National Bank of Ukraine

NBU Working Paper
3/2018

Branch network structure and lending behaviour

Tho Pham
Oleksandr Talavera
Andriy Tsapin

National Bank of Ukraine Working Paper Series:

The Working Paper Series of the National Bank of Ukraine (NBU) presents the independent research of the staff of the NBU or outside contributors on topics relevant to central banks. The purpose of the Working Papers is to provide the platform for discussion and critical comments. The Working Papers are reviewed internationally to ensure the high quality of the content. The opinions and conclusions in the papers are strictly those of author(s) and do not necessarily reflect the views of the National Bank of Ukraine or of the Board members.

This publication is available on the NBU website at **http://www.bank.gov.ua**

Address:

9 Instytutska Street
01601, Kyiv, Ukraine
email: **research@bank.gov.ua**

BRANCH NETWORK STRUCTURE AND LENDING BEHAVIOR

Tho Pham[a], Oleksandr Talavera[b*], Andriy Tsapin[cd]

Abstract

This paper examines the link between branch network structure and bank lending. The unique dataset allows us to differentiate the structures of contact points which do not have decision-making authority and delegated branches which can affect loan decisions. We find that a large and dispersed network of contact points can help increase credit supply and mitigate risks through diversification. Further, banks benefit from information advantage brought by the dispersion of delegated branches. However, longer distance between headquarters and local delegations can also amplify agency problems, which outweigh the benefits. Our findings suggest that the optimal structure could be the centralized network of delegated branches combined with the diversified access point network.

Keywords: consolidation, centralization, decision-making, risk management, lending, access points, delegated branches

JEL classification: G01, G21

[a] School of Management, Swansea University, Fabian Way, Swansea, United Kingdom SA1 8EN.
Email: **anhthodav@gmail.com**
[b] School of Management, Swansea University, Fabian Way, Swansea, United Kingdom SA1 8EN.
Email: **oleksandr.talavera@gmail.com**
[c] Deputy Head of Research Unit, Monetary Policy and Economic Analysis Department, National Bank of Ukraine, Kyiv, Ukraine. Email: **andriy.tsapin@bank.gov.ua**
[d] Lecturer, Faculty of Economics, National University of Ostroh Academy, Ostroh, Ukraine.

Standard disclaimer applies. We are grateful to participants of Swansea University Seminar for comments. We also thank Sergii Meleshchuk and Ihor Voloshyn for their valuable comments and suggestions. Any remaining errors are our own. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bank of Ukraine.
*This project was carried out while Oleksandr Talavera was a Visiting Scholar at the National Bank of Ukraine, supported by the Canada-IMF Technical Assistance Project "NBU Institutional Capacity Building"

1. Introduction

Over the past few decades, a trend of bank consolidation has been seen around the world that has drawn economists' attention. As a result, there is now a large literature investigating the consequences of bank consolidation, such as its impacts on market power, stability, or credit availability.[1] However, the existing literature has not yet accounted for the fact that the effects of consolidation might vary according to the operational and geographical structures underlying the consolidation of bank networks. For instance, the closure of branches that only provide fee-based services might not necessarily affect a bank's credit supply to local borrowers. Further, the impacts of the branch closure might vary across different geographical markets. It could be also the case that the consequences of the consolidation for centralized banks' are different from those for their decentralized counterparts. These issues naturally lead to the question of the banks' optimal structure in the post-consolidation period.

In this study, we aim to answer that question by employing unique and confidential data about the consolidation of Ukrainian banks from 2008 to 2016. Our data were combined from three different datasets, including (1) financial data at the bank level, (2) data on lending at the bank-region level, and (3) data on the consolidation of banks differentiated by branch types and locations. Using these data, we track the changes in the networks of (1) branches with balance sheets that have authority to make loan decisions (hereafter delegated branches or decision-making branches) and (2) branches without balance sheets which do not have decision-making authority (hereafter contact points, access points, or information-collecting branches).

While delegated branches play the role of local decision makers, overall activities are supervised and managed by bank headquarters, which are the central decision makers. Most Ukrainian banks' headquarters are located in the city of Kyiv, which is also a geographical center relative to other regions of Ukraine (Figure 1).[2] Taking advantage of this unique situation, we examine the influence on credit supply and risk management of dispersion between the top decision makers (headquarters) and local ones (delegated branches). Data at bank-region level then allow us to assess the consequences for bank lending in local markets if delegated branches are removed. Moreover, we also investigate the role of access points in facilitating the decision-making process.

(Figure 1 about here)

We find that at the bank level, banks with a more dispersed network of decision-making branches experience lower levels of bad loans, although this effect is weak. This result

[1] See Berger et al. (1999) for the review of literature on bank consolidation.

[2] By 2016, about 69 percent of banks had located their headquarters in the city of Kyiv.

suggests that local decision makers can make more use of soft information, which is difficult to transmit to upper levels that oversee loan performance. Moreover, a more dispersed network of access points can increase the banks' geographical reach, and thus allow them to diversify their loan portfolios. Consequently, such banks are able to increase loan origination, and lower their levels of non-performing loans. At the same time, information about loan applicants, such as credit history, is continually collected by local access points and transferred to the decision-making agents to use in loan screening and monitoring. Given that the process of information collection and transmission can be facilitated by modern technology, banks are more willing to increase loan supply if they know that they can intervene quickly if loan conditions are not met.

An analysis of the effects of the dispersion of these two branch types shows that banks face higher risks if both access points and delegated branches are more dispersed from the headquarters. One explanation for this is that the dispersion of delegated branches, while conferring an information advantage, also creates agency problems, such as local managers' tendency to build "mini-empires." Meanwhile, the headquarters' management supervision of local branches is less effective when the distance between headquarters and local market branches is greater. These issues are then amplified by the dispersion of access points, which are also a part of these "mini-empires." Taken altogether, to minimize costs while maximizing the benefits, banks should opt for a centralized structure of delegated branches, while maintaining a dispersed network of access points.

The analysis at the bank-region level shows that the presence of delegated branches correlates positively with the levels of local loans granted. This could be because the authority given to local managers allows them greater scope for relationship lending. This could also reflect overlending, since delegated branches of a bank that are located in the same local market have to compete with each other for resources from head office. Furthermore, a large number of local access points can positively affect loan supply and risk management. This is more evidence for the importance of the role played by access points in diversifying banks' geographical loan portfolios.

However, large local branch networks, as indicated by higher numbers of both of the two branch types, provide banks with more market power and allow them to cherry-pick their clients. As a result, local loan officers can choose high-quality borrowers, reduce loan sizes, and charge higher interest rates, resulting in a decline in local loans, but lower risks. This "cherry-picking" effect can be facilitated by the more (geographically) diversified information provided by a larger number of access points. The importance of access points is confirmed further when we examine the link between the access-point network and bank lending (1) when decision making is fully centralized at the headquarters and (2) in the presence of an exogenous shock to Ukrainian banks' branch networks.

Our study contributes to several strands of literature. The first strand investigates the impact of bank consolidation on credit availability to small businesses. The most common finding is that mergers and acquisitions (M&As) involving large banks lead to a reduction in small business lending, while M&As among small banks tend to increase the amount of credit provided to small businesses (e.g., Berger et al., 1998; Peek and Rosengren, 1998; Strahan and Weston, 1998; Avery and Samolyk, 2004). Moreover, Berger et al. (1998) acknowledge that the level of post-merger small business loans is determined by the pre-merger portfolio. In other words, if before an M&A an acquirer is a small business lender, then it will continue using the same strategy after an M&A. Furthermore, Sapienza (2002) suggests that consolidation involving banks with small market shares can be beneficial to borrowers. However, when banks accumulate enough market power, they tend to cut lending to small borrowers. We contribute to this strand by showing that the relationship between consolidation and credit supply varies with the structure of a post-consolidation network and the functions of the consolidated branches.

The second strand of literature assesses the impact of geographical diversification/dispersion on bank risk, and provides mixed results. For example, Deng and Elysiani (2008) find that geographical diversification can enhance bank value and reduce bank risks through diversifying loan portfolios. In contrast, some other studies find that geographical diversification can increase risks due to a lack of information about new markets and the need for a more complex organizational structure (e.g., Demsetz and Strahan, 1997; Acharya et al., 2006). Despite the inconclusive results on the diversification-risk relationship, one common finding among these studies is that longer distances between headquarters and local branches can negatively affect bank stability via several channels. The first channel is weakened monitoring and amplified agency problems, as longer distances make it more difficult for managers at headquarters to supervise local branch managers (Brickley et al., 2003; Goetz et al., 2013). The second channel is diseconomies of scale. As suggested by Berger et al. (2005), a narrower branch network provides banks with the advantage of using soft information in making loan decisions. Following these studies, we also investigate the link between geographical diversification and bank lending by taking into account the distance between headquarters and local branches. However, our study is distinct in that we differentiate between the dispersion of delegated branches and the dispersion of access points. In addition, we also assess the interplay between the dispersion of the two branch types.

The third strand of the literature focuses on delegation in decision-making. Aghion and Tirole (1997) suggest that decentralized structures allow subordinates to participate in institutions more, and incentivize them to produce better information. On the downside, head offices might lose control over subordinates. Further, centralized decision-making is only optimal if the principals receive relevant and valuable information from their subordinates, and they

can verify the quality of the information (Dessein, 2002). In a similar vein, Stein (2002) shows that the performance of firms with different decision-making structures depends on the type of information available. If the information about a project is soft and not easily transmissible, firms with decentralized decision-making can make better investment decisions. In contrast, hard and easily transmissible information confers advantages to centralized firms. Despite the vast theoretical literature, empirical studies on decision-making authority, especially studies in the banking context, are scarce – possibly due to a lack of data. To the best of our knowledge, we are the first to examine the impact of the geographical structure on the lending behavior of different types of branches – those with and those without decision-making authority.

The rest of the paper is organized as follows. In Section 2, we provide an overview of the operational and geographical structure of Ukrainian banks. In Section 3, we discuss our identification strategy and describe the dataset. Section 4 is a discussion of our results. Section 5 gives conclusions.

2. Overview about the geographical and operational structure of Ukrainian banks

The operational structure of the Ukrainian banks can be described as follows. The top decision makers are the banks' headquarters, which are responsible for overarching supervision and for taking important decisions, such as on granting loans to big corporate customers. The lower-tier decision makers are those regional branches that have the authority to make (local) loan decisions. The local decision makers also have controls over other local branches that do not have delegated decision making, and which are referred to as access points. Their main roles include (1) widening the banks' reach to customers, especially individual ones, and (2) collecting hard information about local customers.

In recent years, the geographical structure of the Ukrainian banking sector has dramatically changed due to several factors. The trend of foreign banks' to intensively acquire local banks in the 2005-2011 period resulted in an increase in the number of access points, while the number of active banks decreased (**Помилка! Джерело посилання не знайдено.**). There are two reasons for the expansion of access points. First, the foreign banks offered quite a high price – about double the value of equity – to acquire the domestic banks. Second, the main aims of the foreign banks' acquisitions were to expand their operations geographically de jure, and to "buy" local banks' clients de facto. Thus, the banks mainly targeted for foreign acquisition were those with developed branch networks, which in turn created incentives for local banks to open new access points. However, the situation has reversed since 2012, with the gradual withdrawal of foreign-owned banks from the Ukrainian market, leading to a steady reduction in the number of banks and branches. Branch and bank decline has been

accelerating since 2014 through the consolidation imposed by the National Bank of Ukraine (NBU) as a part of a reform program to create a transparent and efficient banking sector.

