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REGIONAL VARIATIONS OF BANKING SERVICES AND POVERTY REDUCTION: EVIDENCE FROM SUBDISTRICT LEVEL ADMINISTRATIVE DATA OF BANGLADESH

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Abstract

While the role of commercial banks in financing economic growth and reducing poverty and income inequality is well documented in cross-country setup, the regional variations of the banking services within a country and its association with poverty reduction is understudied. Understanding of the local-level variations of banking services is essential for deeper understanding of financial inclusion and its impact on local-level poverty. To this end, we first shed light on the regional variations of a host of banking variables by creating a "banking atlas" using administrative data that captures the access to and use of banking services at the sub-district level in Bangladesh. The maps, uncovering interesting regional peculiarities, have the potential to be an important policy tool for targeting lagging regions and designing customized regional interventions in developing countries. Next, we link regional mapping of banking variables to the incidence of poverty using descriptive statistics and regression models. The regression results demonstrate that access to banking services is strongly associated with poverty reduction, even in the rural sample. However, in the case of use of banking services, the amount of deposit has a strong impact on poverty reduction but the amount of credit per adult is found to have no significant impact. These results corroborate the growing evidence that greater access to deposit services can promote saving and increase income. This study also highlights the importance of using administrative data to monitor local-level development.

Keywords: banking maps, financial inclusion, regional targeting, poverty reduction, Bangladesh

JEL Classification: O16, I32, G21

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1. INTRODUCTION

There is ample cross-country evidence suggesting that access to financial services helps promote economic growth and reduce poverty and inequality (Beck et al. 2000; Levine 2005). Moreover, the impact of financial development on poverty reduction has been found to work through both growth and income inequality channels (Beck et al. 2007a).[1] The extent to which economic growth helps reduce income inequality and poverty largely depends on how inclusive the financial system is in a country. That is, the growth effect of financial development becomes pro-poor when the financial system is inclusive—poorer people have access to a wide range of quality financial services (World Bank 2014). While this cross-country understanding of the linkages among growth, financial inclusion, poverty, and income inequality is essential for generalization of findings, within-country studies are particularly important for designing policies and interventions. In this study we argue that a country-specific analysis of financial inclusion remains incomplete without deeper understanding of its spatial aspect. We particularly focus on the spatial distribution of banking services in Bangladesh. This understanding is critical for the policymakers and development practitioners to target the regions with poor penetration of financial services and to craft policy accordingly.

Financial inclusion measured at the country level masks important regional facts and thus making policy based on these aggregated figures might be counterproductive. While the household surveys provide information on the share of poor people having access to different types of formal and informal financial services, this information may not be very useful in designing customized regional interventions since they may not be representative at the lower administrative level. We argue that having detailed maps of the financial services using administrative data at the lower administrative level is important to capture their local-level characteristics and peculiarities. Our study, using a unique administrative data of commercial banks, captures the regional variations of different types of banking services at the sub-district level and relates them to the regional pattern of incidence of poverty in Bangladesh.

Understanding of the local-level heterogeneity of the well-being of people and their potential causes has significant bearing on designing effective and customized tools for interventions (Alam and Iqbal 2016). The success of the geographical targeting critically hinges on the extent we can collect reliable information at the lowest possible administrative unit of a country (Baker and Grosh 1994). Hence, knowledge about spatial distribution of the key development indicators and their co-variates is essential for policy makers and development practitioners. The current discourse on financial inclusion and its impact on reducing poverty and income inequality in developing countries alarmingly lacks the understanding of the regional realities. This is important because national level, top-down planning may overlook regional characteristics that warrant special attention. Local governments can also use these tools for better local planning and budgeting. This study, therefore, is an important contribution to the literature of spatial dimension of financial inclusion and its association with poverty reduction.

In this study we have used a unique administrative data set of major banking variables at the sub-district level on number of branches, number of accounts, amount of deposits, and amount of credit with the breakdown of private and public branches. The richness of data helps us identify regional variations of two important dimensions of financial

[1] Beck et al. (2007) decomposes the growth and inequality channels through which financial development impacts poverty reduction. It shows that 40% of the impact comes from reduction of inequality and the remaining 60% is the result of growth effect.

inclusion—outreach and use (Beck et al. 2007b; Beck et al. 2008). While the number of branches per square kilometer captures the extent of outreach at the level of geographical unit, the number of bank accounts per adult person captures it at the individual level. The extent of use of banks' financial services is captured by the amount of bank deposits and credit per adult person. For better visual illustration, we have created a 'banking atlas' for the banking variables at the sub-district level for the years 2010 and 2015. While this atlas is a collection of 48 maps covering a wide range of banking variables, we use only four sets of relevant maps in this study.

