeting NPL reductions. While subsidiaries of parents located in Basel-member countries respond to changes in NPL ratios of parent banks in a statistically significant way, subsidiaries of non-Basel parent banks do not.

The next exercise checks if the extent of policy spillover varies with physical distance between parent banks and their subsidiaries (the distance is measured between capital cities and the largest cities in the nation, weighted by relative population size, using CEPII dataset). The physical distance is expected to affect transfer of knowledge between banks (Ambos and Ambos, 2009) as higher cost of travel, time difference and cultural differences make it harder for bank staff to communicate. On the other hand, distance should have limited, if any, impact on the consolidated supervision and internal markets transmission channels. The results, reported in Table 15, indicate that spillovers are somewhat weaker when distances between banks are large (exceeding 2,000 km) suggesting that the transfer of knowledge channel plays some role in facilitating cross-border spillovers of NPL policies.

Does cross-border transmission work in reverse – from a subsidiary bank to its parent? The answer to this question may shed further light on the relative importance of various transmission channels. Consolidated supervision channel is expected to work from the parent to subsidiary, knowledge transfer predominantly in this direction while the internal capital markets channel could operate both ways.

To test for transmission of NPL reductions from a subsidiary bank to its parent we reverse equation (4) and regress the NPLR of the parent bank on lagged NPL ratio of its CESEE subsidiaries, parent bank controls and parent jurisdiction macroeconomic variables. The results are reported in Table 12 and show that the estimated transmission of NPLs is statistically significant in some specifications but is one-to-two orders of magnitudes lower than the estimated transmission from the parent bank down. In part, this reflects lower levels of NPLs at parent banks, on average. Imprecise nature of the estimation may also play a role. In particular, we do not observe the subsidiaries located outside of CESEE region and the sample is limited to 65 distinct parent banks[3]. Nonetheless, the results are indicative of the predominant direction of transmission and are consistent with the findings for transmission of monetary policy from large advanced economies to the rest of the world (Hills et al., 2017).

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[3] Table 12 treats parent-subsidiary pairs as unit of observations. We cannot collapse the observations to single parent bank due to the unobserved identity of non-CESEE subsidiaries.

On balance, the evidence is consistent with the cross-border effects of policies targeting NPLs being driven primarily by application of consolidated supervision and, to some extent, by the exchange of knowledge within banking groups and the workings on internal capital markets.

5.4. Robustness tests

To further address concerns that the results may be driven by common economic cycle, or perhaps global policy coordination, we run a placebo test. In this exercise, foreign-owned banks are randomly assigned their parent's domicile, keeping the frequency of home-host country pairs in the dataset unchanged. The results of the exercise yield no statistically significant cross-border spillovers of NPL policies (see Table 13).

Another placebo test preserves the actual ownership data but uses bailouts of subnational government, state-owned enterprises, private-public partnership (PPPs) and other types of non-financial-sector bailouts reported in Bova et al. (2016) in lieu of financial sector bailouts when constructing a measure of policy intervention. We observe 195 such non-financial recapitalisations in 40 countries (excluding instances of disaster relief). The non-financial government bailouts, as predicted, have no meaningful international spillover effect on NPL ratios.

6. Conclusion

This paper investigated whether policies trying to reduce the level of non-performing loans have cross-border spillover effects. The results indicate that a combination of introduction of Asset Management Companies with the view to develop a secondary market for distressed debt and availability of public funding for bank recapitalisation is associated with a sizable reduction in NPL ratios of foreign affiliates of parent banks, where parent banks are based in the jurisdiction in which a policy package is implemented. The stock of NPLs in a foreign affiliate bank falls by an additional 13 percentage points per annum compared with the stock of NPLs of locally-owned banks operating in the same jurisdiction.

To the best of our knowledge, this is the first paper to find evidence of positive international spill-overs due to establishment of AMCs. In contrast, the analysis did not find evidence of significant cross-border spillovers of other policies deployed to address the problem of high and persistent NPL ratios – including financial sector bailouts not accompanied by

establishment of AMCs, changes to the stringency of loan classification, revision to provisioning rules and macroeconomic tightening.

The analysis of parent-subsidiary linkages in Emerging Europe further suggests that cross-border NPL spillovers from policy packages including establishment of AMCs appear to be driven by banking groups being subject to consolidated supervision in their home jurisdictions as well as by the existence of knowledge spillovers within banking groups and the working of internal capital markets. The estimated effects are averages and a relatively small sample size does not permit us to make inference about the importance of the institutional setup of AMCs or their specific features. The findings are nonetheless highly relevant for the policy debate in the EU on the potential establishment of a pan-European AMC.[4] In particular, they suggest that the returns to deploying measures to address NPLs may be higher than previously thought on account of sizable cross-border spillovers.

