

Cross-border spillovers from reducing non-performing loans

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Summary

This paper sheds light on the effectiveness of policies addressing high non-performing loans (NPLs). Using data on ownership of subsidiaries of foreign banks in Emerging Europe, we first show that changes in NPLs of parent banks are associated with changes in NPLs of their foreign affiliates, with elasticity of around 0.25. The transmission is driven primarily by transfer of knowledge within banking groups and possibly by the workings of internal capital markets, while the evidence on the importance of consolidated supervision is inconclusive. We then combine a novel dataset on policies deployed to address high levels of NPLs in a large number of countries over the period 1990-2015 with bank-level data to assess the impact of various NPL policies on bank affiliates operating in foreign jurisdictions. The difference-in-difference identification strategy exploits the arguably exogenous timing of introduction of policies abroad. Establishment of asset management companies (AMCs) with the view to develop a secondary market for impaired loans is associated with a 15 percent per annum reduction in the stock of NPLs over several years. We do not find consistent cross-border effects of financial sector bailouts, macroprudential tightening or changes in rules governing loan classification and provisioning. The social benefits of asset management companies established to reduce NPLs may be larger than previously thought – on account of positive cross-border spillovers.

Keywords: non-performing loans, cross-border spillovers, consolidated supervision, asset management companies

JEL Classification Number: G21, G33, G38, O40

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The authors are grateful to Maria Balgova, Ralph de Haas and Balint Horvath for valuable comments and suggestions. This work was supported by the Economic and Social Research Council [grant 1496118].

The working paper series has been produced to stimulate debate on economic transition and development. Views presented are those of the authors and not necessarily of the EBRD or the ECB.

Working Paper No. 265

Prepared in January 2022

1 Introduction

Years 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. This has brought the issue of NPL resolution to the forefront of policy debate, with countries from Italy to India putting forward packages aiming to reduce the ratios of NPLs to total loans (NPL ratios). Such packages may include establishment of Asset Management Companies (AMCs) specialising in dealing with non-performing assets, 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 or amendments to the tax treatment of NPLs.

Estimating the effectiveness of policies addressing high NPLs is challenging as the choice and timing of such policies are not random (see Balgova et al., 2017). Sound policies adopted early in the crisis may look ineffective due to the severity of economic downturn, while recoveries may flatter the assessment of policies adopted late. Much of the evidence on the effectiveness of policies tackling high NPLs is based on case studies of various episodes (see Baudino and Yun, 2017, for a recent summary of lessons learned).

This paper revisits the effectiveness of policies addressing high NPLs by exploiting the fact that financial sector developments may affect banks across borders. 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; 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 adding to the international transmission of monetary policy (Aiyar et al., 2014a, 2014b; Ongena et al., 2013; Berrospide et al., 2017; Hills et al., 2017).

This paper paper is the first, to the best of our knowledge, to study the transmission of changes in NPLs from parent banks to their subsidiaries. To document this transmission we use detailed information on bank owners in Central and South-Eastern Europe (CESEE) based on De Haas et al. (2015). We find that a one percent reduction in the stock of parent bank NPLs is associated with a 0.25 of a percentage point reduction in the stock of NPLs of a subsidiary bank operating in a foreign jurisdiction. This regularity appears to be primarily driven by transfer of knowledge within banking groups and possibly by the workings of internal capital markets, while the evidence on the importance of consolidated supervision is inconclusive.

The estimates of such cross-border effects are themselves of interest. Policy packages aimed at reducing NPLs tend to have high fiscal costs. Cross-border spillovers from such policies mean that their welfare benefits can be higher than commonly assumed. In 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.

In addition, this insight enables us to revisit the effectiveness of NPL policies by exploiting arguably exogenous variation in deployment of policies in jurisdictions of parent banks. The identification comes from comparing the evolution of NPLs in domestic banks and in affiliates of foreign banks in the same year in the same jurisdiction and linking any observed differentials to financial sector policies deployed in the jurisdictions of parent banks. Importantly for the identification, both sets of banks (domestic and foreign-owned) are exposed to the same macroeconomic conditions and domestic policy environments. As part of this analysis, we combine a novel dataset on policy actions in a large number of countries over the period 1990-2015 with bank-level data from Bankscope and data on ownership of banks from Claessens and van Horen (2015).