Next, we link the sub-district level variations of access and use of banking variables to the regional variations of poverty level. We do so first by inspection of maps of banking variables and incidence of poverty as well as the scatter plots of these two variables. With some initial understanding of their association, we then run regression models to draw more robust inference, controlling for a host of confounding factors at the sub-district level. Note that the latest sub-district wise poverty data is available for 2010 and therefore, this part of our analysis is based on 2010 data only.[2]

There are two sets of interesting results on – (i) the spatial distribution of outreach and use of banking services, and (ii) their association with poverty level at the sub-district level. A number of observations on regional variations of banking services are worth noting. First, while the outreach of branches in terms of their geographical density and account per adult in a sub-district has increased substantially over the period 2010–2015 for the whole country, the rate of increase is much higher for the rural areas. And this growth is largely due to growth in branches and accounts of the private banks. For example, both the average number of branches per square kilometer and number of accounts per adult of private banks has increased three-fold in rural areas for the period 2010–2015 compared to a very moderate nation-wide increase. Similarly, with regard to use of banking services, both deposits and credit per adult person in a sub-district have increased two-fold, with a greater rate of increase for the rural regions in the period of 2010–2015.

Second, low outreach (branch penetration and account per adult) is found in Chittagong Hill Tracts, parts of the southern area (around Sundarban), some patches of the north (previously Monga affected area[3]) and the *haor* areas. This matches very well with the most poverty-stricken areas of Bangladesh when we juxtapose banking maps with the poverty maps. This indicates that administrative data on access and use of financial services can well complement the household surveys for regional targeting of poverty. However, while in most of the cases the poverty-stricken areas, such as Kurigram, Gaibandha, and Jamalpur in the north and Satkhira, Khulna, and Bandarban in the south, match very well with the low outreach and use of banking services, there are areas where both the incidence of poverty and the level of banking services are high. Further, some poverty pockets are not necessarily the areas with very low banking services. These are the interesting cases which require rapid appraisal of these pockets by the policy makers and the development practitioners.

Third, if we divide the country equally by a horizontal line, we observe that the southern part of the country saw much higher proliferation of the number of bank accounts in the period of 2010–2015. This is interesting because we do not see such patterns for the branch density. It implies that the number of accounts per branch has grown at a much faster rate in the south than in the north in this period. Similarly, more areas of the

[2] Though the last round of HIES was conducted in 2016, it has not been made available to the researchers.

[3] "Monga" is a local term which refers to the famine-like situation that used to occur in lean seasons in the northwest part of the country.

southern part have higher amounts of deposit per adult than the northern part.[4] We do not observe such pattern for the amount of credit per adult. Greater remittances from internal and external migration may have contributed to higher number of bank accounts and amount of deposits. These findings of higher growth of bank accounts and deposits in the south have profound implications on our understanding of the spatial distribution of incidence of poverty in Bangladesh. The discourse on regional distribution of poverty has been centered around the "east–west" divide (Shilpi 2008), implying that eastern part of the country is better off than the western part. These findings shed new light on this debate, indicating that this divide may have become indistinguishable.

Regression results show that outreach, captured by number of branches in 10 square kilometers and number of accounts per adult, has a strong negative association with both extreme and moderate poverty, even in the rural sample. Though we could not use any exogenous variations of branch placement to ensure robust causal inference, our choice of control variables and rural sample helps avoid omitted variable biases, to some extent. The choice of rural sample is motivated by two reasons. First, the current banking regulations requiring one rural branch in every five new urban branches provides some evidence of exogenous branch placement.[5] Second, within rural areas variations of economic development are less and thus the profit motive of branch placement is weaker in the rural sample. We found that an increase in number of bank branches in 10 square kilometers is found to be associated with a 13 percentage-point decrease in moderate poverty and seven percentage-point decrease in extreme poverty in the rural areas of a sub-district.[6] Similarly, an increase in one account per adult in a rural sub-district is associated with about a four and three percentage-point decrease in moderate and extreme poverty, respectively. In the case of use of banking services, we found that amount of deposit has a strong negative association with both moderate and extreme poverty, but not with amount of credit. Regression results are robust to the use of the average of banking variables of the neighboring sub-districts[7] as well as inclusion of an alternate set of controls.