The results are also indicative of the lower bound of effectiveness of various NPL policies in terms of reducing NPLs within the jurisdiction where they are deployed. Direct estimates of the effectiveness of such policies may be subject to large biases on account of non-random timing of the adoption of NPL policies. Moreover, the direction of such bias is ambiguous and in turn depends on the timing and speed of adoption of various measures.

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[4] EC work on the AMC Blueprint is available at http://ec.europa.eu/finance/docs/policy/180314-staff-working-document-non-performing-loans_en.pdf

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Appendix

Table 1. Descriptive statistics

Variable	N	Mean	Std. Dev	Min	Max
NPL, %	267,508	3.21	5.37	0	32.73
ΔNPL stock, pp	205.497	0.12	0.97	-8.62	8.51
NCO, % of loans	227,052	0.47	1.08	-1.49	6.78
Credit growth, %	344,204	0.13	0.35	-0.55	2.23
ROAA, %	384,333	0.85	1.74	-6.52	10.19
Total assets, US$ mln	386,486	11,794	92,606	0.1	3,807,892
Δ Total assets, %	348,499	8.27	19.65	-52.76	91.63
Δ Deposits, %	344,602	8.4	24.31	-78.67	119.72
Sovereign bondholdings, % of total assets	186,026	0.1	0.11	0	0.52
Foreign	44,757	0.31	0.46	0	1

Table 2. Policies targeting NPLs

NPL policy type	Frequency of occurrence*	No. countries implementing policy type
Asset Management Company	853	62
Public	740	58
Internal	83	10
Deposit guarantee scheme	111	6
Bank bailouts	279	66
Macroprudential policy tightening	254	119
Tightening loan classification stringency	74	64
Tightening provision stringency rules	60	53
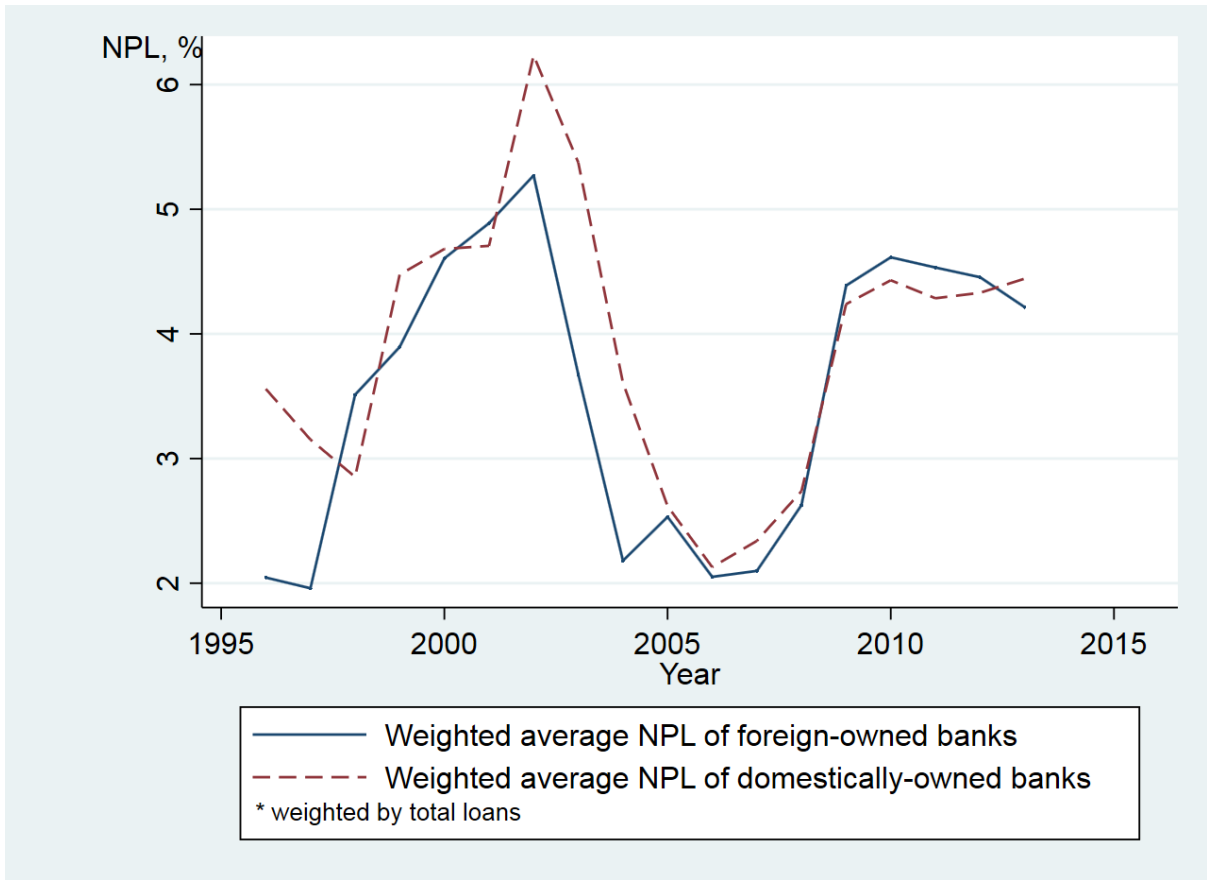
Figure 3 The evolution of NPL over time for domestic- and foreign-owned banks