We find sizeable cross-border effects of policies aimed at reducing NPLs. Following the establishment of an AMC in the jurisdiction of a parent bank, NPLs on the balance sheets of foreign subsidiary banks are estimated to decline 15 percent per annum faster than those on the balance sheets of domestic banks in the same jurisdiction. This effect does not appear to be enhanced by public sector bailouts in the foreign jurisdiction. Furthermore, the link between financial sector bailouts in the absence of AMCs and NPL ratios appears to be weak, if any. Changes in loan classification stringency, revisions to provisioning rules or macroprudential policy tightening do not appear to be associated with changes in NPL ratios across borders.

The paper contributes to two distinct strands of literature. The first 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 the evolution of non-performing loans. The second strand looks at the aftermaths of banking crises and approaches to dealing with the overhang of non-performing loans in the banking sector. By estimating cross-border effectiveness of policies addressing high NPLs, this paper offers a lower-bound estimate of policies' effects and tentatively points toward greater effectiveness of specialized asset management companies.

The rest of the paper is structured as follows. Section 2 discusses the adverse economic effects associated with high NPLs and surveys financial sector policies that can help reduce NPL ratios. Section 3 discusses mechanisms underpinning potential transmission of reductions in NPLs within banking groups and presents empirical evidence. Building on this analysis, section 4 presents empirical evidence on policy spillovers across borders. Section 5 concludes.

2 Policies aimed at reducing NPLs

2.1 Adverse effects of high NPL ratios

High levels of non-performing loans tend to suppress 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 build-up of NPLs. 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 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 sizeable growth dividend (see Balgova et al., 2017).

2.2 Dealing with non-performing loans: Asset management companies

Recognising adverse effects of NPLs policymakers adopted a number of measures aimed at accelerating NPL reductions. The first step is guiding banks to transparently assess the quality of bank assets and build up provisions against expected losses. Where judicial capacity to deal with non-performing assets case-by-case is lacking, centralised out-of-court debt workout programmes may play an important role. They were actively used, for instance, 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 accumulation: the establishment of an asset management company, injection of public funds in the financial sector (for instance, for bank recapitalisation), changes to macroprudential regulation, changes to loan classification and changes to provisioning stringency, which are discussed in turn.

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. Unlike individual banks, AMCs may internalise the effect of foreclosure on the value of housing collateral in the portfolio (Favara and Giannetti, 2017). They also enjoy economies of scale and are not subject to bank capital regulation.

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, thus creating number of internal AMCs. Such guarantees help to bridge the difference between the asking price of NPLs and the price potential buyers are willing to pay. This difference may arise, for instance, due to asymmetric information (see Avgouleas and Goodhart, 2017).

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 tasked to maximise recovery value from a portfolio of impaired assets (see Lucchetta et al., 2018). Occasionally, deposit insurance funds are directly used to acquire non-performing assets (see Segura and Suarez (2019) for a discussion).

The Building Better Bad Banks project by Hallerberg and Gandrud (2015) further provides information on 139 AMCs (109 public, 20 internal, 8 backed by deposit insurance and 2 unclassified) across 62 economies, both advanced and developing, 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. Where the data on AMC closure is not available, an AMC is assumed to have a life span of 8 years, the mean across the sample.

2.3 Recapitalizing banks with public funds

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 public bailouts. Our analysis is focused on the short-term effect of bailouts on NPLs and abstracts from their possible moral hazard implications over the longer term, whereby banks counting on government support may take greater risks (Dam and Koetter, 2012).

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) which are used in a placebo test.

2.4 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 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.

2.5 Changes in loan classification and provisioning stringency

Changes in the stringency of loan classification and provisioning may also have an impact on NPL ratios. 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 (see also Table 2 for a summary). 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 changes in NPLs

3.1 Cross-border transmission and 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 and non-bank financial institutions 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; Claessens et al., 2021).

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

3.2 Transmission channels: 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. An injection of public 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. In addition, NPL resolution at the parent bank level may free up management resources to focus on the performance of subsidiaries.

3.3 Transfer of 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 Geneturk, 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 (see Boisell et al. 2015 for the evidence of aligning loan loss provisions policy when a subsidiary gets acquired in line with the new parent group).

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 regularly offered training by the parent (see Gupta and Govindarajan, 2000, for a general discussion of knowledge transfer).

3.4 Consolidated supervision

As global financial markets have become increasingly intertwined, bank supervisors moved to supervision on a consolidated basis, examining the prudential risks of an institution and all its international establishments, including branches and subsidiaries. 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 target high NPLs can apply to the supervised

subsidiaries. For example, NPL Guidance first issued by the European Central Bank's (ECB) and the European Commission in 2017-18 covers significant institutions' international subsidiaries and branches (ECB, 2017b).