When regional branches close, the geographical structure of branch networks also changes. In 2008, delegated branches tended to be located in more economically or financially developed markets such as Kyiv region and the city of Kyiv, and Dnipropetrovsk, Kharkiv, Lviv, and Poltava regions. This suggests that before the reform, the banks' choice of where to locate delegated branches could have been driven by the demand side. If banks maintain this strategy after consolidation, one would expect a disproportional distribution in favor of the markets that are more developed.[3] However, in fact we do not observe this – the distribution of the number of delegated branches in 2016 is relatively even among the various markets. Similarly, the degree to which access points are disproportionally distributed has reduced over the 2008-2016 period.

(Figure 2 about here)

The above transformations raise the question of the optimal structure of branch networks for facilitating the centralization of decision making. The fact that most headquarters are placed in the city of Kyiv, coupled with the uniqueness of Ukraine's geography, provides us with an ideal setting to answer this question. More specifically, we examine the relationship between the dispersion of headquarters and local branches and bank lending. Furthermore, we also analyze the consequences of the removal of branches from a region on local lending practices.

3. Data and empirical strategy

3.1. Empirical specifications

3.1.1. Bank branch structure and bank lending

In the first part of our analysis, we employ the following model to examine the impact of post-consolidation structure on the banks' lending strategies and risk management.

$$Y_{bt} = \beta_0 + \beta_1 Dispersion_{bt}^{delegated\ branches} + \beta_2 Dispersion_{bt}^{access\ points} + \beta_3 Dispersion_{bt}^{delegated\ branches} \times Dispersion_{bt}^{access\ points} + Controls_{bt}\beta_4 + \epsilon_b + \theta_t + \varepsilon_{bt} \quad (1)$$

where *b* refers to a bank and *t* refers to a quarter. We employ two dependent variables, including (1) *Loans/TA,* which is the ratio of loans to total assets, and (2) *NPL,* which is the ratio of non-performing loans to total loans. To account for the potentially different effects

[3] In 2014, the top five regions with the highest gross regional product per capita included Kyiv region and the city of Kyiv, and Dnipropetrovsk, Poltava, Zaporizhzhya, and Kharkiv regions. In 2016 the top five regions with the highest share of enterprises are Kyiv region and the city of Kyiv, and Dnipropetrovsk, Odesa, Kharkiv, and Lviv regions.

on corporate loans and individual loans, we also measure *Loans/TA* and *NPL* separately for these two loan types.

Following previous studies (e.g., Gosh, 2015), we include a vector of control variables, *Controls*, to account for other factors that can affect the banks' risk management and credit creation. These variables include *Wholesale funding* (the ratio of funding from non-bank financial institutions to total funding), *Size* (the natural logarithm of total assets), *Equity/Assets* (the ratio of total equity to total assets), *Deposits/Assets* (the ratio of total deposits to total assets), *Provisions* (the ratio of loan loss provisions to total assets), *Other banks' delegated branches* (the natural logarithm of the number of delegated branches of other banks), and *Other banks' access points* (the natural logarithm of the number of access points of other banks). In the regression, we also control for the time fixed effect (θ_t) and the bank fixed effect (ϵ_b). Finally, ε_{bt} is the error term. All financial variables are trimmed at the 1st and 99th percentile level of their distributions each quarter.

The dispersion variable, *Dispersion*, indicates the geographical dispersion of branches, taking headquarters as the focus. Adopting the approach used in previous studies (e.g., Deng and Elyasiani, 2008; Degl'Innocenti et al., 2017), we construct a dispersion measure for a bank operating in *m* regions by taking into account the geographical distance between the headquarters location and other regions (*distance*$_i$) as follows:

$$Dispersion_i = \sum_{i=1}^{m} \left[\frac{Branches_i}{\sum Branches_i} \times \ln(1 + distance_i) \right]$$

where *Dispersion* is the either the dispersion of delegated branches or access points. By construction, with the same number of branches, the level of dispersion is higher if those branches are located further away from the headquarters. *Dispersion* takes a value of zero if banks cut their delegated branches in all distant markets and only retained those in the headquarters' market, or if banks cut all local delegated branches and centralized decision-makings at headquarters.

3.1.2. Local branch networks and lending

Although when consolidating their networks, banks adjust the number of delegated branches and access points throughout their markets, the scale of adjustments is different across markets. This variation in turn might result in different impacts on loan supply and risk management among markets within the same bank network. To test this possibility, we employ the following empirical specifications:

$$\begin{aligned} Y_{bmt} = {} & \beta_0 + \beta_1 Delegated\ branches_{bmt} + \beta_2 Access\ points_{bmt} + \\ & \beta_3 Delegated\ branches_{bmt} \times Access\ points_{bmt} + \\ & Controls_{bmt}\beta_4 + \epsilon_b + \theta_{mt} + \varepsilon_{bmt} \end{aligned} \quad (2)$$

where *b* indexes banks, *m* indexes markets, and *t* indexes quarters. The dependent variable is either (1) *Ln(loans),* which is the natural logarithm of loans granted by a bank in a regional market or (2) the *NPL* ratio, which is the ratio of non-performing loans to the total loans of a bank in a market. *Delegated branches* and *Access points* are the natural logarithm of the number of delegated branches or the number of access points of each bank in each market plus one, respectively.[4]

To control for competitiveness as well as the general consolidation process in a market, we include the variables *Other banks' delegated branches in the market* and *Other banks' access points in the market,* which are the natural logarithms of the number of delegated branches and access points of other banks in a market, respectively. As a bank's investment in a market might depend on the importance of that market to the banks, we control for this by employing *Accrued income from loans,* which is the ratio of total accrued income from loans granted by a bank in a market to the sum of total accrued income and total overdue income from loans. We also include dummy variables to control for the bank- (ϵ_b) and market-time (θ_{mt}) fixed effects. Finally, ε_{bmt} is the error term.

3.2. Data and sample

Our data are combined from three datasets, including (1) data on Ukrainian banks' branch networks, differentiated by branches with balance sheets and branches without balance sheets, (2) loan data at the bank-region level, and (3) income statement and balance sheet data at the bank level. The branch network data allow us to determine for each bank, in each region, the number of decision-making branches and the number of branches that serve as contact points.

The data cleaning process is as follows. First, we exclude banks that are headquartered in Crimea, Luhansk, and Donetsk. Second, we only include active banks that had at least one delegated branch throughout the examined period. Third, we exclude data on banks that were involved in mergers and acquisitions. This process provides us with the cleanest data set, in which the changes in the banks' branch network structures were made intentionally by the banks. At the same time, any possible changes in the branch networks caused by the ongoing conflict in eastern Ukraine, merger and acquisition activities, or the suspension of banks' operations are ruled out. After cleaning, our panel data set consists of 26 banks with 897 observations covering the period from 2008 Q1 to 2016 Q4.[5]

[4] We also experiment with the squared terms of branch network measures to control for non-linearity, and obtain quantitatively consistent results. These results are available upon request.

[5] Our results remain quantitatively similar if we (1) include in the analysis active banks that only have headquarters and access points, or (2) exclude some banks that carried out "suspicious" operations during the examined period. Results based on these samples are available upon request.

Panel A of Table 1 presents descriptive statistics for the estimation sample at bank level. Interest-taking activities play an important role in the operations of Ukrainian banks, since total loans make up more than half of their assets on average. Most loans are made in the form of corporate loans – their total value is about three times more than loans to households and individuals. However, corporate loans that are classified as bad loans account for about 7 percent of total loans. In addition, the proportion of problem loans generated from loans to firms is one-and-a-half times higher than the proportion of bad loans generated by loans to individuals. Regarding the dispersion of branch networks within a bank, we observe a more dispersed networks of contact points, while networks of decision-making branches are likely be more concentrated towards the headquarters markets.

In terms of other banks' characteristics, around 8 percent of total assets are made up by loan loss provisions, reflecting Ukrainian banks; general expectations of huge loan losses, and thus an unstable banking system. Additionally, while total deposits account for 35 percent of banks' assets, only 3.2 percent of total customers' funds are raised from the wholesale market. Equity capital plays quite an important role, as more than 15 percent of total assets are shareholders' equity. Our data also reveal that networks of access points are much larger compared to the network of delegated branches – the average number of access points is about 33 times higher than that of decision-making branches.

(Table 1 about here)

At the bank-region level, in addition to the data cleaning steps specified above, we further exclude Crimea, Luhansk, and Donetsk to rule out the possibility that changes in local network structure have been induced by geopolitical issues rather than the banks' strategies. We also exclude unusual data that might bias the results.[6] Our final sample contains 378 bank-region pairs, with 10,284 observations. Summary statistics for the estimation sample at the bank-region level are presented in Panel B of Table 1. On average, a bank operates one delegated branch and 29 access points in each market. The competition between the access points of different banks in a market is quite intense, as the average total number of access points of any given bank's competitors is 359 branches. In terms of loan origination, there is not much difference in the loans granted to corporations and to individuals. However, the non-performing loans generated from personal loans are slightly higher than the ones from corporate loans –accounting for 10 percent and 7 percent of total granted loans, respectively. In addition, around 41 percent of the income from loans is collected on time, whereas the rest are overdue.

[6] Unusual data include *NPL* ratios and ratios of the share of loans issued by a bank in a region to total loans of the bank that are greater than 1.

Figure 3 shows the evolution of banks and their branches over time. Overall, we observe a downward trend in the number of banks and branches over the 2008-2016 period. The number of active banks dropped from nearly 180 in 2008 Q1 to less than 80 banks by the end of 2016. The sharpest fall in the number of active banks was in 2014, with the start of the consolidation process imposed by the NBU. From 2008 until late 2012, the average number of decision-making branches declined significantly, from nearly 10 branches to about two branches per bank, while it then stabilized afterwards. This trend suggests the Ukrainian banks' strategy was to centralize the decision-making process at the headquarters level. The access point network, however, developed according to a different pattern. The 2008 to early 2014 period witnessed an increase in the number of access points, since this period is considered as one of recovery and expansion of Ukrainian banks following the financial crisis of 2007 to 2008. However, since 2014, the average number of contact points has declined substantially, which is in line with the change in the number of banks.