Table 3 NPL ratio and selected policies

	(1)	(2)	(3)	(4)
		ΔNPL/Loans		
Foreign x AMC only^F	-0.403	-0.309	-0.860*	
	(0.425)	(0.305)	(0.459)	
Foreign x Public Bailout only^F	0.155	-0.0209	0.173	
	(0.406)	(0.300)	(0.401)	
Foreign x AMC and Public Bailout^F	-0.644*	-0.297	-0.661*	
	(0.365)	(0.270)	(0.387)	
AMC only^D		-0.275	-0.177	-0.754***
		(0.180)	(0.273)	(0.149)
Public Bailout only^D		-0.168	-0.0295	-0.110
		(0.161)	(0.250)	(0.163)
AMC and Public Bailout^D		-0.388**	-0.402	-0.738***
		(0.172)	(0.287)	(0.150)
ROAA$_{t-1}$	0.180***		0.145**	0.130***
	(0.0637)		(0.0583)	(0.0255)
ΔT.assets$_{t-1}$	-0.00489		-0.00996	-0.000931
	(0.00732)		(0.00643)	(0.00269)
ΔDeposits$_{t-1}$	0.00629		0.00993*	0.00499**
	(0.00572)		(0.00535)	(0.00225)
S.Bondholdings$_{t-1}$	-3.751***		-4.146***	-2.842***
	(1.025)		(0.837)	(0.366)
Foreign x Inflation^F	-3.250	0.190	-6.546	
	(5.873)	(4.413)	(6.376)	
Foreign x ΔGDP^F	-10.17*	-8.167**	-11.28**	
	(5.712)	(4.002)	(4.865)	
Foreign x ΔInvestment^F	1.599	-0.204	0.882	
	(1.618)	(1.015)	(1.247)	
Foreign	1.392**	1.206***	2.057***	
	(0.571)	(0.416)	(0.553)	
Inflation^D		4.355***	6.444***	2.931**
		(1.635)	(2.225)	(1.185)
ΔGDP^D		-18.53***	-19.44***	-18.20***
		(1.914)	(2.273)	(1.278)
ΔInvestment^D		-2.415***	-2.270***	-2.952***
		(0.446)	(0.530)	(0.350)
Observations	11276	18430	10204	79236
R^2	0.368	0.191	0.224	0.202
Bank FE	Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes
Domestic Country-Year FE	Yes			

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Table 4 NPL ratio and selected regulatory policies

	(1)	(2)	(3)	(4)
		ΔNPL/Loans		
Foreign x Tightening loan classification^F	-0.314 (0.437)	-0.0877 (0.392)	0.377 (0.301)	
Foreign x Tightening provision stringency^F	0.164 (0.668)	-0.432 (0.529)	-0.304 (0.481)	
Foreign x Macroprudential tightening^F	-0.198 (0.265)	-0.320 (0.288)	-0.111 (0.227)	
Tightening loan classification^D		0.307* (0.182)	0.492*** (0.129)	0.630*** (0.113)
Tightening provision stringency^D		-0.122 (0.186)	-0.318** (0.130)	0.0135 (0.126)
Macroprudential tightening^D		-0.238* (0.144)	-0.00308 (0.0873)	-0.194** (0.0800)
ROAA$_{t-1}$	0.180*** (0.0641)	0.157*** (0.0599)		0.130*** (0.0264)
ΔT.assets$_{t-1}$	-0.00622 (0.00746)	-0.00908 (0.00646)		-0.00132 (0.00271)
ΔDeposits$_{t-1}$	0.00732 (0.00584)	0.00940* (0.00544)		0.00514** (0.00231)
S.Bondholdings$_{t-1}$	-3.596*** (1.014)	-4.186*** (0.861)		-2.815*** (0.368)
Inflation^D		4.949** (2.070)	2.254 (1.623)	3.900*** (1.246)
ΔGDP^D		-18.42*** (2.283)	-16.78*** (1.895)	-17.09*** (1.338)
ΔInvestment^D		-1.856*** (0.549)	-1.975*** (0.466)	-2.618*** (0.378)
Foreign x Inflation^F	-5.721 (7.612)	-6.829 (6.761)	-0.911 (3.577)	
Foreign x ΔGDP^F	-9.958* (5.824)	-11.52** (5.367)	-9.057** (4.183)	
Foreign x ΔInvestment^F	1.250 (1.785)	0.648 (1.557)	0.0778 (1.137)	
Foreign	1.540** (0.600)	2.188*** (0.604)	1.288*** (0.434)	
Observations	11155	9792	17327	75951
R^2	0.367	0.219	0.184	0.201
Bank FE	Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes
Domestic Country-Year FE	Yes			