The findings that access and deposits have strong negative association with incidence of poverty corroborate with the growing experimental evidence that suggests that access to payment and saving services have profound impact on variables such as saving, investment, and income (Ashraf et al. 2006; Dupas and Robinson 2013). Randomly given access to bank accounts has been found to increase expenditure on education and protein diets (Prina 2015).

Is our finding a remittance story? Remittance is argued to be one of the drivers of poverty reduction in Bangladesh (World Bank 2015), and it also promotes financial development (Aggarwal et al. 2011; Gupta et al. 2009). Remittances can impact poverty in two ways—directly and through financial development. By including proxy for remittance in our regression model, we take care of the first channel. The fact that the remittance variable loses significance when included with deposit variables lends support to the presence of the indirect effect of remittance through financial development. Anzoategui et al. (2014) also found that remittance has a positive impact

[4] Khalily et al. (2014) using nation-wide household survey found similar trends—Barisal and Khulna divisions in the south were found to have a greater increase in formal deposit.

[5] It is important to note that we cannot use exogenous branch placement due to change in banking regulations as in Burgess and Pande (2005). We do not have branch level data.

[6] Average number of bank branches in 10 square kilometers was 0.40 in rural sub-districts in 2010. Hence, one unit increase is about 2.5 times increase from the mean.

[7] Households may have bank accounts in the neighboring sub-districts. Therefore, incidence of poverty in a sub-district may also depend on the extent of bank penetration in the bordering sub-districts.

on the use of deposit accounts, but an insignificant effect on the demand and use of formal credit in El Salvador.

The literature on financial inclusion, especially with regard to the banking sector, and its impact on poverty and inequality in Bangladesh is very thin. There are two types of studies on financial inclusion—based on household survey and on aggregate data. While the former focuses on the access of a household to a wide range of financial services including credit, saving, and insurance by all types of financial institutions such as banks, MFIs, and informal sources, the latter documents basic descriptive statistics of supply of financial services of banks and MFIs using aggregated country-wide data. A country-wide household survey conducted in 2014 by the Institute of Microfinance (Khalily et al. 2014) shows that about 79% of households have access to financial services, while the access to formal financial services was limited to only 43%. This survey also sheds light on some divisional differences in access to and use of formal financial services, which match very well with our banking maps. Khalily and Khaleque (2013) find that greater access to credit has contributed to higher labor productivity and income. The Bangladesh Bank study (Islam and Mamun 2011), on the other hand, documents the role of Bangladesh Bank and provides a narrative how the outreach and access to banks have evolved over time.[8]

However, drawing robust causal inference of the impact of the access to banking service on poverty from observational household data or administrative data is challenging because of the selection bias. In the case of household-level data, a more capable person with entrepreneurial ability is more likely to borrow from the banks. As a result, a positive correlation between reduction of poverty (or increase in income) and use of banking services can be driven by the persons' unobserved characteristics. Similarly, in the case of administrative banking data, the banks will choose the developed areas for branch placement and therefore any observed association between bank branch and economic development (or poverty reduction) in a region can be due to the fact that the former responded to the latter, not the other way around. In order to avoid such problems, Burgess and Pande (2005) exploit the exogenous variations of government regulations to study the impact of banking service on poverty reduction. Between the 1970s and 1990s, India's bank branching regulations required banks to open four branches in unbanked locations for every new branch opened in an urban area. This led to the establishment of up to 30,000 rural bank branches, and the study provides direct evidence that this expansion of the bank branch network had a positive impact on financial inclusion and contributed to a considerable decline in rural poverty.

Similar results were found in Mexico by Bruhn and Love (2014), who identified the importance of the labor market through which access to greater financial services impacts poverty. This study exploits the opening of 800 branches of Banco Azteca in Mexico as a natural experiment and finds a sizable effect of access to finance on labor market activity and income levels, especially among low-income individuals.

Country-specific study on financial inclusion, particularly on banking services, using lower level administrative data is not very common, largely because these types of data are not publicly available. Our extensive search found only one such study on India—Bhandari (2009) —which, using state level variations of number of bank accounts, found that growth of bank accounts is not significantly associated with reduction of poverty.