In sum, consolidated supervision both imposes additional implicit costs associated with NPLs in subsidiaries and encourages harmonization of approaches to dealing with NPLs across 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 cost-effective to prioritise reducing NPLs in its subsidiaries abroad.

3.5 Data

To test for co-movements in NPLs within banking groups we match international parent banks and subsidiary banks operating in Central, Eastern and Southern-Eastern Europe (CESEE) using an extended version of the dataset compiled by De Haas et al. (2015). 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. Observations where the absolute value of log-change in NPLs exceeds 3 are are discarded (this corresponds to the annual change of 20 times). In the resulting dataset, we have comprehensive data on 412 banks, with observations covering the period 1999-2015. Around one third of these banks are foreign-owned, with parent banks coming from a total of 43 countries. The data on ownership are combined with data from bank balance sheets and income statements as reported in Bankscope, including NPL data for the period 1990-2015. Descriptive statistics are reported in Table 1.

Using 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 may vary from country to country and certain jurisdictions may not report the quality of loans meaningfully. At the same time, consistent under-reporting of NPLs in certain emerging markets, if anything, would lead to co-movements in NPLs being underestimated in our analysis.

The identification comes primarily from differences in evolution of NPLs at foreign-owned and domestic banks. Overall trends in NPLs are similar across these two groups, with some differences (Table 1). The rates of growth of non-performing loans are somewhat lower for foreign-owned banks (averaging 0.17 versus 0.21 for domestically-owned banks), while the ratios of NPLs to total loans tend to be higher among foreign-owned banks.

3.6 Estimation strategy

To estimate co-movements in NPLs, we relate the change in the logarithm of the stock of NPLs of bank i located in country d in year t to the lagged value of the stock of NPLs and a number of explanatory variables. In particular, where a bank is owned by a parent bank operating in foreign country f, we interact the foreign-ownership dummy F with the (lagged) change in the logarithm of the NPL stock of the parent bank ($\Delta lnNPL^P$) as well as the lagged total capital ratio of the parent bank.

$$\Delta lnNPL_{it} = \beta_0 lnNPL_{i,t-1} + \beta_1 F_{i,t-1} \Delta lnNPL_{i,t-1}^P + \beta_2 F_{i,t-1} * Z_{i,t-1}^P + \gamma Z_{i,t-1} + \delta_i + \delta_{dt} + \epsilon_{it} \quad (1)$$

The approach broadly follows estimation of cross-border spillovers in lending in De Haas and Van Lelyveld (2014) and Allen et al. (2014). The set of bank-level control variables Z include the (lagged) non-performing loans ratio, return on average assets, change in bank's total assets, the change in bank's total deposits and the total capital ratio, in addition to bank fixed effects (δ_i). Except in cases where bank ownership changed, they also subsume country fixed effects thus accounting for time-invariant differences between countries such as the origin of the legal system. The specifications also include a set

of country-year fixed effects, δ_{dt} , to control for time-varying macro factors that affect both domestic and foreign-owned banks in the same jurisdiction d. Where parent bank accounts are reported on a consolidated basis, we net out NPLs of the subsidiary bank to avoid picking up a mechanical relationship through consolidated accounting.

3.7 Results

The results reported in Table 3 reveal a co-movement between the changes in NPLs of subsidiary banks and those of their parents. A one percentage point reduction in NPL stock of a parent is associated with a a 0.25 percent reduction in NPLs of a subsidiary, controlling for macroeconomic factors (country-year effects). This association is robust to controlling for various characteristics of banks and their parents.

The coefficients on control variables are by and large intuitive. The stock of NPLs is more likely to decline when it is high, the bank is better capitalised and enjoys faster deposit growth. Faster asset expansion in the past is associated with a build-up in NPLs, on the other hand. For foreign-owned banks, growth of NPLs is faster where the parent is less well-capitalized and has higher levels of non-performing assets.

Next, we discuss the evidence regarding possible transmission channels. To shed light on the existence of the consolidated supervision channel we investigate if the spillover effect is stronger when parent banks reside in member countries of the Basel Committee for Banking Supervision (BCBS). BCBS promotes multinational cooperation among banking supervisors. If a parent bank is domiciled in a country where the banking supervisor is a member of BSBC, its foreign subsidiaries are subjected to indirect supervision in the home jurisdiction, with consistent approach to identifying and managing NPLs. The membership of the Basel committee grew from 11 economies in the 1990s to include the European Union as well as 18 additional jurisdictions outside the EU. In the empirical specification (equation 1) the variables of interest are additionally interacted with the mutually exclusive dummy variables for parent bank location (BCBS members versus non-members).