Table 5 NPL stock and selected policies

	(1)	(2)	(3)	(4)
		Change in log NPL stock		
Foreign x AMC only^F	-0.0607	-0.114**	-0.104*	
	(0.0508)	(0.0558)	(0.0543)	
Foreign x Public Bailout only^F	-0.0541	-0.0779	-0.0965*	
	(0.0590)	(0.0546)	(0.0549)	
Foreign x AMC and Public Bailout^F	-0.127**	-0.168***	-0.193***	
	(0.0504)	(0.0528)	(0.0501)	
AMC only^D		-0.0721**	-0.0685**	-0.0563***
		(0.0300)	(0.0300)	(0.0145)
Public Bailout only^D		-0.103***	-0.104***	-0.0204
		(0.0308)	(0.0313)	(0.0208)
AMC and Public Bailout^D		-0.0871***	-0.0746***	-0.0605***
		(0.0287)	(0.0287)	(0.0142)
ROAA$_{t-1}$	0.0271***	0.0357***		0.0576***
	(0.00552)	(0.00543)		(0.00298)
ΔT.assets$_{t-1}$	0.00151*	0.00121*		0.00336***
	(0.000797)	(0.000735)		(0.000388)
ΔDeposits$_{t-1}$	0.000769	0.000522		-0.000535*
	(0.000563)	(0.000555)		(0.000316)
Inflation^D		0.636***	0.644***	-0.614***
		(0.220)	(0.189)	(0.120)
ΔGDP^D		-1.613***	-1.334***	-2.527***
		(0.273)	(0.271)	(0.170)
ΔInvestment^D		-0.193***	-0.174***	-0.579***
		(0.0659)	(0.0643)	(0.0432)
Foreign x Inflation^F	-0.0726	-0.297	-0.0535	
	(0.373)	(0.437)	(0.474)	
Foreign x ΔGDP^F	-1.648***	-1.329**	-1.217**	
	(0.624)	(0.565)	(0.532)	
Foreign x ΔInvestment^F	0.272*	0.159	0.0425	
	(0.164)	(0.127)	(0.124)	
Foreign	0.188***	0.242***	0.203***	
	(0.0535)	(0.0637)	(0.0629)	
Observations	18434	16694	18233	171256
R-squared	0.315	0.189	0.185	0.126
Bank FE	Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes
Domestic Country-Year FE	Yes			

Table 6 NPL stock and regulatory policies

	(1)	(2)	(3)	(4)
	Log percentage change in NPL stock			
Foreign x Tightening loan classification^F	-0.0189 (0.0621)	0.0519 (0.0625)	0.0575 (0.0609)	
Foreign x Tightening provision stringency^F	0.0423 (0.0845)	-0.103 (0.0825)	-0.0709 (0.0881)	
Foreign x Macroprudential tightening^F	0.0213 (0.0442)	-0.0438 (0.0422)	-0.0533 (0.0425)	
Tightening loan classification^D		0.0666*** (0.0232)	0.0681*** (0.0230)	-0.00823 (0.0154)
Tightening provision stringency^D		-0.0700*** (0.0257)	-0.0709*** (0.0257)	-0.0813*** (0.0166)
Macroprudential tightening^D		-0.0107 (0.0168)	-0.000580 (0.0163)	-0.0760*** (0.00788)
ROAA$_{t-1}$	0.0265*** (0.00552)	0.0355*** (0.00560)		0.0586*** (0.00309)
ΔT.assets$_{t-1}$	0.00149* (0.000804)	0.00161** (0.000762)		0.00357*** (0.000410)
ΔDeposits$_{t-1}$	0.000812 (0.000572)	0.000347 (0.000575)		-0.000655** (0.000332)
Inflation^D		0.580** (0.246)	0.578*** (0.205)	-0.929*** (0.154)
ΔGDP^D		-1.321*** (0.285)	-1.067*** (0.285)	-2.111*** (0.182)
ΔInvestment^D		-0.181*** (0.0693)	-0.171** (0.0679)	-0.606*** (0.0453)
Foreign x Inflation^F	0.192 (0.394)	0.0799 (0.410)	-0.0473 (0.462)	
Foreign x ΔGDP^F	-1.708*** (0.660)	-1.036* (0.621)	-0.768 (0.597)	
Foreign x ΔInvestment^F	0.337* (0.176)	0.138 (0.159)	0.0128 (0.151)	
Foreign	0.152*** (0.0502)	0.192*** (0.0650)	0.155** (0.0631)	
Observations	18189	15766	17146	162206
R-squared	0.316	0.188	0.185	0.127
Bank FE	Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes
Domestic Country-Year FE	Yes			