[8] For a general overview of the financial inclusion in Bangladesh, see Mujeri (2015).

Our study is also related to the growing field experiments that provide more robust causal evidence on the impact of access to deposit services on saving behavior and other real variables.[9]

The rest of the paper is organized as follows. The second section describes the data collected and compiled for this study; section three describes the summary statistics and maps and draws some preliminary observations about the regional distribution of the banking variables; section four studies the association between the banking variables and poverty; section five specifies the regression models and describes the results; and section six draws conclusions.

2. DATA

2.1 Banking Sector Data

The Statistical Division of the Bangladesh Bank provides us with the sub-district level data on the formal banking sector. The electronic data stored in the Enterprise Data Warehouse of Bangladesh Bank does not cover the period before 2008. Therefore, the administrative data span from 2008–2015. We compiled data on number of bank branches, number of accounts, total deposits, and the amount of credit outstanding. All the variables are available with the breakdown of private and public banks. Private commercial banks and foreign commercial banks are grouped as private banks, while state-owned commercial banks and specialized banks are together termed as public banks.

In some cases, the names of the sub-districts provided by the Bangladesh Bank (BB) do not match the names published by the Bangladesh Bureau of Statistics (BBS). According to the 2011 Population Census, there were 544 sub-districts in Bangladesh and we follow this number and their respective geocode. For example, Bangladesh Bank data show that there is a sub-district called “EPZ” under Chittagong district. But according to BBS, there is no sub-district called EPZ. In fact, the EPZ is under the sub-district of Halishahar of Chittagong district, according to BBS. Similarly, there is no sub-district called Enayetpur under Sirajganj district; it is an area of Chowhali sub-district of Siranganj.

In some other cases, older names of sub-districts were used in Bangladesh Bank’s dataset. For example, Swarupkhati is the older name of the Nesarabad sub-district of Pirojpur district. Other mismatches between BB and BBS have occurred because of a few newly formed sub-districts after the 2011 Population Census. However, we strictly followed and the names and their composition of the 2011 Population Census. One advantage of using the 2011 Population Census is that we can pair this data with 2010 poverty estimates at the sub-district level perfectly.

2.2 Poverty Data

We use sub-district level poverty data of 2010 generated by WFP-BBS. We have poverty data for all 544 sub-districts.

[9] See Karlan and Morhuch (2010) for an extensive review.

2.3 Population Data

We use age-group wise total populations for all sub-districts from the Population Census 2011 of BBS. From the distribution of age-groups, we created the number of the population for all sub-districts above the age of 18. Note that the population data is available only in the census year of 2011. So, we extrapolate the population up to the year 2015 using the common national population growth rate for all sub-districts. We use this population variable to create a number of banking variables per adult, such as amount of deposits and credit per adult in a sub-district.

2.4 Rural–Urban Data

In any sub-district, there are unions and wards. We consider unions as the rural areas and wards as the urban areas. In the case of city corporations, the sub-district equivalent unit is Thana and a Thana is purely an urban area. Since we are interested in focusing on the rural areas, we exclude all city corporations (that is, all Thanas) and all sub-districts with Pourashava (that is, wards) to define a sub-district that is solely rural. These data are collected from District Statistics, 2011. There are 190 such rural sub-districts in Bangladesh.

2.5 Data on Other Control Variables

In the regression models we control for regional development for the rural sample only. Income from farm and non-farm activities, as well as foreign remittances, is the major source of growth of the rural income (World Bank 2015). We capture the extent of agricultural activities by cropping intensities. It is hard to come by any good proxy for non-farm income at the sub-district level. We use the length of paved road as a measure of economic activities, especially for the non-farm ones (Khandker et al. 2009). In the case of foreign remittances, there is no data available at the sub-district level. However, we calculated the number of remittance-recipient households at the district level from the Household Income and Expenditure Survey (HIES) 2010.[10] We consider the top ten districts with the highest share of remittance-recipient households and construct dummy variables for them.[11] So, we use a dummy variable if the district is among the top ten districts with remittance-recipient households. The rural areas of Bangladesh are vulnerable to natural disasters, such as river erosion, flood, cyclone, etc., and these events significantly impact the well-being of the rural people. In our study we control for river erosion, as it is the extreme manifestation of flood. District Statistics 2011 of BBS documents whether the sub-district experienced river erosion in 2010, 2009, and 2008. We find the sum of these three years and construct a variable that captures the number of years a sub-district experienced river erosion in the last three years. Hence, it takes the value of between 0 and 3. Note again that data on all these control variables at the sub-district level are compiled from District Statistics 2011, BBS, except for remittance-recipient districts.[12]

[10] Note that a large number of sub-districts were not covered by HIES 2010. Therefore, we choose to control the extent of remittance inflow at the district level.