(Figure 3 about here)

4. Results

4.1. The structure of branch networks and bank lending

Estimated results for model (1) are presented in Table 2, where Panels A and B show results with *Loans/TA* and *NPL* as the dependent variables, respectively.[7] In Panel A, the coefficients on $Dispersion^{access\ points}$ are significant and positive, suggesting that a more dispersed network of contact points is beneficial to banks. Particularly, a one standard deviation increase in the dispersion of the access-point network leads to an increase of 10.68 percent in $Loans^{total}/TA$ and an increase of 4.25 percent in $Loans^{personal}/TA$.[8] In contrast, the coefficients on delegated branch dispersion are not statistically significant. In Panel B, we observe the negative and significant effects of dispersion on the non-performing loans ratio of the two types of branches. More specifically, if the dispersion of decision-making branches increases by one standard deviation, the share of total non-performing loans and non-performing loans issued to households and individuals decline by about 6-7 percent. Similarly, a one standard deviation increase in $Dispersion^{access\ points}$ is associated with a 10.88 percent decline in the total *NPL* ratio. The figures are 5.16 percent and 6.51 percent for $NPL^{corporate}$ and $NPL^{personal}$, respectively.

[7] The branch network variables ($Dispersion^{delegated\ branches}$, $Dispersion^{access\ points}$, *Ln(other banks' delegated branches)*, and *Ln(other banks' access points)*) are multiplying by 10 for the purpose of presentation.

[8] We compute these figures by multiplying the standard deviation of $Dispersion^{access\ points}$ (1.692) by the coefficient estimates (0.631 for $Loans^{total}/TA$ and 0.251 for $Loans^{corporate}/TA$) then divided by 10. Thus, the reported figures in the main text show us changes compared to the sample mean.

(Table 1 about here)

While the dispersion of each network type alone has a positive impact on overall bank risk management, we observe the opposite effect when the network types share the same dispersion pattern. In other words, a more dispersed network of access points results in higher risks for banks if its delegated branch network is also more dispersed. There are also signs of a negative impact of this on loan creation, although the effect is not statistically significant. These results are visualized in Figures 4 and 5, which show the predicted $Loans^{total}/TA$ and *NPL* ratio with respect to the changes in the dispersion of decision-making branches and contact points. As can be clearly seen, the optimal structure for minimizing risks and maximizing credit supply is to combine a more dispersed access-point network with a more centralized delegated branch network.

(Figures 4 and 5 about here)

The positive impacts of the dispersion of access points on credit supply and risk management could be explained by this branch type's main role, which is to increase the banks' access to clients. This role goes hand-in-hand with the availability of a large amount of information about loan applicants, such as their credit history or to whom they have also applied for loans, which is gathered at contact points. The collected information is then delivered to the local delegated branches or the headquarters, where loan decisions are made. In general, banks with a more dispersed network of access points enjoy higher levels of credit supply, since they have access to more clients. In the meantime, using information on geographically diversified loan applicants, banks can lower overall risks through counterbalancing higher risks in some markets with lower risks in others (Deng and Elyasiani, 2008).

Our results provide support for Liberti and Mian (2009), who find that the greater the distance between information collecting agents and decision makers, the less the banks rely on soft information, and the more they use hard information. Since the process of information collection, storage, and dissemination can be facilitated by the adoption of advanced technology (Petersen and Rajan, 2002), decision-making agents can now have instant and frequent access to hard information about local borrowers, which is beneficial for ex-post monitoring. As a result, banks with more dispersed networks of access points are more willing to expand lending, knowing that they can intervene quickly if loan conditions deteriorate. The effects are stronger if loans are transactional-based, as decisions on this type of loan are made purely based on hard information, and transaction loans can easily be replicated by any other bank (Boot and Thakor, 2000). Consequently, having a more dispersed network of contact points creates opportunities for banks to attract new individual customers who have not been previously served, or who want to switch their banks.

Our results also reveal the advantages and disadvantages of the dispersion of delegated branches. On the one hand, loan officers at the delegated branches have access to soft

information about local borrowers. Given the difficulties in disseminating soft information, the presence of delegated branches in those local markets that are farther away from head offices could help banks to better control local loan quality. Soft information also allows local decision makers to preserve a bank's relationship lending with local firms and individuals.

On the other hand, a more dispersed network of decision-making branches may lead to agency problems. More specifically, the lengthening distance between head offices and local branches can hinder the headquarters' ability to supervise local loan officers' actions and to enforce the headquarters' lending policies (Alessandrini et al., 2008). As a result, local decision makers might devote less time and effort to ex ante screening and ex post monitoring, subsequently leading to greater lending risks. Furthermore, it has been shown that local managers who have been granted decision-making authorities tend to build their own mini-empires (e.g. Harris and Raviv, 1996; Graham et al., 2015). This tendency can also cause divergences from the head offices' interests and hinder effective control by headquarters over local delegated branches, especially distant ones.

The costs of a dispersed delegated branch network thus might outweigh the benefits, since agency problems are exacerbated by the dispersion of access points that are also part of a mini-empire. In other words, a centralized structure of delegated branches, coupled with the dispersion of access points, is more beneficial to banks. This is because in the centralized structure, head offices can more closely supervise local loan officers' activities, thus reducing risks associated with agency problems. At the same time, banks can issue loans at a greater distance using hard information about the local borrowers' creditworthiness that has been transmitted from contact points (Berger et al., 2005). Meanwhile, distant lending has been facilitated, agency problems reduced, and information transmission improved by recent technological innovations in the banking industry (Berger, 2003; Mocetti et al., 2017).

In terms of the effects of other banks' characteristics, we find that better-capitalized banks are safer. This result supports the moral hazard hypothesis, which suggests that a low level of capitalization induces incentives to take on excessive risk in lending, along with poor loan monitoring (Berger and De Young, 1997). Further, moral hazard incentives also occur at banks that have low credit quality, which incentivizes them to increase the riskiness of their loan portfolios (Ghosh, 2015). As the result, the low equity-to-assets ratio and the higher level of loan loss provisions are positively related to a high level of bad loans.

4.2. Local branch networks and lending practice

The results for the effects of branch network structure at bank-region level on risk management and credit supply are presented in Table 3. We find that a higher number of local delegated branches is positively related to the total amount of the loans issued in that market – regardless of loan type. In terms of economic significance, if a bank increases the

number of delegated branches in a local market by 10 percent, the volume of loans issued in that market is expected to increase by about 20.46 percent. The figures for corporate loans and personal loans are 36.17 percent and 23.53 percent, respectively. The results suggest there is a huge economic impact on credit supply from the presence of delegated branches in local markets. Moreover, the positive impact of the presence of delegated branches on corporate lending are larger than the effects on personal loans, suggesting that firms are more likely to rely on relationship lending compared to individual borrowers (Berger et al., 2003). In addition, the expansion of the local decision-making branch network only negatively affects the local risk management of personal loans, while the coefficients on regressions with NPL^{total} and $NPL^{corporate}$ ratios are negative but insignificant: If the number of delegated branches increases by 10 percent, the $NPL^{personal}$ ratio is expected to rise by 0.3 percent.

We also acknowledge the significant and positive impact of the number of access points on credit creation and risk management in local markets. Specifically, if the number of a bank's local contact points increases by 10 percent, the total amount of loans granted in the market increases by 7.6 percent. The increases in the amount of local corporate loans and personal loans issued are 13.73 percent and 8 percent, respectively. Further, the expansion of the local contact point network also leads to a decline in the levels of problem loans, especially personal loans. With a 10 percent increase in the number of contact points, the *NPL* ratio for total non-performing loans and non-performing personal loans declines by about 0.2 percent.

(Table 3 about here)

Interestingly, a larger delegated branch network size, coupled with a large network of access points, might bring both pros and cons to banks. For instance, the presence of a large number of both types of branches causes a reduction in local credit supply. Moreover, there is a negative impact on the level of non-performing loans. These effects are visualized in Figures 6 and 7. As can be seen, the optimal structure for a bank's local branch network is to keep the number of delegated branches at a minimum i.e. no more than five decision-making branches in a market, while maintaining a medium-sized network of contact points i.e. 150-250 branches in a market.

(Figures 6 and 7 about here)

These findings provide insight into the impact of local branch networks on bank lending. First, we find support for our argument about the role of contact points as (hard) information collectors. Given that the main function of access points is to attract customers and collect information from borrowers, and then to transfer that information to decision makers, having a large number of access points in a region can help banks geographically diversify their pools of loan applicants within a region. Geographical diversification of loan applicants then enables banks to grant more (transactional-based) loans in local markets, while reducing the amount of bad loans. Additionally, as the information-collecting agents have no authority to make

lending decisions, they might instead have incentives to conceal from decision makers bad loan conditions or unfavorable information about the local borrowers with whom they have a personal relationship (Berger and Udell, 2002). This would explain why the expansion of this branch type is positively related to the origination of corporate loans, but does not reduce the level of related bad loans.

Second, there is evidence for the presence of relationship lending in the local credit supply, and relationship lending is more likely to exist with the presence of local delegated branches. Thus, removing local decision-making branches means cutting relationship with long-term clients, irrespective of the borrower and loan types. On the contrary, the expansion of these branches provides loan officers in newly delegated branches with opportunities to issue loans to local borrowers with whom they have a personal friendship. The intensity of relationship lending is enhanced by increased competition (Boot and Thakor, 2000; Dinc, 2000; Canales and Nanda, 2012). In our study, a large number of delegated branches indicates fiercer competition among local decision makers, who have preference for empire building while competing directly in the internal capital market. Enhanced competition thus creates extra pressure on local loan officers regarding their performance, resulting in overinvestment – regardless of the borrowers' quality. While local loan officers have incentives to generate new loans, they devote less effort to monitoring the existing ones (Berger and Udell, 2002), leading to higher levels of non-performing loans.

Third, study of the interaction between large networks of local delegated branches and access points implies that local loan officers have a tendency to "cherry-pick," as documented in the literature (e.g., Sapienza, 2002; Canales and Nanda, 2012). More specifically, large networks of both types of branch indicate that the bank has a relatively large empire in a region, providing it with monopoly power. Thus, local decision makers might have incentives to cherry-pick the highest-quality clients, restrict loan sizes, and charge higher interest rates on loans. Consequently, in regions where the number of both access points and delegated branches is large, the level of local loans decreases, while the ex post loan performance increases – as indicated by lower numbers of non-performing loans. This effect is most profound for loans to individuals and households, which are made on the basis of hard information.

4.3. The effects of dispersion of access points when decision-making is fully centralised

We have found that the dispersion of access points is beneficial to banks' decision-making, as it provides a geographically diversified pool of information. To check whether the effect holds when banks are fully centralized and their headquarters is the only decision-making agent, we employ the following model:

$$Y_{bt} = \beta_0 + \beta_1 Completed\ time_b + \beta_2 Dispersion_{bt}^{access\ points} + \beta_3 Completed\ time_b \times Dispersion_{bt}^{access\ points} + Controls_{bt}\beta_4 + \epsilon_b + \theta_t + \varepsilon_{bt} \quad (3)$$

where *b* indexes banks and *t* indexes quarters. *Completed time* is equal to 1 for quarters after the banks have closed all delegated branches, and zero for quarters before that. We employ the same dependent variables and control variables as the ones in model (1). This model only covers the sample of banks that have completed fully centralized consolidation.