The results, reported in Table 4, are somewhat inconclusive. The elasticity of changes in NPLs with respect to those of the parent bank tends to be statistically significant for both Basel members and non-members. The effect is larger for Basel members in most specifications but the differences (reported at the bottom of the table) are statistically insignificant. In part, this may reflect the fact that only a minority of parent banks reside in non-Basel-member countries (accounting for up to 14 percent of observations, see Table 1).

Testing for the transfer of knowledge relies on the assumption that the physical distance, time difference and language barriers make it harder for bank staff to communicate (Ambos and Ambos, 2009) while these factors should have limited, if any, impact on incentives created by consolidated supervision or the workings of internal capital markets. In the empirical analysis, the distance between the subsidiary and the parent is based on the location of the largest cities in the respective jurisdictions (alternative measures capture distance between capitals or population-weighted distance based on the data provided by the CEPII). The variables of interest are interacted with dummy variables for short distance (up to 500 km) and long distance. An alternative specification uses categorical variable with several distance brackets (up to 500 km, 500 to 1,000 km, 1,000 to 2,000 km...). We similarly interact the variable of interest with the dummy variables for common language spoken by at least 9 percent of respective populations (constructed based on CEPII data from the same source).

The results reported in Table transmission 4 are consistent with a non-trivial role played by transfer of knowledge. While co-movement in NPLs is detected for both banks in proximate locations and banks with parents headquartered in distant countries, the effect is significantly larger for banks located within what can be considered a driving distance. This is the case for around 16 percent of foreign subsidiaries in the sample (for example, subsidiaries of an Austrian bank in Hungary or the Slovak Republic would qualify while those in Russia or Belarus would not). Similar findings emerge for subsidiary-parent pairs with and without a common language (with around 8 percent of subsidiary-parent pairs sharing a language). Semi-parametric approaches based on distance yield similar results, confirming that the effect is largest for nearby subsidiaries.

Finally, we note that the coefficient on the parent bank total capital ratio in our estimations is consistently negative and sizable (see Tables 3 and 4). An extra percentage point in terms of a parent's capitalisation is associated with a 2 percentage point slower growth of NPLs at the subsidiary, a meaningful effect equivalent to around one tenth of the average change in NPLs. This negative relationship, however, is statistically significant mostly at the 10 percent level and not in all specifications. This suggests that while higher capitalisation of the parent nay indeed enable subsidiary banks to tackle non-performing assets more actively, this effect appears to be limited.

On balance, the evidence is consistent with the cross-border effects of changes in NPLs being driven primarily by the exchange of knowledge within banking groups, with internal capital markets possibly playing a role, while evidence on the importance of consolidated supervision is inconclusive.

4 Cross-border effects of policies aiming to address high NPLs

4.1 Data

Having established that changes in NPLs spill over to banks' subsidiaries abroad, we use this insight to estimate the effectiveness of policies targeting reductions in NPLs – by looking at the cross-border impact of such policies. While in this analysis we do not observe the exact ownership (beyond the country), we benefit from a large panel covering the period 1995-2013 (descriptive statistics are reported in Table 1). Data on foreign ownership of 5,102 banks across 140 countries 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. In the regression analysis, foreign policies are defined based on the home country of the largest foreign shareholder.

A typical host country is home to foreign-owned subsidiaries with parents located in different home jurisdictions that are subject to distinct policy environments. 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.

4.2 Estimation strategy

A straightforward way to estimate the relationship between NPL policies and NPL ratios involves linking bank outcomes to the adoption of specific policies. When interpreting such estimates, it is important to acknowledge that policymakers' decision to intervene, the timing of intervention and the choice of policy instrument are likely to be influenced by the evolution of NPLs and various circumstances. 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.

When estimating cross-border effects of policy measures, we benefit from an arguably exogenous timing of their adoption. In particular, we focus on the performance of foreign-owned banks and policy changes in jurisdictions where the corresponding parent 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 a certain policy intervention. The two groups of banks are subject to the same set of economic conditions and domestic policy environment – except some foreign-owned banks are also indirectly exposed to changes in policy and economic environment affecting their parents (see Figure 1 for a schematic representation of this approach).