[11] These districts are Noakhali, Lakhipur, Chittagong, Sylhet, Feni, Comilla, Dhaka, Tangail, Brahmanbaria, and Chandpur.

[12] Description of an alternate set of controls is provided in robustness check (section 6).

3. BANKING ATLAS: ACCESS AND USE OF BANKING SERVICES, 2010 AND 2015

The banking atlas is a collection of 48 maps on eight major banking variables for the years 2010 and 2015 at the sub-district level, with the breakdown of public and private banks. It has been prepared for the General Economics Division, Ministry of Planning, Government of Bangladesh to better target the lagging regions, particularly in terms of financial development. While detailed description of all maps is beyond the scope of our paper, we focus only on four major sets of variables—number of banks branches, number of bank account, amount of deposit, and amount of credit—which are sufficient to capture the outreach and use of banking services.

3.1 Number of Bank Branches

In 2010, a sub-district on an average had 14.43 branches, of which 8.96 were public and 4.16 were private branches (Table 1). Since then the average number of branches of private banks has increased faster than that of public branches. In 2015, the average number of branches in a sub-district increased to 16.83 with 9.34 public branches and 7.5 private branches.

In the case of the rural sample, which consists of 190 sub-districts, the average number of total, public, and private branches was 7.15, 5.63, and 1.52, respectively in 2010. The growth of the number of branches in rural areas also follows the pattern of the whole country—bank branches of private sector banks have increased at a faster rate than the public sector banks. In fact, the average number of public bank branches remained more or less constant at around 5.63–5.85 for the period 2010–2015. A rural sub-district had about 2.65 private bank branches in 2015 as compared to 1.52 in 2010.

The lower number of bank branches in rural areas, described above, can be due to the smaller size of rural sub-districts. Therefore, in order to account for size of the sub-district, we consider the average number of branches per square kilometer of the sub-districts. This captures the geographical concentration of the bank branches. In 2010, there were 0.72 branches per square kilometer of a sub-district. This figure increased to 0.86 in 2015. Put differently, there were 8.6 branches for every 10 square kilometers. Interestingly, the number of private branches per square kilometer was higher than that of public branches. In fact, number of public branches per square kilometer had been stagnant at around 0.26–0.27 since 2010, while the private branches per square kilometer had increased from 0.45 in 2010 to 0.59 in 2015. This trend follows from the fact that average number of public bank branches remained constant during this period, but the number of private sector banks has increased.

In the rural areas, there was one branch in 25 square kilometers in 2010 and this number increased to about one branch in 17 kilometers in 2015. In the case of public banks, the number remained constant at one branch in 33 kilometers for the period of 2010–2015. In the case of private banks, the situation improved from one branch in 100 square kilometers in 2010 to one bank branch in 33 kilometers. It also indicates that penetration of private branches has also increased, even in the rural areas.

Table 1a: Descriptive Statistics of the Banking Variables

Banking Variable per Sub-district	Full Sample (Country)		Rural Sample	
	2010	2015	2010	2015
Average number of branches	14.43	16.83	7.15	8.5
Public	8.96	9.34	5.63	5.85
Private	5.46	7.5	1.52	2.65
Average number of branches per km^2	0.72	0.86	0.04	0.06
Public	0.26	0.27	0.03	0.03
Private	0.45	0.59	0.01	0.03
Number of adult persons per branch	11,195	9,657	15,776	13,394
Public	18,016	17,414	20,040	19,450
Private	29,571	21,678	74,140	43,023
Number of bank accounts per adult person	0.69	1.04	0.53	0.72
Public	0.5	0.61	0.49	0.59
Private	0.2	0.43	0.04	0.13
Amount of bank deposits per adult person (thousand)	45	118	9	22
Public	17	41	6	12
Private	28	78	3	10
Amount of bank credit per adult person (thousand)	34	85	4	8
Public	10	20	3	5
Private	24	65	1	3

Source: authors' calculation.