To examine bank lending in local markets in the condition of local delegated branches no longer existing, we adjust model (2) as follows.

$$Y_{bmt} = \beta_0 + \beta_1 Completed\ time_{bm} + \beta_2 Access\ points_{bmt} + \beta_3 Completed\ time_{bm} \times Access\ points_{bmt} + Controls_{bmt}\beta_4 + \epsilon_b + \theta_{mt} + \varepsilon_{bmt} \quad (4)$$

where *b* indexes banks, *m* indexes markets and *t* indexes quarters. *Completed time* is equals to 1 for quarters after the banks have closed all delegated branches in a market, and zero for quarters before that. Dependent variables and control variables are the same as the ones in model (2).

The estimated results are reported in Tables 4 and 5. Consistently with previous findings, the dispersion of information-collecting branches is positively related to loan creation and loan quality. At first glance, there is no evidence of a significant impact from fully centralized consolidation on banks' lending activities. However, the results of the model for the local loan supply reveal that the closure of all local decision-making branches in a region has a substantial negative impact on local lending. After the closure, the market suffers from a deep reduction in credit origination, regardless of loan type. The results support our previous argument that the closure of local delegated branches means cutting ties with the long-term borrowers who are connected to those local branches. However, the negative impact of fully centralized consolidation could be mitigated by increasing the number of local access points. After the removal of all local delegated branches, an expansion of 10 percent in the number of access points can indeed lead to increases of 2.7 percent, 5.2 percent, and 2.68 percent in total, corporate, and personal loans, respectively. The findings emphasize the importance of the presence of local access points in increasing banks' access to clients and facilitating the decision-making process, especially in the absence of local delegated branches.

(Tables 4 and 5 about here)

4.4. The effects of access point dispersion in the event of an exogenous shock

In this section, we use an exogenous shock to the Ukrainian banking sector to test the robustness of the impacts of access-point network structure. In particular, the geopolitical conflict between Ukraine and Russia has led to the closure of bank branches in conflict areas, resulting in changes in the banks' branch structures. Banks are more likely to have been exposed to the conflict if they had previously placed more branches in the conflict regions (Crimea, Donetsk, and Luhansk). Thus, after the onset of the conflict in 2014 Q1, the more conflict-exposed banks have lost more branches and their network structures have been more affected. Furthermore, we are only interested the share of access points, as there were not many delegated branches in the conflict regions even before 2014 Q1. Our difference-in-differences regression is as follows.

$$Y_{bt} = \beta_0 + \beta_1 Conflict_t + \beta_2 Dispersion_{bt}^{access\ points} + \beta_3 Conflict_t \times Share_{b,2014\ Q1} + \beta_4 Conflict_t \times Dispersion_{bt}^{access\ points} + \beta_5 Conflict_t \times Share_{b,2014\ Q1} \times Dispersion_{bt}^{access\ points} + Controls_{bt}\beta_6 + \epsilon_b + \theta_t + \varepsilon_{bt} \quad (5)$$

where *Conflict* is equal to 1 for quarters from 2014 Q1, and zero otherwise. *Share* is the share of access points in the conflict regions compared to the bank's total number of access points as of 2014 Q1. The dispersion (of access points) variable and control variables are those defined previously. Since we are interested in examining the role of access points only, we run this model only on the sample of active banks that have located their headquarters in the city of Kyiv, regardless of the number of delegated branches. The time span is from 2013 Q3 to 2015 Q3.[9]

The estimated results of the model run are presented in Table 6. We find that personal loans are negatively affected by the conflict, while banks tend to increase their lending to corporate clients. Banks that placed more access points in the conflict regions are indeed more exposed to the conflict, thus experiencing a sharper reduction in their credit supply. At the same time, the more affected banks also face an increase in the levels of bad loans, as clients in the conflict regions are more reluctant to repay their loans. Furthermore, the coefficients on the interaction between *Dispersion*$^{access\ points}$ and *Conflict* are significant and positive in the regressions with *Loans/Total assets*, but significantly negative in the regressions with *NPL* ratios. In other words, we still observe that a high access point dispersion has a significant role in reducing risks and increasing credit supply after the onset of the conflict.

[9] Estimations with different time intervals yield quantitatively similar results and are available upon request.

In addition, the positive effects of dispersion on risk management and credit origination can indeed outweigh the negative effects caused by conflict exposure. More specifically, since 2014 Q1, the geographic diversification of access points may have helped more conflict-exposed banks increase their lending, especially lending to individuals and households, and to reduce the levels of problem loans. These results suggest that a diversified network of access points can help more conflict-affected banks enhance their access to the local clients, thus, increasing lending in other regions to make up for losses in the conflict regions. Moreover, given the already high levels of risk, decision-making agents at more affected banks are more likely to be risk averse. Therefore, they might have incentives to perform better risk management by making use of information generated from the diversified access-point network.

(Table 6 about here)

5. Conclusion

In this study, we examine the impact of branch network structure on credit supply and risk management. Our results reveal that it is not only the structure that matters – the functions of branches are also important. Since the main role of access points is to enhance banks' access to clients, the geographic dispersion of this branch type can help banks diversify their pools of loan applicants. As a result, banks can increase their lending while reducing overall risks. At the same time, information about local borrowers' creditworthiness is delivered to decision-making agents to use in loan screening and monitoring. Given instant access to up-to-date information, banks are willing to grant more loans and enjoy lower levels of non-performing loans, as they can intervene promptly if loan conditions are not met.

The dispersion of delegated branches that have the authority to make loan decisions, in contrast, can affect bank lending in different ways. On the one side, local delegated branches have access to soft information that is difficult to disseminate. Thus, the dispersion of this branch type can help banks monitor loan quality in distant markets better. On the other side, the distance between the headquarters and local decision-making branches leads to several agency problems. For instance, the greater distance makes the headquarters' supervision less effective. Moreover, local managers, especially ones in distant markets, tend to have a preference for building their own mini-empires. Therefore, they might have incentives to deviate from the headquarters' strategies rather than act in the headquarters' interests. Our analysis shows that the dispersion of delegated branches, coupled with the dispersion of access points, indeed intensifies agency costs, which making banks worse off in terms of risk management. Hence, to achieve high levels of credit supply while maintaining the low levels of risk, the banks' optimal network structure is to combine a more centralized delegated branch network with a more dispersed network of access points.

Since banks structure their branch networks differently across markets, we further study the link between local branch structure and bank lending. We find that the intensity of delegated branches in a market is positively related to the origination of local loans. Since the loan officers in the delegated branches are granted decision-making authorities, they have incentives to issue loans to local borrowers with whom they have personal relationships. In other words, having a large network of delegated branches in a local market provides loan officers with opportunities to engage in relationship lending. Similarly to the results at the bank level, having a larger number of access points in a region can increase local lending and improve risk management, as banks can geographically diversify their local loan portfolios.

Our analysis also shows that banks having large networks of both access points and delegated branches in a region might be not beneficial to local borrowers. This is because having large networks provides banks with more market power in local markets, which in turn increases "cherry-picking" incentives. In this case, local decision makers of more (locally) powerful banks tend to issue (smaller) loans to the best borrowers, while charging higher interest rates, leading to a reduction in the levels of granted loans but better ex post performance. The process can be facilitated by having hard information about geographically diversified borrowers, collected by the access-point networks. The role of access points in improving banks' access to customers and facilitating decision-making is confirmed when we examine its impact on the lending of (1) banks that centralized the decision-making process at the headquarters level, and (2) banks that are more exposed to the geopolitical conflict between Ukraine and Russia that started in 2014 Q1.

Our results bear some policy implications. First, the consolidation process should take into account the functions and network structures of branches. More specifically, delegated branches should be centralized, while there is a need for a more dispersed network of access points. In addition, banks should place more contact points in distant markets, which could help their head offices in risk management, while expanding credit supply in these markets. Second, the adoption of information technology should be promoted to make the monitoring process and information dissemination more efficient. This would provide headquarters or decision-making agents more incentives to provide loans in remote or under-served areas, which in turn benefits customers.

References

Acharya, V.V., Hasan, I. and Saunders, A., 2006. Should banks be diversified? Evidence from individual bank loan portfolios. *The Journal of Business*, *79*(3), pp.1355-1412.

Aghion, P. and Tirole, J., 1997. Formal and real authority in organizations. *Journal of Political Economy*, *105*(1), pp.1-29.

Alessandrini, P., Presbitero, A.F. and Zazzaro, A., 2008. Banks, distances and firms' financing constraints. *Review of Finance*, *13*(2), pp.261-307.

Avery, R.B. and Samolyk, K.A., 2004. Bank consolidation and small business lending: the role of community banks. *Journal of Financial Services Research*, *25*(2-3), pp.291-325.

Berger, A., Klapper, L., Miller, M. and Udell, G., 2003. Relationship lending in the Argentine small business credit market. In: Margaret Miller (ed.) *Credit Reporting Systems and the International Economy*. MIT Press, Cambridge, Massachusetts, pp.255-270.

Berger, A.N. and DeYoung, R., 2001. The effects of geographic expansion on bank efficiency. *Journal of Financial Services Research*, *19*(2), pp.163-184.

Berger, A.N. and Udell, G.F., 2002. Small business credit availability and relationship lending: The importance of bank organisational structure. *The Economic Journal*, *112*(477).

Berger, A.N., 2003. The economic effects of technological progress: Evidence from the banking industry. *Journal of Money, Credit, and Banking*, *35*(2), pp.141-176.

Berger, A.N., Demsetz, R.S. and Strahan, P.E., 1999. The consolidation of the financial services industry: Causes, consequences, and implications for the future. *Journal of Banking & Finance*, *23*(2-4), pp.135-194.

Berger, A.N., Miller, N.H., Petersen, M.A., Rajan, R.G. and Stein, J.C., 2005. Does function follow organizational form? Evidence from the lending practices of large and small banks. *Journal of Financial Economics*, *76*(2), pp.237-269.

Berger, A.N., Saunders, A., Scalise, J.M. and Udell, G.F., 1998. The effects of bank mergers and acquisitions on small business lending. *Journal of Financial Economics*, *50*(2), pp.187-229.

Boot, A.W. and Thakor, A.V., 2000. Can relationship banking survive competition? *The Journal of Finance*, *55*(2), pp.679-713.

Brickley, J.A., Linck, J.S. and Smith Jr, C.W., 2003. Boundaries of the firm: evidence from the banking industry. *Journal of Financial Economics*, *70*(3), pp.351-383.

Canales, R. and Nanda, R., 2012. A darker side to decentralized banks: Market power and credit rationing in SME lending. *Journal of Financial Economics*, *105*(2), pp.353-366.

Degl'Innocenti, M., Mishra, T. and Wolfe, S., 2017. Branching, lending and competition in Italian banking. *The European Journal of Finance*, pp.1-28.

Demsetz, R.S. and Strahan, P.E., 1997. Diversification, size, and risk at bank holding companies. *Journal of Money, Credit, and Banking*, *29*(3), pp.300-313.

Deng, S.E. and Elyasiani, E., 2008. Geographic diversification, bank holding company value, and risk. *Journal of Money, Credit and Banking*, *40*(6), pp.1217-1238.