We estimate a reduced-form model (equation 2) linking log-change in NPLs to a set of bank characteristics. This specification further includes interaction terms between the foreign ownership

dummy F 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_{ft}^F). For instance, the respective dummy 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 capture the cross-border effects of policies. Bank fixed effects, δ_i , 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 the stock of NPLs upon a bank changing ownership from domestic to foreign or vice versa (in approximately 9 percent of cases foreign ownership status of a bank changed during 1995-2013). Domestic (subsidiary-jurisdiction) country-year fixed effects, δ_{dt} , capture both changes in demand for credit and any changes in domestic policies that apply to all banks. Some specifications additionally control for macroeconomic conditions in the jurisdictions of parents (such as the rate of inflation of growth in income per capita).

$$\Delta lnNPL_{it} = \beta F_{it}POL_{ft}^F + \lambda F_{it} + \gamma Z_{i,t-1} + \theta F_{it}M_{ft}^F + \delta_i + \delta_{dt} + \epsilon_{it}$$
(2)

Reassuringly, we find no large systematic difference between NPL ratios in domestic and foreign-owned banks. In both groups of banks, average NPL ratios evolved in similar ways and reached similar levels (see Figure 2).

The estimation first distinguishes between three mutually exclusive policy scenarios: establishment of an asset management company (AMC); use of public funds to recapitalise banks (bailouts); and a combination of the two policies (see Table 2 for a summary of policy interventions in the sample). The use of three mutually exclusive groups takes into account potential synergies between AMCs and bank recapitalisation packages, whereby financial support ensures that entities incurring losses on the NPL disposals remain adequately capitalized (see Segura and Suarez, 2019).

4.3 Results

Establishment of AMCs in the parent bank's jurisdiction is associated with a statistically significant reduction in the NPL of subsidiary banks – NPLs at the impacted subsidiaries decline by around 15 to 20 percentage points more than those of comparator banks (see Table 5). The effect does not increase if AMC is established alongside a package providing for bank bailouts. In fact the effect becomes smaller in some specifications, although these differences are not statistically significant. In the absence of AMCs, the provision of bailouts is associated with a small and statistically insignificant reduction in the stock of NPLs.

In other words, in the absence of structural measures to tackle overhang of non-performing assets, bailouts may do little to strengthen incentives for resolving non-performing loans. These results may in part also reflect the pressure to ringfence the use of public funds for domestic purposes reducing the extent of cross-border transmission. In some circumstances, bailouts may create space for greater provisioning of bad debts (and thus their recognition). Bailouts may also encourage banks to pursue riskier new borrowers in search of higher upside expecting the downside risk to be limited.

We do not find consistent significant cross-border effects of changes in loan classification, provisioning stringency or macroprudential tightening (see Table 5). This might reflect the propensity of international banking groups to apply stricter loan classification and provisioning standards than the minimum required by the regulation.

Cross-border effects linked predominantly to asset management companies are consistent with the earlier finding whereby cross-border transmission of co-movements in NPLs was driven primarily by transfer of knowledge within banking groups (rather than the working of internal capital markets or consolidated supervision).

4.4 Discussion and robustness checks

The estimated cross-border effects could be seen as the lower bound of the domestic effect of various policies on NPL ratios as the effect of these policies is only partially transmitted across borders, based on the earlier estimates of co-movements in NPLs of parents and subsidiaries.

Cross-border policy transmission could in principle be amplified if an AMC directly purchased a significant amount of NPLs from the balance sheet of a bank subsidiary abroad. Anecdotal evidence suggests that such cross-border transactions are rare, not least because AMC's comparative advantages in dealing with problem loans do not easily extend to foreign jurisdictions. For example, Ireland's National Asset Management Agency was set up to purchase NPLs exclusively from Irish domestic banks. NAMA's 2017 financial statement show that 83 percent of loans on its balance sheet are backed by collateral from Ireland, 12 percent from the UK and 5 percent from the rest of the world. Spain's SAREB portfolio consists exclusively of loans backed by collateral in Spain, as reported in its 2017 annual statements.

The estimates provide an insight into average effectiveness of policies. Individually, measures may have been less or more effective, depending on their design and local circumstances. The relatively small sample size imposes hard limits on the granularity of the analysis that can be undertaken. In addition, this study focuses on short-term effects while moral hazard associated with NPL resolution may only manifest itself in the longer term.

To further address concerns that the observed spillovers may simply reflect common economic cycle, or perhaps global policy coordination, we run a placebo test where policies are assumed to have been enacted two years earlier than they actually were (see Table 6). Reassuringly, the cross-border effects of, say, placebo asset management companies are statistically insignificant, small and frequently switch sign. This also suggests that introduction of AMCs is not commonly anticipated by banks. The results are also robust to applying additional data filters, such as winsorizing changes in non-performing loans at the first and 99th percentiles or restricting the sample to log-changes in NPLs not exceeding 2 in absolute value.