Table 7 Credit supply and selected policies

	(1)	(2)	(3)	(4)
		Credit growth		
Foreign x AMC only^F	-0.0131	-0.0399*	-0.0237	
	(0.0200)	(0.0217)	(0.0245)	
Foreign x Public Bailout only^F	-0.0380**	-0.0719***	-0.0722***	
	(0.0184)	(0.0193)	(0.0222)	
Foreign x AMC and Public Bailout^F	-0.0290	-0.0730***	-0.0809***	
	(0.0198)	(0.0201)	(0.0227)	
AMC only^D		0.00158	-0.00547	-0.00228
		(0.0221)	(0.0244)	(0.0233)
Public Bailout only^D		-0.0619***	-0.0654***	-0.0362
		(0.0231)	(0.0221)	(0.0372)
AMC and Public Bailout^D		-0.0299	-0.0330	-0.00689
		(0.0244)	(0.0264)	(0.0224)
ΔNPL	-0.0141***	-0.0159***	-0.0160***	-0.0143***
	(0.00236)	(0.00255)	(0.00238)	(0.00309)
ROAA$_{t-1}$	0.0123***	0.0184***		0.0105***
	(0.00284)	(0.00363)		(0.00254)
ΔT.assets$_{t-1}$	0.000364	0.000455		0.00162***
	(0.000548)	(0.000557)		(0.000302)
ΔDeposits$_{t-1}$	0.000516	0.000308		0.000158
	(0.000397)	(0.000430)		(0.000279)
Inflation^D		-0.0993	0.0183	-0.102
		(0.154)	(0.173)	(0.140)
ΔGDP^D		0.943***	1.099***	1.292***
		(0.230)	(0.235)	(0.444)
ΔInvestment^D		0.0567	0.0713	0.0252
		(0.0446)	(0.0447)	(0.0726)
Foreign x Inflation^F	-0.107	0.0968	0.138	
	(0.138)	(0.171)	(0.175)	
Foreign x ΔGDP^F	0.588***	0.696***	0.691***	
	(0.176)	(0.212)	(0.189)	
Foreign x ΔInvestment^F	0.0827	0.0847	0.0526	
	(0.0545)	(0.0579)	(0.0557)	
Foreign	0.0186	0.0245	0.00599	
	(0.0262)	(0.0286)	(0.0322)	
Observations	18562	16816	18370	196761
R-squared	0.538	0.376	0.361	0.289
Bank FE	Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes
Domestic Country-Year FE	Yes			

Table 8 Credit supply and selected regulatory policies

	(1)	(2)	(3)	(4)
		Credit growth		
Foreign x Tightening loan classification^F	0.0398* (0.0209)	0.0239 (0.0241)	0.0333 (0.0231)	
Foreign x Tightening provision stringency^F	-0.0164 (0.0251)	-0.0270 (0.0261)	-0.0262 (0.0286)	
Foreign x Macroprudential tightening^F	-0.0298 (0.0297)	-0.0454 (0.0331)	-0.0587* (0.0335)	
Tightening loan classification^D		-0.0157 (0.0199)	-0.0132 (0.0254)	-0.0338** (0.0138)
Tightening provision stringency^D		0.0151 (0.0101)	0.0150 (0.0111)	0.0580*** (0.0179)
Macroprudential tightening^D		0.00151 (0.0106)	-0.00213 (0.0123)	-0.0285 (0.0186)
ΔNPL	-0.0141*** (0.00238)	-0.0159*** (0.00270)	-0.0160*** (0.00250)	-0.0142*** (0.00315)
ROAA$_{t-1}$	0.0122*** (0.00283)	0.0170*** (0.00359)		0.0101*** (0.00246)
ΔT.assets$_{t-1}$	0.000473 (0.000553)	0.00112** (0.000445)		0.00173*** (0.000292)
ΔDeposits$_{t-1}$	0.000427 (0.000400)	-0.000146 (0.000309)		0.000134 (0.000314)
Inflation^D		-0.0780 (0.192)	0.0721 (0.223)	-0.142 (0.160)
ΔGDP^D		1.045*** (0.287)	1.242*** (0.277)	1.378*** (0.495)
ΔInvestment^D		0.0405 (0.0467)	0.0530 (0.0462)	0.0425 (0.0636)
Foreign x Inflation^F	0.0751 (0.170)	0.233 (0.237)	0.201 (0.253)	
Foreign x ΔGDP^F	0.781*** (0.181)	1.009*** (0.237)	1.039*** (0.216)	
Foreign x ΔInvestment^F	0.0639 (0.0602)	0.0350 (0.0712)	-0.00410 (0.0671)	
Foreign	0.00316 (0.0259)	0.000111 (0.0317)	-0.0187 (0.0335)	
Observations	18316	15887	17281	187717
R-squared	0.540	0.377	0.369	0.293
Bank FE	Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes
Domestic Country-Year FE	Yes			