Dessein, W., 2002. Authority and communication in organizations. *The Review of Economic Studies*, *69*(4), pp.811-838.

Dinc, I.S., 2000. Bank reputation, bank commitment, and the effects of competition in credit markets. *The Review of Financial Studies*, *13*(3), pp.781-812.

Ghosh, A., 2015. Banking-industry specific and regional economic determinants of non-performing loans: Evidence from US states. *Journal of Financial Stability*, *20*, pp.93-104.

Goetz, M.R., Laeven, L. and Levine, R., 2013. Identifying the valuation effects and agency costs of corporate diversification: Evidence from the geographic diversification of US banks. *The Review of Financial Studies*, *26*(7), pp.1787-1823.

Graham, J.R., Harvey, C.R. and Puri, M., 2015. Capital allocation and delegation of decision-making authority within firms. *Journal of Financial Economics*, *115*(3), pp.449-470.

Harris, M. and Raviv, A., 1996. The capital budgeting process: Incentives and information. *The Journal of Finance*, *51*(4), pp.1139-1174.

Liberti, J.M. and Mian, A.R., 2009. Estimating the effect of hierarchies on information use. *The Review of Financial Studies*, *22*(10), pp.4057-4090.

Mocetti, S., Pagnini, M. and Sette, E., 2017. Information technology and banking organization. *Journal of Financial Services Research*, *51*(3), pp.313-338.

Peek, J. and Rosengren, E.S., 1998. Bank consolidation and small business lending: It's not just bank size that matters. *Journal of Banking & Finance*, *22*(6-8), pp.799-819.

Petersen, M.A. and Rajan, R.G., 2002. Does distance still matter? The information revolution in small business lending. *The Journal of Finance*, *57*(6), pp.2533-2570.

Sapienza, P., 2002. The effects of banking mergers on loan contracts. *The Journal of Finance*, *57*(1), pp.329-367.

Stein, J.C., 2002. Information production and capital allocation: Decentralized versus hierarchical firms. *The Journal of Finance*, *57*(5), pp.1891-1921.

Strahan, P.E. and Weston, J.P., 1998. Small business lending and the changing structure of the banking industry. *Journal of Banking & Finance*, *22*(6-8), pp.821-845.

Tables

Table 1. Descriptive statistics

	Mean	SD	Obs.
	(1)	(2)	(3)
Panel A. Bank level			
Risk			
NPL^{total}	0.103	0.149	876
$NPL^{corporate}$	0.065	0.115	882
$NPL^{personal}$	0.041	0.097	881
Credit creation			
$Loans^{total}/TA$	0.542	0.174	897
$Loans^{corporate}/TA$	0.398	0.185	898
$Loans^{personal}/TA$	0.145	0.165	898
Branch dispersion			
$Dispersion^{delegated\ branches}$	2.725	2.733	898
$Dispersion^{access\ points}$	3.993	1.691	898
Other characteristics			
Other banks' delegated branches	301.007	231.918	898
Other banks' access points	9800.130	1522.525	898
Wholesale funding	0.032	0.051	898
Provisions	0.084	0.081	898
Deposits/Assets	0.345	0.143	898
Size	15.200	1.897	898
Equity/Assets	0.173	0.136	898
Panel B. Bank-region level			
Risk			
NPL^{total}	0.139	0.190	9,527
$NPL^{corporate}$	0.068	0.134	7,829
$NPL^{personal}$	0.095	0.159	9,759
Credit creation			
$Ln(loans^{total})$	10.917	2.540	10,284
$Ln(loans^{corporate})$	9.948	3.587	8,822
$Ln(loans^{personal})$	9.596	2.599	10,282
Branch structure			
Delegated branches	0.817	2.404	10,284
Access points	28.708	60.951	10,284
Other characteristics			
Other banks' delegated branches	10.205	9.988	10,284
Other banks' access points	359.463	169.997	10,284
Accrued income from loans	0.407	0.337	10,284

This table presents descriptive statistics for bank level data (Panel A) and bank-region level data (Panel B). In Panel A, *Dispersion*$^{delegated\ branches}$ and *Dispersion*$^{access\ points}$ are the dispersion of branches with and without balance sheets, respectively. *NPL*^{corporate}, *NPL*^{personal}, *NPL*^{total} are the ratios of non-performing loans granted to firms, to individuals, and total non-performing loans over total loans, respectively. *Loans*^{corporate}*/TA*, *Loans*^{personal}*/TA*, and *Loans*^{total}*/TA* are ratios of loans granted to firms, to individuals, and total loans to total assets, respectively. *Wholesale funding* is the ratio of deposits from non-bank financial institutions to total funding from customers. *Size* is the natural logarithm of total assets. *Equity/Assets* is the ratio of total equity to total assets. *Deposits/Assets* is the ratio of total deposits to by total assets. *Provisions* is the ratio of loan loss provisions to total assets. *Other banks' delegated branches* and *Other banks' access points* are the number of delegated branches and access points of other banks, respectively. In Panel B, *Ln(loans*^{corporate}*)*, *Ln(loans*^{personal}*)*, and *Ln(loans*^{total}*)* are the natural logarithm of corporate loans, personal loans, and total loans, respectively. *NPL*^{corporate}, *NPL*^{personal}, *NPL*^{total} are the ratios of non-performing loans granted to firms, to individuals, and total non-performing loans over total loans, respectively. *Delegated branches* and *Access points* are the number of delegated branches and access points of each bank in each market, respectively. *Other banks' delegated branches* and *Other banks' access points* are the number of the delegated branches and access points of other banks in a market, respectively. *Accrued income from loans* is the ratio of total accrued income from loans granted by a bank in a market to the sum of total loans accrued income from loans and the overdue income from loans.

Table 2. Relationship between branch network structure and lending/risk management at bank level

	Total	*Corporate*	*Personal*
	(1)	(2)	(3)
	Panel A. Loans/TA		
$Dispersion^{delegated\ branches}$	0.007	-0.014	0.019
	(0.188)	(0.129)	(0.111)
$Dispersion^{access\ points}$	0.631***	0.385	0.251**
	(0.209)	(0.247)	(0.121)
$Dispersion^{delegated\ branches} \times Dispersion^{access\ points}$	-0.167	-0.144	-0.020
	(0.365)	(0.303)	(0.220)
Ln(other banks' delegated branches)	0.619	0.468	0.143
	(0.924)	(0.968)	(0.301)
Ln(other banks' access points)	5.717	3.956	1.578
	(3.543)	(2.828)	(1.037)
Wholesale funding	-0.052	0.020	-0.077
	(0.193)	(0.266)	(0.150)
Provisions	0.213	0.182	0.035
	(0.147)	(0.142)	(0.093)
Deposits/Assets	0.541***	0.399***	0.142**
	(0.095)	(0.114)	(0.064)
Size	0.035	0.040	-0.005
	(0.026)	(0.041)	(0.021)
Equity/Assets	0.062	0.028	0.031
	(0.089)	(0.101)	(0.040)
Obs.	897	898	898
Adjusted R-squared	0.361	0.297	0.378
	Panel B. NPL		
$Dispersion^{delegated\ branches}$	-0.247**	-0.034	-0.224*
	(0.114)	(0.069)	(0.117)
$Dispersion^{access\ points}$	-0.643***	-0.305**	-0.385***
	(0.211)	(0.147)	(0.104)
$Dispersion^{delegated\ branches} \times Dispersion^{access\ points}$	0.586***	0.196	0.420**
	(0.202)	(0.129)	(0.183)
Other banks' delegated branches	0.001	0.230	-0.221
	(0.495)	(0.451)	(0.252)
Other banks' access points	-0.877	0.093	-1.330
	(1.382)	(1.034)	(1.323)
Wholesale funding	0.281	-0.148	0.541***
	(0.208)	(0.134)	(0.181)
Provisions	1.150***	0.903***	0.215

	(0.197)	(0.236)	(0.169)
Deposits/Assets	-0.194**	-0.086	-0.107**
	(0.081)	(0.068)	(0.052)
Size	-0.020	0.009	-0.031*
	(0.026)	(0.020)	(0.016)
Equity/Assets	-0.199*	-0.155	-0.029
	(0.106)	(0.098)	(0.064)
Obs.	876	882	881
Adjusted R-squared	0.553	0.445	0.393

This table presents estimated results for model 1. In all regressions, a constant term as well as bank and time fixed effects are included but not reported. Robust standard errors are presented in parentheses. Panels A and B show results for regressions with *Loans/TA* and *NPL* as the dependent variable, respectively. Columns (1)-(3) show results with total loans, corporate loans, and personal loans, respectively. $Dispersion^{delegated\ branches}$ and $Dispersion^{access\ points}$ are the dispersion of branches with and without balance sheets, respectively. *Wholesale funding* is the ratio of deposits from non-bank financial institutions to total funding from customers. *Size* is the natural logarithm of total assets. *Equity/Assets* is the ratio of total equity to total assets. *Deposits/Assets* is the ratio of total deposits to by total assets. *Provisions* is the ratio of loan loss provisions to total assets. *Other banks' delegated branches* and *Other banks' access points* are the natural logarithms of the number of delegated branches and access points of other banks, respectively. ∗, ∗∗, and ∗∗∗ denote 10%, 5%, and 1% significance level, respectively.

Table 3. Relationship between branch network structure and lending/risk management at bank-region level

	Total	*Corporate*	*Personal*
	(1)	(2)	(3)
	Panel A. Ln(loans)		
Delegated branches	1.953***	3.239***	2.217***
	(0.365)	(0.606)	(0.289)
Access points	0.769***	1.350***	0.797***
	(0.114)	(0.201)	(0.114)
Delegated branches×Access points	-0.351***	-0.600***	-0.413***
	(0.067)	(0.111)	(0.055)
Other banks' delegated branches	-0.161	-0.567**	0.022
	(0.116)	(0.237)	(0.089)
Other banks' access points	-0.099	-0.376	-0.795**
	(0.364)	(0.791)	(0.384)
Accrued income from loans	0.883***	1.279***	0.159
	(0.147)	(0.305)	(0.116)
Obs.	8,869	7,500	8,868
Adjusted R-squared	0.175	0.123	0.293
	Panel B. NPL		
Delegated branches	0.030	0.017	0.031*
	(0.021)	(0.018)	(0.017)
Access points	-0.021*	0.007	-0.017*
	(0.011)	(0.009)	(0.009)
Delegated branches×Access points	-0.009*	-0.006	-0.011**
	(0.005)	(0.004)	(0.005)
Other banks' delegated branches	-0.005	-0.012	0.007
	(0.014)	(0.010)	(0.012)
Other banks' access points	-0.065	0.011	-0.096**
	(0.055)	(0.036)	(0.047)
Accrued income from loans	-0.201***	-0.105***	-0.134***
	(0.015)	(0.015)	(0.013)
Obs.	8,289	6,681	8,407
Adjusted R-squared	0.320	0.122	0.292
Adjusted R-squared	0.320	0.122	0.292

This table presents estimated results for model 2. In all regressions, a constant term as well as bank, market and time fixed effects are included but not reported. Robust standard errors are presented in parentheses. Panels A and B show results for regressions with *Ln(loans)* and *NPL* as the dependent variable, respectively. Columns (1)-(3) show results with total loans, corporate loans, and personal

loans, respectively. *Delegated branches* and *Access points* are the natural logarithm of the number of delegated branches and access points of each bank in each market, respectively. *Other banks' delegated branches in the market* and *Other banks' access points in the market* are the natural logarithm of the number of delegated branches and access points of other banks in each market, respectively. *Accrued income from loans* is the ratio of accrued income from issued loans to the sum of accrued and overdue income from issued loans of a bank in a market. $*$, $**$, and $***$ denote 10%, 5%, and 1% significance level, respectively.