5 Conclusion

This paper examined co-movements in NPL stocks of parent banks and their foreign affiliates as well as cross-border spillovers of policies aimed at reducing level of non-performing bank assets. The analysis reveals that a one percent reduction in the stock of NPLs is associated with an approximately 0.25 percent reduction in NPLs of a subsidiary bank operating in a foreign jurisdiction. This transmission appears to be driven largely by the transfer of knowledge in the area of NPL resolution. Internal capital markets may play some role, while the evidence on the role of consolidated supervision is inconclusive.

In the light of co-movements in bank NPLs, policies aimed at reducing non-performing assets may have cross-border effects. The analysis reveals that the introduction of asset management companies with the view to develop a secondary market for distressed debt is associated with a sizable reduction in the stock of NPLs of foreign affiliates of parent banks, where parent banks are based in the jurisdiction where an AMC was established. The stock of NPLs in a foreign affiliate bank falls by at least an additional 15 percentage points per annum compared with the stock of NPLs of locally-owned banks operating in the same jurisdiction. This cross-border spillover does not appear to become stronger in the presence of public bailouts in the jurisdiction of the parent banks and no significant NPL spillovers were detected for other types of policies.

To the best of our knowledge, this is the first paper to present evidence of positive international spillovers arising from the establishment of asset management vehicles. The estimated effects are subject to multiple caveats: they averages across various designs of AMCs and are indicative lower bounds of AMC effects that can be expected within a jurisdiction.

While imprecise, the estimates are valuable to the extent that direct estimates of effectiveness of policies addressing high NPLs may be subject to large biases of ambiguous sign. The findings are also

highly relevant for the policy debate in the EU on the potential establishment of a pan-European AMC. In particular, they suggest that the returns to deploying measures to address NPLs may be higher than previously thought on account of sizeable cross-border spillovers. We also hope that the findings can inform further research into cross-border spillovers of financial-sector policies and the effectiveness of various policy interventions.

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Figures and Tables

Figure 1: Identification strategy





 1 .

Figure 2: NPL for domestic- and foreign-owned banks in the full sample

Variables	Mean	Median	St. dev.	Min	Max
CESEE subsample					
	0.012	0.117	0 700	0.057	2 000
Non-mange in NPLS	0.213	0.117	0.702	-2.957	3.000
Non-performing loans, log	0.002	8.989 6.120	2.201	0.075	14.244
NPL ratio, pp	10.045	0.130	9.893	0.010	32.730
Return on average assets, pp)	0.900	1.060	2.132	-0.520	10.190
Change in assets	0.114	0.077	0.277	-1.420	2.313
Change in deposits	0.125	0.089	0.323	-1.709	3.288
Iotal capital ratio	18.248	15.940	9.498	-45.200	98.000
Foreign-owned	0.367	0.000	0.482	0.000	1.000
Foreign-owned					
Log-change in NPLs	0.171	0.074	0.636	-2.957	2.945
Non-performing loans, log	9.524	9.820	1.980	0.294	12.999
NPL ratio	11.025	7.530	9.535	0.010	32.730
Return on average assets, pp	0.624	1.000	2.015	-6.520	6.480
Change in assets	0.048	0.018	0.241	-1.426	1.398
Change in deposits	0.057	0.022	0.279	-1.503	1.628
Total capital ratio	18.117	16.205	8.969	0.580	98.000
Log-change in NPLs, parent	0.130	0.084	0.431	-1.396	3.839
NPL ratio, parent, pp	9.264	6.935	8.275	0.170	32.730
Total capital ratio, parent, pp	14.230	13.700	3.948	-5.100	33.900
Distance to parent, km	1506.942	884.611	1606.506	59.617	8070.750
Parent in Basel member jurisdiction	0.856	1.000	0.351	0.000	1.000
Common language	0.079	0.000	0.270	0.000	1.000
Domestically owned					
Log-change in NPLs	0.237	0.143	0.736	-2.956	3.000
Non-performing loans, log	8.509	8.542	2.237	0.075	14.244
NPL ratio, pp	9.476	5.380	10.054	0.010	32.730
Return on average assets, pp	1.060	1.110	2.182	-6.520	10.190
Change in assets	0.152	0.127	0.289	-1.263	2.313
Change in deposits	0.164	0.137	0.340	-1.769	3.288
Total capital ratio	18.325	15.770	9.793	-45.200	94.560
Full sample					
Log-change in NPLs	0.142	0.085	0.593	-2.957	3.000
Non-performing loans, log	9.146	9.263	2.490	-0.399	16.142
NPL ratio, pp	5.925	3.330	7.156	0.010	32.730
Return on average assets, pp	1.019	0.920	1.728	-6.520	10.190
Change in assets	0.116	0.093	0.214	-1.836	2.018
Change in deposits	0.120	0.099	0.256	-4.079	3.240
Total capital ratio	16.482	14.390	8.896	-47.410	100.000
Foreign-owned	0.266	0.000	0.442	0.000	1.000

Table 1: Descriptive statistics

Source: Bankscope and authors' calculations.