Table 1b: Descriptive Statistics of Other Variables

Variable	Description	Observations	Mean	Standard Deviation
Lower poverty line	Share of population under lower poverty line in 2010	172	19.98	10.73
Upper poverty line	Share of population under upper poverty line in 2010	172	34.06	13.39
Occurrence of river erosion	The number of incidences of river erosion in last three years (2010, 2009, and 2008)	172	0.89	1.33
Cropping intensity	Total cropped area / Net cultivable area	172	173.46	36.54
Length of paved road	Length of paved road per square kilometer	172	0.002	0.001
Dummy: top remittance-recipient districts	Dummy variable if the sub-district belongs to the top ten remittance-recipient districts	172	0.19	0.39
Irrigation	Share of land under irrigation for paddy	170	0.33	0.24
Industry	Number of industrial units (Rice textile, jute, match, steel, and engineering, sugar, aluminum, others)	170	70.22	121.88
Migrant	Average number of international migrant workers per year from a sub-district for the period 2005–2017	170	815	1,190

Note: First six variables correspond to the regression sample of Table 1 and the following 3 variables correspond to Table 7.

We also consider the average number of adult persons who are above 18 years old per bank branch in a sub-district. This variable captures the concentration of branches in terms of adult population, indicating the size of potential market demand for bank services. On average, there was a branch of a commercial bank for about 11,000 adult persons in a sub-district in 2010. As the number of bank branches increased at a faster rate than the growth of adult population, the number of adult persons per branch decreased to 9.6 thousand in 2015. Since the number of public branches is higher than that of private in a sub-district, the number of people per branch was much lower for public banks than the private banks. In rural areas, on average, there was a branch of a commercial bank for about 20,000 adult persons in a sub-district in 2010 and about 13.4 thousand in 2015.

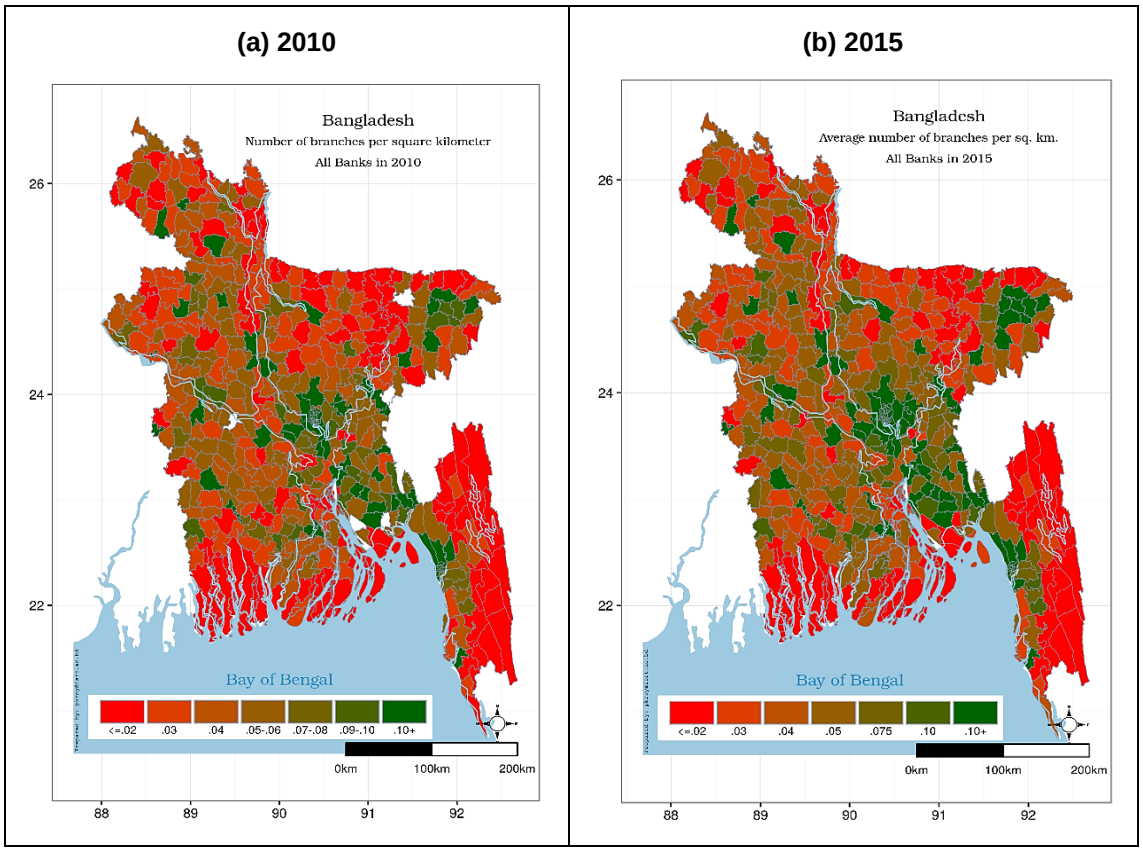
Vibrant rural economy, greater competition among the banks, aggressive banking by the new generation of private banks, as well as new banking regulations are argued to have contributed to the increase in number of banks' branches in rural areas. Currently banking regulations require that one in every five new branches has to be in a rural area and this has contributed to the number of rural branches of the private banks.