Table 4. Effects of access point dispersion under the full centralization at bank level

	Loans/TA			**NPL**		
	Total	*Corporate*	*Personal*	*Total*	*Corporate*	*Personal*
	(1)	(2)	(3)	(4)	(5)	(6)
Completed time	0.040	0.021	0.020	0.074	-0.002	0.080*
	(0.062)	(0.044)	(0.048)	(0.049)	(0.031)	(0.045)
$Dispersion^{access\ points}$	0.068***	0.041	0.027**	-0.051**	-0.029	-0.025*
	(0.023)	(0.025)	(0.010)	(0.024)	(0.019)	(0.013)
Completed time× $Dispersion^{access\ points}$	0.003	0.004	-0.001	-0.017*	-0.003	-0.015*
	(0.014)	(0.013)	(0.010)	(0.010)	(0.006)	(0.008)
Other banks' delegated branches	0.151	0.085	0.064*	-0.037	0.030	-0.064
	(0.139)	(0.118)	(0.036)	(0.055)	(0.031)	(0.053)
Other banks' access points	0.841*	0.520	0.294**	-0.186	0.017	-0.245
	(0.482)	(0.401)	(0.138)	(0.188)	(0.145)	(0.172)
Wholesale funding	0.071	0.128	-0.062	0.212	-0.221	0.553***
	(0.211)	(0.273)	(0.142)	(0.220)	(0.138)	(0.178)
Provisions	0.253*	0.253**	0.004	1.073***	0.799***	0.245
	(0.129)	(0.107)	(0.103)	(0.206)	(0.264)	(0.197)
Deposits/Assets	0.529***	0.378***	0.150*	-0.131	-0.033	-0.095
	(0.106)	(0.125)	(0.073)	(0.090)	(0.069)	(0.061)
Size	0.037	0.048	-0.011	-0.027	0.000	-0.030
	(0.033)	(0.053)	(0.028)	(0.029)	(0.022)	(0.020)
Equity/Assets	0.088	0.056	0.030	-0.074	-0.069	-0.010
	(0.086)	(0.104)	(0.045)	(0.098)	(0.091)	(0.081)
Obs.	717	718	718	696	702	701
Adjusted R-squared	0.421	0.361	0.376	0.543	0.411	0.387

This table presents estimated results for the examination of the effects of access point dispersion at bank level when banks close all delegated branches. In all regressions, a constant term, and bank and time fixed effects are included, but not reported. Robust standard errors are presented in parentheses. The dependent variables in Columns (1)-(6) are $Loans^{total}/TA$, $Loans^{corporate}/TA$, $Loans^{personal}/TA$, NPL^{total}, $NPL^{corporate}$, and $NPL^{personal}$, respectively. $Loans^{corporate}/TA$, $Loans^{personal}/TA$, and $Loans^{total}/TA$ are the ratios of loans granted to firms, to individuals and total loans over total assets, respectively. $NPL^{corporate}$, $NPL^{personal}$, and NPL^{total} are the ratios of non-performing loans granted to firms, to individuals, and total non-performing loans over total loans, respectively. $Dispersion^{access\ points}$ is the dispersion of branches without balance sheets. *Completed time* is equal to 1 for quarters since the banks complete fully centralized consolidation, and 0 for quarters before that. *Wholesale funding* is the ratio of deposits from non-bank financial institutions to total funding from customers. *Size* is the natural logarithm of

total assets. *Equity/Assets* is the ratio of total equity to total assets. *Deposits/Assets* is the ratio of total deposits to total assets. *Provisions* is the ratio of loan loss provisions to total assets. *Other banks' delegated branches* and *Other banks' access points* are the natural logarithms of the number of delegated branches and access points of other banks, respectively. $*$, $**$, and $***$ denote 10%, 5%, and 1% significance levels, respectively.

Table 5. Effects of access point network under the full centralization at bank-region level

	Ln(loans)			**NPL**		
	Total	*Corporate*	*Personal*	*Total*	*Corporate*	*Personal*
	(1)	(2)	(3)	(4)	(5)	(6)
Completed time	-1.360***	-2.284***	-1.526***	-0.008	-0.049	-0.033
	(0.347)	(0.545)	(0.366)	(0.026)	(0.032)	(0.032)
Access points	0.703***	0.987***	0.667***	-0.004	-0.001	-0.001
	(0.147)	(0.206)	(0.139)	(0.014)	(0.013)	(0.007)
Access points× Completed time	0.280**	0.532***	0.277**	0.009	0.026	0.018
	(0.112)	(0.157)	(0.125)	(0.010)	(0.016)	(0.019)
Other banks' delegated branches	-0.555**	-0.765*	-0.311*	0.013	-0.023	0.034**
	(0.240)	(0.401)	(0.167)	(0.020)	(0.019)	(0.014)
Other banks' access points	0.559	0.279	-0.448	-0.041	-0.001	-0.101*
	(0.547)	(0.779)	(0.461)	(0.067)	(0.062)	(0.058)
Accrued income from loans	1.140***	1.756***	0.104	-0.241***	-0.188***	-0.087***
	(0.204)	(0.309)	(0.169)	(0.024)	(0.025)	(0.015)
Obs.	4,679	4,570	4,679	4,260	4,211	4,460
Adjusted R-squared	0.240	0.213	0.453	0.306	0.210	0.232

This table presents estimated results for the examination of the effects of access point dispersion at the bank-region level when banks close all delegated branches in the region. In all regressions, a constant term as well as bank, market and time fixed effects are included but not reported. Robust standard errors are presented in parentheses. The dependent variables in Columns (1)-(6) are $Ln(loans^{total})$, $Ln(loans^{corporate})$, $Ln(loans^{personal})$, NPL^{total}, $NPL^{corporate}$, and $NPL^{personal}$, respectively. $Ln(loans^{corporate})$, $Ln(loans^{personal})$, and $Ln(loans^{total})$ are the natural logarithm of corporate loans, personal loans, and total loans, respectively. $NPL^{corporate}$, $NPL^{personal}$, and NPL^{total} are the ratios of non-performing loans granted to firms, to individuals, and total non-performing loans over total loans, respectively. *Completed time* is equal to 1 for quarters after the banks complete fully centralized consolidation in a market, and 0 for quarters before that. *Access points* is the natural logarithm of the number of access points of each bank in each market. *Other banks' delegated branches in the market* and *Other banks' access points in the market* are the natural logarithms of the number of delegated branches and access points of other banks in each market, respectively. *Accrued income from loans* is the ratio of accrued income from issued loans to the sum of accrued and overdue income from the loans issued by a bank in a market. $*$, $**$, and $***$ denote 10%, 5%, and 1% significance levels, respectively.

Table 6. Effects of access point dispersion in the presence of the geopolitical conflict

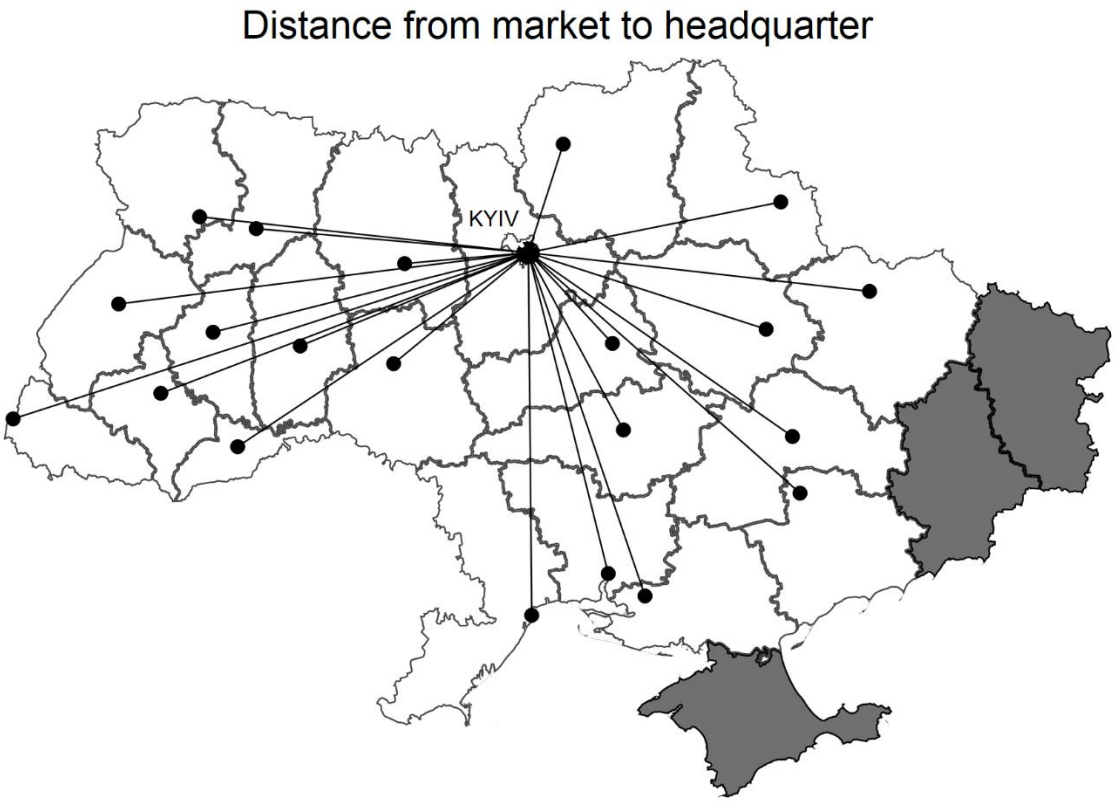
	Loans/TA			**NPL**		
	Total	*Corporate*	*Personal*	*Total*	*Corporate*	*Personal*
	(1)	(2)	(3)	(4)	(5)	(6)
$Dispersion^{access\ points}$	-0.007	-0.011	0.004	0.012	0.016	-0.007
	(0.014)	(0.011)	(0.007)	(0.016)	(0.012)	(0.008)
Conflict	0.314**	0.422***	-0.108**	-0.029	-0.045	0.036
	(0.139)	(0.136)	(0.040)	(0.066)	(0.067)	(0.053)
Share×Conflict	-1.579***	-0.992	-0.576**	1.368***	0.874**	0.485**
	(0.569)	(0.591)	(0.211)	(0.443)	(0.345)	(0.214)
$Dispersion^{access\ points}$ ×Conflict	0.020*	0.014	0.006	-0.014**	-0.005	-0.008*
	(0.010)	(0.012)	(0.004)	(0.006)	(0.006)	(0.004)
$Dispersion^{access\ points}$ ×Share×Conflict	0.219**	0.121	0.096***	-0.257***	-0.169***	-0.090**
	(0.096)	(0.099)	(0.034)	(0.076)	(0.059)	(0.034)
Other banks' delegated branches	0.311**	0.403***	-0.091**	-0.064	-0.031	-0.023
	(0.142)	(0.131)	(0.043)	(0.066)	(0.061)	(0.044)
Other banks' access points	0.073	0.065	0.012	-0.263***	-0.235***	-0.007
	(0.095)	(0.103)	(0.032)	(0.079)	(0.072)	(0.056)
Wholesale funding	0.007	0.016	-0.004	0.051	-0.076*	0.125*
	(0.114)	(0.109)	(0.021)	(0.064)	(0.039)	(0.071)
Provisions	-0.310	-0.157	-0.145	1.536***	1.192***	0.506
	(0.314)	(0.244)	(0.226)	(0.228)	(0.322)	(0.417)
Deposits/Assets	-0.066	-0.152	0.088**	-0.210***	-0.155***	-0.070*
	(0.113)	(0.136)	(0.038)	(0.056)	(0.049)	(0.039)
Size	0.032	0.039	-0.006	-0.059	0.046**	-0.105***
	(0.033)	(0.043)	(0.020)	(0.039)	(0.021)	(0.037)
Equity/Assets	0.094	-0.047	0.138*	-0.281**	-0.086	-0.202**
	(0.135)	(0.135)	(0.069)	(0.131)	(0.094)	(0.091)
Obs.	402	402	403	402	389	403
Adjusted R-squared	0.158	0.191	0.455	0.555	0.447	0.448