Table 9 Impact of parent NPL on subsidiary

	(1)	(2)	(3)	(4)
	$NPLR_t^{SUB}$			
Foreign x $NPLR_{t-1}^{PB}$	0.428***	0.664***	0.481**	0.761***
	(0.135)	(0.192)	(0.201)	(0.245)
Foreign x Total Capital Ratio$_{t-1}^{PB}$	-0.0683	-0.105*	-0.0482	-0.0880
	(0.0547)	(0.0533)	(0.0685)	(0.0551)
$NPLR_{t-1}^{SUB}$	0.286***	0.296***	0.194*	0.216**
	(0.0570)	(0.0485)	(0.103)	(0.0957)
$ROAA_{t-1}$	-0.251***	-0.241***	-0.239	-0.278
	(0.0685)	(0.0664)	(0.184)	(0.193)
$\Delta T.assets_{t-1}$	-0.011**	-0.0094***	-0.00782	0.00289
	(0.00448)	(0.00328)	(0.0180)	(0.0123)
$\Delta Deposits_{t-1}$	-0.00231	-0.00300	-0.00147	-0.0105
	(0.00205)	(0.00177)	(0.0112)	(0.00979)
Total Capital Ratio$_{t-1}$			-0.0324	0.00422
			(0.0727)	(0.0470)
Foreign x Inflation^F		-18.66		-24.81
		(11.18)		(19.94)
Foreign x ΔGDP^F		40.57*		37.68*
		(23.71)		(21.91)
Foreign x $\Delta Investment^F$		-22.19**		-24.43**
		(9.786)		(9.732)
Observations	2953	2951	989	987
R-squared	0.799	0.803	0.822	0.832
Adjusted R-squared	0.693	0.700	0.706	0.720
Bank FE	Yes	Yes	Yes	Yes
Domestic Country-Year FE	Yes	Yes	Yes	Yes

Table 10 Impact of parent NPL on subsidiary using instrumental variable approach

	(1)	(2)	(3)	(4)
		$NPLR_t^{SUB}$		
Foreign x $NPLR_{t-1}^{PB}$	0.754*	0.874*	1.086**	1.258**
(Instrumented)	(0.439)	(0.449)	(0.476)	(0.499)
Foreign x Total Capital Ratio$_{t-1}$ ^{PB}	-0.139	-0.156*	-0.162*	-0.188**
	(0.0837)	(0.0812)	(0.0907)	(0.0881)
$NPLR_{t-1}^{SUB}$	0.300***	0.301***	0.221**	0.225**
	(0.0442)	(0.0450)	(0.0898)	(0.0916)
$ROAA_{t-1}$	-0.257***	-0.249***	-0.305	-0.299
	(0.0709)	(0.0689)	(0.183)	(0.190)
$\Delta T.assets_{t-1}$	-0.00763**	-0.00778**	0.0114	0.0123
	(0.00341)	(0.00326)	(0.0124)	(0.0120)
$\Delta Deposits_{t-1}$	-0.00372**	-0.00366*	-0.0102	-0.0140
	(0.00179)	(0.00182)	(0.00843)	(0.00858)
Total Capital Ratio$_{t-1}$			0.0209	0.0251
			(0.0356)	(0.0372)
Foreign x Inflation^F		-11.35		-12.77
		(9.686)		(17.72)
Foreign x ΔGDP^F		17.08		19.26
		(18.60)		(17.14)
Foreign x $\Delta Investment^F$		-12.74		-17.65**
		(7.965)		(8.098)
Observations	2949	2949	985	985
Adjusted R-squared	0.104	0.107	0.054	0.062
Cragg-Donald Wald F stat	118.4	133.1	51.14	52.93
Kleibergen-Paap rk Wald F stat	3.531	5.191	3.082	3.643
Kleibergen-Paap rk LM stat	5.594	6.247	5.800	5.325
Chi-sq	0.133	0.100	0.122	0.150
Hansen J stat	6.014	6.079	7.930	8.075
Chi-sq	0.0494	0.0479	0.0190	0.0176
Bank FE	Yes	Yes	Yes	Yes
Domestic Country-Year FE	Yes	Yes	Yes	Yes

Instruments:

      Dummy equal 1 when AMC only was in use in the parent's country between t-4 and t-1

      Dummy equal 1 when bailout only was in use in the parent's country between t-4 and t-1

      Dummy equal 1 when AMC and bailouts were in use simultaneously in the parent's country between t-4 and t-1

Overidentified system (3 instruments, 1 endogenous variable Parent NPLR)