Note: Where only consolidated parent bank data was available the mechanical adjustment is done to remove non-performing loans related to the subsidiary activity to form a quasi-unconsolidated data. The imputed NPLs of the parent are restricted to be non-negative. CESEE sample refers to 2,599 observations for 412 banks in Central, Eastern and South-Eastern Europe. Distance to parent is calculated based on the most populated cities in respective countries. Full sample comprises 13,589 observations for 2,114 banks with data on non-performing loans and capitalisation.

Table 2: Policies addressing high non-performing loans: A summary

Policy	Economies	
Asset management company	62	
of which:		
Public	58	
Internal	10	
Deposit guarantee scheme	6	
Bank recapitalisation packages	66	
Macroprudential tightening	119	
Tightened loan classification stringency	64	
Tightened provision stringency rules	53	

Source: Authors' calculations.

Table 3: Cross-border transmission of changes in non-performing loans

		0 1	0	
Dep. var. log-change in NPLs	1	2	3	4
Foreign * Parent log-change in NPLs	0.223***	0.202***	0.278***	0.250***
	(0.059)	(0.061)	(0.068)	(0.070)
NPL, log, lagged	-0.468***	-0.487***	-0.471***	-0.489***
	(0.024)	(0.025)	(0.026)	(0.028)
Return on average assets		-0.000		0.002
		(0.008)		(0.008)
Log-change in assets		0.406^{***}		0.417^{***}
		(0.108)		(0.105)
Log-change in deposits		-0.265***		-0.253***
		(0.087)		(0.089)
Total capital ratio		-0.010***		-0.010***
		(0.003)		(0.003)
Foreign * Parent NPL ratio			0.012^{**}	0.014^{**}
			(0.005)	(0.006)
Foreign * Parent total capital ratio			-0.015	-0.018
			(0.010)	(0.011)
R^2	0.586	0.597	0.591	0.602
Observations	2543	2413	2471	2341
Bank fixed effects	Yes	Yes	Yes	Yes
Country*year fixed effects	Yes	Yes	Yes	Yes

Source: Authors' calculations.

Note: Standard errors in parentheses at clustered at the country level. ***, **, * denote statistical significance at the 1%, 5% and 10% levels, respectively. The dependent variable is an annual change in logarithm of total non-performing loans of a bank. Estimated for banks in Central, Eastern and South-Eastern Europe over the period 1999-2015. All specifications include bank and country-year fixed effects, all variables are lagged by one year unless otherwise specified.

Dep. var. log-change in NPLs	By Basel membership		By distance to parent		By distance, brackets		By common language	
	1	2	3	4	5	6	7	8
Foreign*Parent log-change in NPLs*								
* Basel non-member	0.217^{*}	0.215^{*}						
* Basel member	(0.115) 0.305^{***} (0.068)	(0.119) 0.273^{***} (0.072)						
* Long distance to parent HQ	(0.000)	(0.072)	0.236^{***}	0.218^{***}				
* Short distance to parent HQ			(0.001) 0.645^{***} (0.074)	(0.071) (0.577^{***}) (0.064)				
* Long distance to parent HQ			(0.07.1)	(0.000-)	0.317^{***} (0.052)	0.295^{***} (0.055)		
* Distance \leq 500 km					$(0.032)^{(0.032)}$ (0.084)	0.558^{***} (0.072)		
* 500 km ; Distance \leq 1,000 km					0.111^{*} (0.059)	0.083 (0.064)		
* 1,000 km ; Distance \leq 2,000 km					0.013 (0.204)	0.006 (0.203)		
* No common language					. ,		0.233^{***} (0.072)	0.208^{***} (0.074)
* Common language							0.435^{***} (0.051)	0.496^{***} (0.053)
Foreign * Parent total capital ratio	-0.015	-0.020*	-0.015	-0.020*	-0.018*	-0.022*	-0.016	-0.020*
	(0.010)	(0.012)	(0.010)	(0.011)	(0.009)	(0.011)	(0.009)	(0.011)
Difference between subsamples	0.087	0.058	0.409***	0.359^{***}	0.414***	0.367***	0.202***	0.288***
L L	(0.111)	(0.117)	(0.090)	(0.091)	(0.093)	(0.092)	(0.062)	(0.067)
R^2	0.591	0.599	0.592	0.600	0.593	0.601	0.592	0.600
Observations	2471	2348	2471	2348	2471	2348	2471	2348
Bank-level controls	No	Yes	No	Yes	No	Yes	No	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country*year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 4: Cross-border transmission of changes in non-performing loans: Differential effects

Source: Authors' calculations.