This table presents estimated results for the examination of the effects of dispersion of access points in the presence of the exogenous shock to banks' branch networks. Regressions are estimated at bank level. In all regressions, a constant term as well as bank and time fixed effects are included but not reported. Robust standard errors are presented in parentheses. The dependent variables in Columns (1)-(6) are $Loans^{total}/TA$, $Loans^{corporate}/TA$, $Loans^{personal}/TA$, NPL^{total}, $NPL^{corporate}$, and $NPL^{personal}$, respectively. $Loans^{corporate}/TA$, $Loans^{personal}/TA$, and $Loans^{total}/TA$ are the ratios of loans granted to firms,

to individuals and total loans over total assets, respectively. $NPL^{corporate}$, $NPL^{personal}$, and NPL^{total} are the ratios of non-performing loans granted to firms, to individuals, and total non-performing loans over total loans, respectively. *Conflict* equals one for quarters since 2014 Q1, zero otherwise. *Share* is the share of access points in Crimea, Donetsk, and Luhansk as of 2014 Q1. *Dispersion of access points* is the dispersion of branches without balance sheets. *Wholesale funding* is the ratio of deposits from non-bank financial institutions to total funding from customers. *Size* is the natural logarithm of total assets. *Equity/Assets* is the ratio of total equity to total assets. *Deposits/Assets* is the ratio of total deposits to by total assets. *Provisions* is the ratio of loan loss provisions to total assets. *Other banks' delegated branches* and *Other banks' access points* are the natural logarithms of the number of delegated branches and access points of other banks, respectively. $*$, $**$, and $***$ denote 10%, 5%, and 1% significance level, respectively.

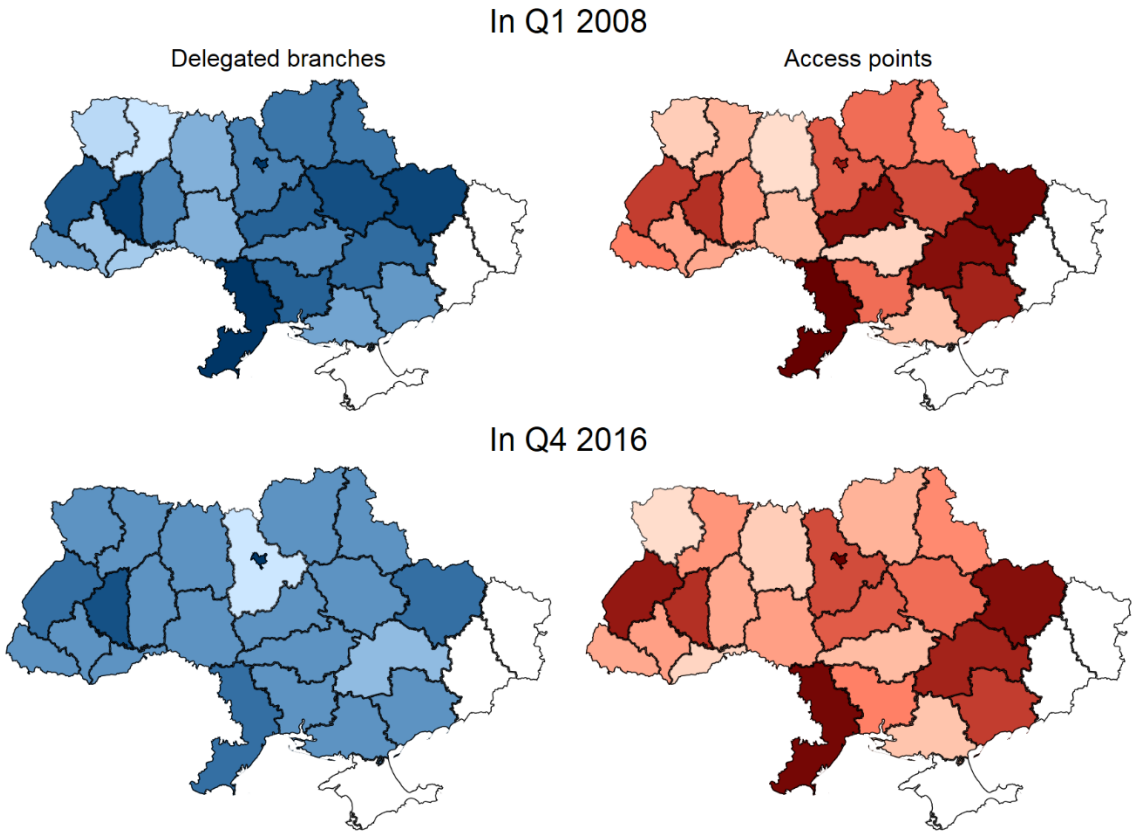
Figures

Figure 1. Distance from a region to Kyiv



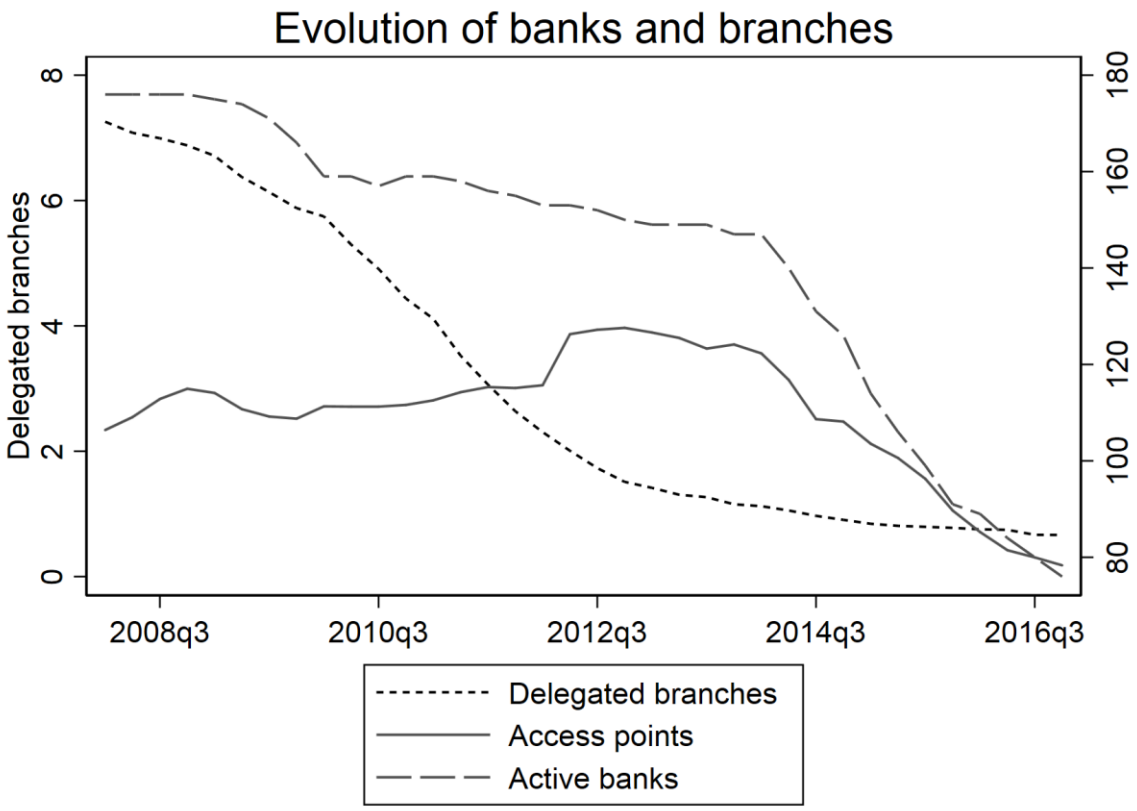
This figure shows the distance between each regional centre to Kyiv city which is the proxy of the region (local market) – headquarter distance. The darker regions are the conflict regions (Crimea, Luhansk, and Donetsk).