Table 11 Impact of parent NPL on subsidiary – consolidated supervision channel

	(1)	(2)	(3)	(4)
		$NPLR_t^{SUB}$		
$NPLR_{t-1}^{SUB}$	0.282***	0.293***	0.192*	0.213**
	(0.0566)	(0.0484)	(0.0990)	(0.0941)
Basel member=0 x Foreign x $NPLR_{t-1}^{PB}$	-0.0670	0.226	-0.459	0.0257
	(0.365)	(0.158)	(0.504)	(0.190)
Basel member=1 x Foreign x $NPLR_{t-1}^{PB}$	0.415**	0.669**	0.469**	0.757***
	(0.193)	(0.247)	(0.188)	(0.247)
Basel member=0 x Foreign x Total Capital Ratio$_{t-1}$ ^{PB}	-0.150***	-0.150***	-0.136**	-0.123***
	(0.0414)	(0.0400)	(0.0536)	(0.0392)
Basel member=1 x Foreign x Total Capital Ratio$_{t-1}$ ^{PB}	-0.00526	-0.0685	0.0391	-0.0425
	(0.0548)	(0.0652)	(0.0472)	(0.0669)
$ROAA_{t-1}$	-0.247***	-0.240***	-0.202	-0.259
	(0.0693)	(0.0675)	(0.161)	(0.184)
$\Delta T.assets_{t-1}$	-0.0101**	-0.00897**	-0.00255	0.00571
	(0.00399)	(0.00323)	(0.0150)	(0.0123)
$\Delta Deposits_{t-1}$	-0.00242	-0.00309*	-0.00402	-0.0116
	(0.00177)	(0.00171)	(0.00956)	(0.00955)
Foreign x Inflation^F		-20.01*		-25.27
		(11.20)		(19.00)
Foreign x ΔGDP^F		38.99*		37.03*
		(21.84)		(20.36)
Foreign x $\Delta Investment^F$		-20.77**		-22.16**
		(9.133)		(8.993)
Total Capital Ratio$_{t-1}$			-0.0381	-0.000478
			(0.0631)	(0.0436)
Constant	4.465***	4.348***	7.129***	6.273***
	(0.364)	(0.305)	(1.866)	(1.413)
Observations	2953	2951	989	987
R-squared	0.800	0.804	0.825	0.833
Adjusted R-squared	0.695	0.701	0.711	0.722
Bank FE	Yes	Yes	Yes	Yes
Domestic Country-Year FE	Yes	Yes	Yes	Yes

Table 12 Impact of subsidiary NPL on parent bank NPL ratio

	(1)	(2)	(3)	(4)
	Parent NPLR			
$NPLR_{t-1}^{PB}$	0.368*	0.382	0.245	0.129
	(0.199)	(0.220)	(0.165)	(0.183)
$NPLR_{t-1}^{SUB}$	0.0464	0.0514	0.0176**	0.0169*
	(0.0263)	(0.0298)	(0.00695)	(0.00921)
Total Capital Ratio$_{t-1}^{SUB}$	-0.0183	-0.0211	0.0294*	0.0452**
	(0.0329)	(0.0371)	(0.0157)	(0.0170)
$ROAA_{t-1}^{PB}$	-0.161	-0.0759	-0.487**	-0.769***
	(0.392)	(0.485)	(0.212)	(0.244)
$\Delta T.assets_{t-1}^{PB}$	0.0188	0.0182	-0.00260	-0.00509
	(0.0261)	(0.0263)	(0.0119)	(0.0114)
$\Delta Deposits_{t-1}^{PB}$	-0.0184	-0.0213	-0.0120	-0.00409
	(0.0254)	(0.0293)	(0.0133)	(0.0127)
Inflation^{F}		-4.976		-11.80
		(7.651)		(12.49)
ΔGDP^{F}		-12.39		32.45**
		(15.12)		(11.38)
$\Delta Investment^{F}$		6.209		-13.45**
		(6.475)		(4.756)
Total Capital Ratio$_{t-1}^{PB}$			0.285***	0.359***
			(0.0752)	(0.0549)
Constant	3.958***	4.115***	0.718	0.163
	(0.909)	(0.906)	(0.947)	(0.667)
Observations	297	279	281	263
R-squared	0.958	0.957	0.981	0.983
Adjusted R-squared	0.910	0.905	0.959	0.962
Bank FE	Yes	Yes	Yes	Yes
Foreign Country-Year FE	Yes	Yes	Yes	Yes