Note: Standard errors in parentheses at clustered at the country level. ***, **, * denote statistical significance at the 1%, 5% and 10% levels, respectively. The dependent variable is an annual change in logarithm of total non-performing loans of a bank. Estimated for banks in Central, Eastern and South-Eastern Europe over the period 1999-2015. All specifications include bank and country-year fixed effects, all variables are lagged by one year unless otherwise specified. Common language if countries have a language in common spoken by at least 9% of population; short distance to parent HQ if distance between most populated cities in the respective countries does not exceed 500 km.

Dep. var.: Log-change in NPLs	AMC and recapitalisation			Macroprude	Macroprudential, provisioning, classification		
	1	2	3	4	5	6	
Foreign-owned *							
* AMC only	-0.164^{**} (0.080)	-0.172^{**} (0.079)	-0.199^{**} (0.078)				
* Recapitalisation only	-0.043	-0.027 (0.052)	-0.044				
* AMC and recapitalisation	-0.151^{**} (0.063)	-0.138** (0.066)	-0.154^{**} (0.067)				
*Tighter loan clasification	(01000)	(0.000)	(0.000)	-0.138^{**} (0.068)	-0.124^{*} (0.070)	-0.108 (0.066)	
Tighter provisioning				0.128^{} (0.076)	0.133^{*} (0.076)	0.083 (0.086)	
* Macroprudential tightening				(0.016) (0.037)	-0.007 (0.036)	0.008 (0.037)	
Foreign	0.188^{**} (0.073)	0.182^{**} (0.075)	0.231^{***} (0.077)	(0.061) (0.144^{**}) (0.063)	(0.000) (0.135^{**}) (0.064)	0.152^{**} (0.067)	
NPL, log, lagged	-0.392^{***} (0.041)	-0.404^{***} (0.044)	-0.405^{***} (0.044)	-0.396^{***} (0.041)	-0.407^{***} (0.044)	-0.408^{***} (0.045)	
R^2	0.514	0.525	0.527	0.515	0.525	0.527	
Observations	13251	12255	12082	13056	12074	11981	
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	
Country-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	
Additional bank-level controls	No	Yes	Yes	No	Yes	Yes	
Foreign macro controls	No	No	Yes	No	No	Yes	

Table 5: Cross-border effects of policies aimed at reducing non-performing loans

Source: Authors' calculations.

Note: Standard errors in parentheses at clustered at the country level. ***, **, * denote statistical significance at the 1%, 5% and 10% levels, respectively. The dependent variable is an annual change in logarithm of total non-performing loans of a bank. All specifications include bank and country-year fixed effects. All specifications include interactions between foreign-ownership dummy and policy dummy, equal to one when the policy was in place in the parent's jurisdiction between years t - 3 and t - 1 as well as bank-level controls lagged by one year.

Table 6: Robustness checks: A placebo test

Dep. var.: Log-change in NPLs	1	2	3
Foreign*AMC only (placebo)	-0.070	-0.038	-0.037
	(0.068)	(0.070)	(0.070)
Foreign*recapitalisation only (placebo)	0.061	0.109	0.106
	(0.076)	(0.077)	(0.078)
Foreign*AMC and recapitalisation(placebo)	0.061	0.100	0.092
	(0.085)	(0.092)	(0.095)
R^2	0.542	0.560	0.560
Observations	9312	8596	8473
Bank fixed effects	Yes	Yes	Yes
Country-year fixed effects	Yes	Yes	Yes
Additional bank-level controls	No	Yes	Yes
Foreign macro controls	No	No	Yes

Source: Authors' calculations.

Note: Standard errors in parentheses at clustered at the country level. ***, **, * denote statistical significance at the 1%, 5% and 10% levels, respectively. The dependent variable is an annual change in logarithm of total non-performing loans of a bank. All specifications include bank and country-year fixed effects. In the placebo test, policies are assumed to have been adopted 2 years earlier and are applied based on lagged parent-subsidiary relationships.