Figure 2. Distribution of delegated branches and access points across Ukrainian regions



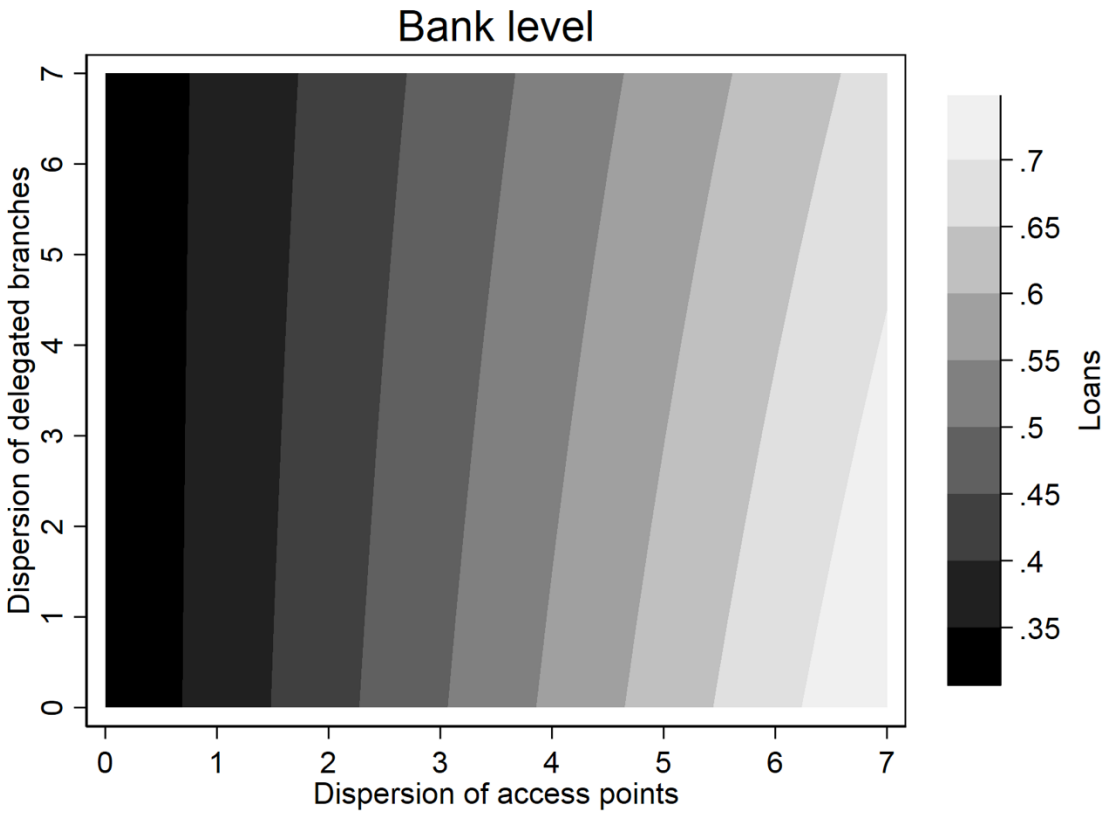
This figure shows the distribution of delegated branches and information-collecting branches across regions over time. The darker shades show the higher intensity of branches.

Figure 3. Evolution of branches by types over time



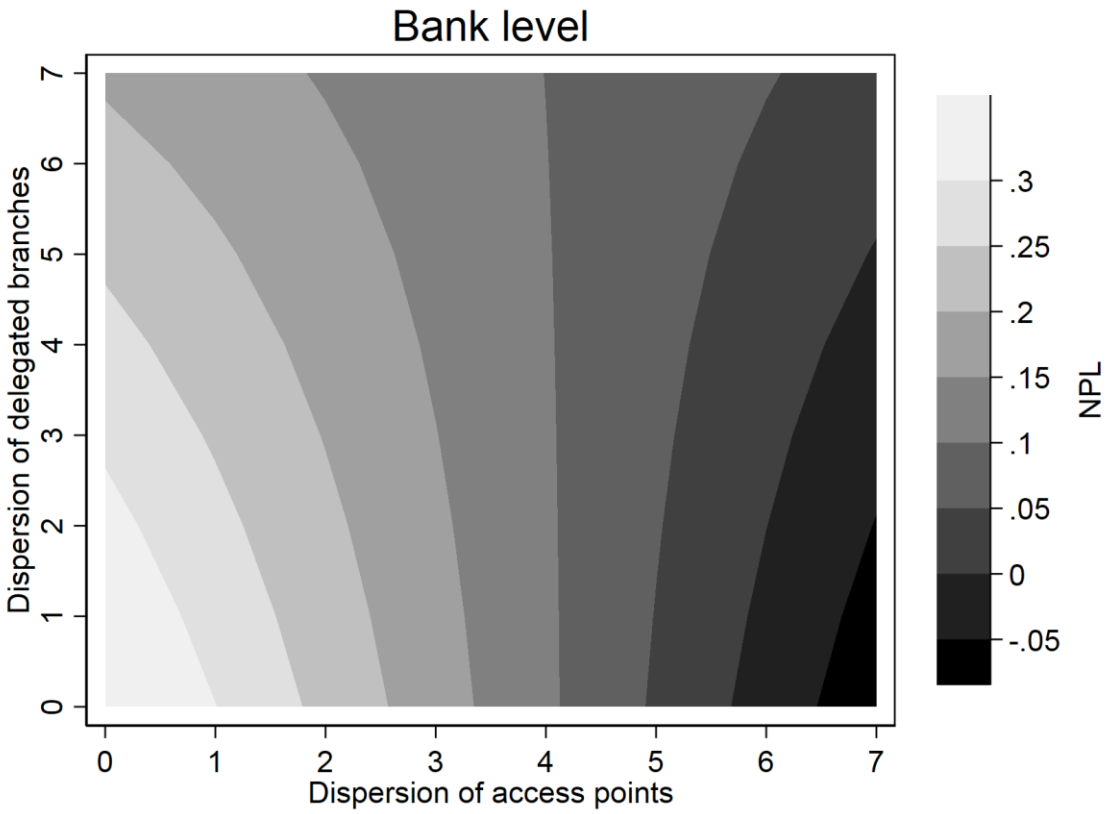
This figure shows the average number of delegated branches and access points of multimarket banks over time.

Figure 4.



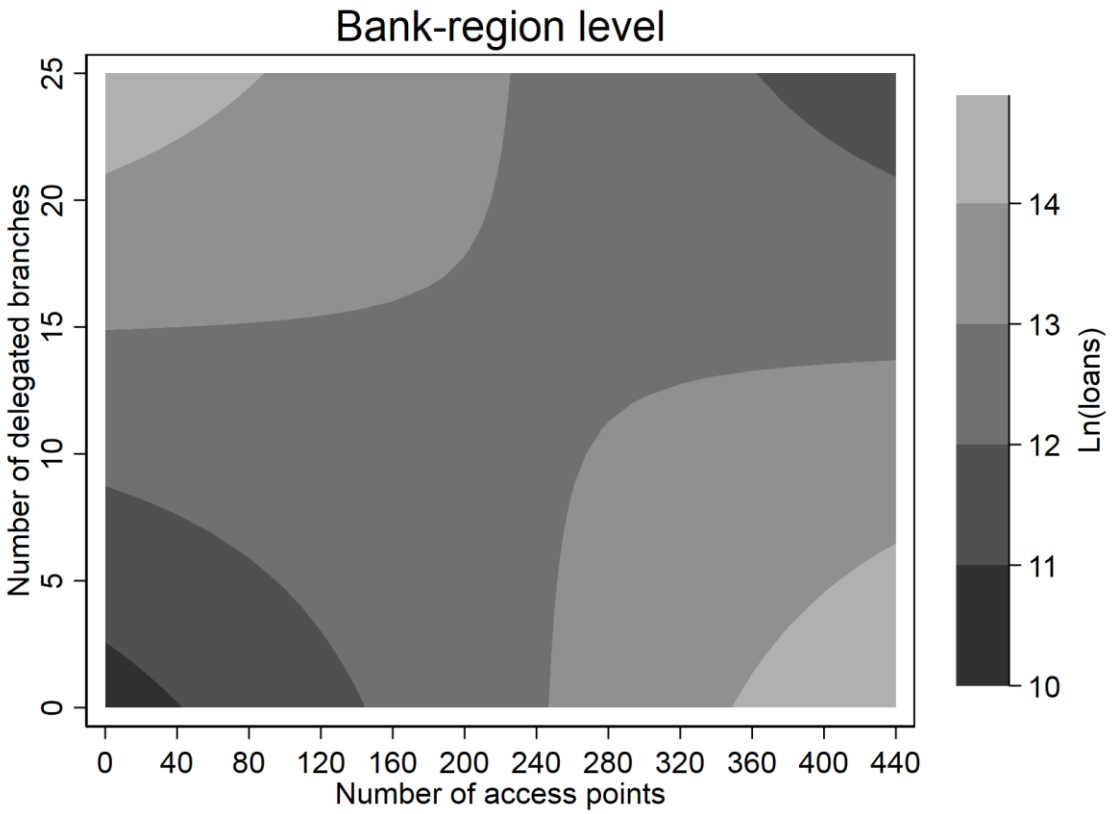
This figure shows the marginal effects of the dispersion of delegated branches and access points on predicted $Loans^{total}/TA$.

Figure 5.



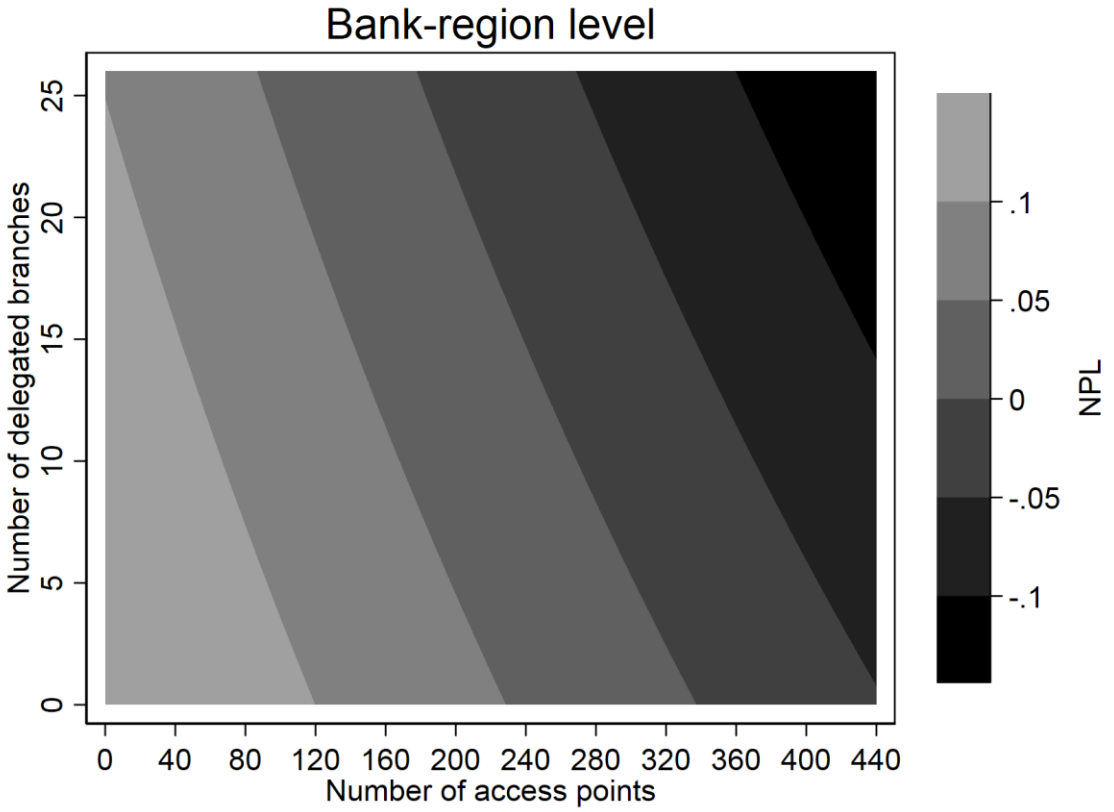
This figure shows the marginal effects of the dispersion of delegated branches and access points on predicted NPL^{total} ratio.

Figure 6.



This figure shows the marginal effects of the number of local delegated branches and access points on predicted $Ln(loans^{total})$.

Figure 7.



This figure shows the marginal effects of the number of local delegated branches and access points on predicted NPL^{total} ratio.