Table 13 Robustness check - random assignment of parent countries

	(1) ΔNPL stock		(2) ΔNPL stock
Foreign x AMC only[F]	-0.0432	Foreign x	0.0168
	(0.0502)	Tightening loan classification[F]	(0.0502)
Foreign x	-0.0277	Foreign x	-0.0171
Public Bailout only[F]	(0.0563)	Tightening provision stringency[F]	(0.0642)
Foreign x	-0.0458	Foreign x	0.0163
AMC and Public Bailout[F]	(0.0445)	Macroprudential tightening[F]	(0.0353)
$ROAA_{t-1}$	0.0261***	$ROAA_{t-1}$	0.0232***
	(0.00682)		(0.00720)
$\Delta T.assets_{t-1}$	0.00146*	$\Delta T.assets_{t-1}$	0.00129
	(0.000830)		(0.000841)
$\Delta Deposits_{t-1}$	0.000777	$\Delta Deposits_{t-1}$	0.000862
	(0.000583)		(0.000579)
Foreign	0.128***	Foreign	0.122***
	(0.0483)		(0.0456)
Observations	18756	Observations	18354
R^2	0.315	R^2	0.317
Adjusted R^2	0.110	Adjusted R^2	0.110
Bank FE	Yes	Bank FE	Yes
Domestic Country-Year FE	Yes	Domestic Country-Year FE	Yes

Table 14 Robustness check - Consolidated supervision

	(1)	(3)
	Log change in NPL stock	Log change in NPL stock
	Basel member parent	Non-Basel member parent
Foreign x AMC only[F]	-0.0266	-0.133
	(0.0638)	(0.116)
Foreign x Public Bailout only[F]	-0.0282	-0.00846
	(0.0534)	(0.104)
Foreign x AMC and Public Bailout[F]	-0.120*	-0.143
	(0.0702)	(0.166)
$ROAA_{t-1}$	0.0256***	0.0261***
	(0.00770)	(0.00725)
$\Delta T.assets_{t-1}$	0.00150**	0.00126
	(0.000735)	(0.000950)
$\Delta Deposits_{t-1}$	0.000773	0.00101
	(0.000572)	(0.000685)
Foreign x Inflation	0.556	-0.129
	(1.382)	(0.434)
Foreign x ΔGDP	-2.379**	-1.805*
	(1.066)	(1.066)
Foreign x ΔInvestment	0.470	0.192
	(0.354)	(0.216)
Foreign	0.127	0.247***
	(0.0823)	(0.0870)
Observations	16943	14765
R^2	0.321	0.334
Adjusted R^2	0.113	0.116
Bank FE	Yes	Yes
Domestic Country-Year FE	Yes	Yes

Table 15 Robustness check – spillover distance

	(1) Log change in NPL stock	(2) Log change in NPL stock
	Far subsidiaries >2000 km	Close subsidiaries <=2000 km
Foreign x AMC only^F	0.00330	-0.132*
	(0.0853)	(0.0699)
Foreign x Public Bailout only^F	-0.0992	-0.0206
	(0.0717)	(0.0911)
Foreign x AMC and Public Bailout^F	-0.102	-0.184***
	(0.0958)	(0.0679)
ROAA$_{t-1}$	0.0303***	0.0245***
	(0.00772)	(0.00694)
ΔT.assets$_{t-1}$	0.00108	0.00178**
	(0.000881)	(0.000856)
ΔDeposits$_{t-1}$	0.00107*	0.000659
	(0.000608)	(0.000649)
Foreign x Inflation	-0.0226	0.240
	(0.662)	(0.407)
Foreign x ΔGDP	-2.474	-1.281
	(1.494)	(0.872)
Foreign x ΔInvestment	0.378	0.225
	(0.441)	(0.194)
Foreign	0.194**	0.187***
	(0.0858)	(0.0708)
Observations	16168	15557
R^2	0.313	0.332
Adjusted R^2	0.103	0.119
Bank FE	Yes	Yes
Domestic Country-Year FE	Yes	Yes

Table 16 Placebo test - non-financial bailouts

	(1)	(2)
	Log percentage change in NPL stock	
Non-financial Bailout^D	-0.111***	
	(0.0337)	
Foreign x Non-financial Bailout^F		0.0185
		(0.0357)
ROAA$_{t-1}$	0.0591***	0.0268***
	(0.0180)	(0.00726)
ΔT.assets$_{t-1}$	0.00393***	0.00150*
	(0.00107)	(0.000860)
ΔDeposits$_{t-1}$	-0.000851*	0.000795
	(0.000448)	(0.000594)
Inflation^D	-0.767	
	(0.474)	
ΔGDP^D	-2.849***	
	(0.518)	
ΔInvestment^D	-0.653*	
	(0.331)	
Foreign x Inflation^F		0.253
		(0.388)
Foreign x ΔGDP^F		-1.225
		(0.835)
Foreign x ΔInvestment^F		0.200
		(0.250)
Foreign		0.0940*
		(0.0540)
Observations	163072	17663
R-squared	0.127	0.315
Adjusted R-squared	0.004	0.108
Bank FE	Yes	Yes
Year FE	Yes	
Domestic Country-Year FE		Yes