The figure on the left above (Figure 1a) shows the geographical distribution of bank branches per square kilometer at the sub-district level in the country for 2010. Several characteristics of the spatial distribution stand out. We observe comparatively low branch density in several parts of the country (the luminous red). While such areas were scattered throughout the country, several regions can be identified that had the least concentration of bank branches (less than or equal to 0.02 branches per km^2). These include the Chittagong Hill Tracts (CHT), parts of the southern region (parts of Satkhira, Khulna, Bagerhat, Barguna, Patuakhali, and Bhola) and portions of the north (including parts of Netrakona, Sunamganj, and Kishoreganj), especially the *haor* area. These districts are known as the poorest districts of the country.

On the other hand, the most concentration (more than 0.1 branches per km^2) was observed (dark green) broadly in the regions surrounding the capital Dhaka (Gazipur, Narayanganj), parts of Sylhet and Moulvibazar, and the western portion of Chittagong division including parts of Feni, Noakhali, Chandpur, and Chittagong district. All of these districts are rich districts except for Chadpur and Noakhali. But at the same time, there were also several pockets of regions with high branch densities located within areas that had generally much lower concentrations. Such pockets are more likely to exist in the eastern part (e.g., Rangpur, Bogra, Jessore) of the country than the western part. One such interesting sub-district is the Pirgonj of Rangpur district. This sub-district has very high outreach and use compared to its neighboring sub-districts. The rest of the country had a more moderate concentration, averaging in the range of 0.06 branches per km^2.

The figure on the right (Figure 1b) displays the same variable for the year 2015. Region-wise concentration of bank branches appears to have increased in some places, while generally staying more or less the same five years onwards. An increase in density can be seen in and around the capital and parts of Chittagong, regions that were also previously highly concentrated. Parts of Nawabganj, Rajshahi Jamalpur, and Patuakhali districts also witnessed increased branch densities. But the interesting feature is that regions that had the least concentration in 2010 were also similarly lagging behind in 2015. Thus, banking activities in the country tend to expand to and around the areas that are already highly concentrated.

Figure 1: Number of Branches per km^2



3.2 Number of Accounts

We capture the extent of banking penetration at the individual level by the number of bank accounts per adult person. Table 1 shows that there were 69 bank accounts for every 100 people in 2010 and this number has increased substantially to 104 accounts for every 100 people in 2015, signifying increasing availability of banking services. That is, in 2015, there were more bank accounts than the number of adult persons. At first look, this figure might seem too high to believe. This is plausible because the total number of accounts includes both deposit and credit accounts.[13] A study by Bangladesh Bank (Islam and Mamun 2011) shows that there were about 765 deposit accounts per 1,000 persons and 100 credit accounts per 1,000 persons in 2010. Note that this study uses total person as the denominator, not the number of adult persons, as in ours. Moreover, a person also can have multiple deposit accounts. Considering all these, in fact, ours is a more conservative figure.

Since 2010, Bangladesh Bank has been pursuing targeted policies to reach out the unbanked people. In January 2010, BB introduced No-Frill Accounts (NFAs) [14] by instructing banks to open NFAs for farmers. Commercial banks are now advised to open bank accounts for farmers for free with initial deposit of Tk10 only. These accounts are used for receiving subsidies. About Tk7 billion of diesel subsidies were

[13] Note that Bangladesh Bank data did not have the breakdown of deposit and credit account at the sub-district level.

[14] NFA is a basic banking account with no requirement of minimum balance. Charges applicable to such accounts are low and the services available to such account are also limited.

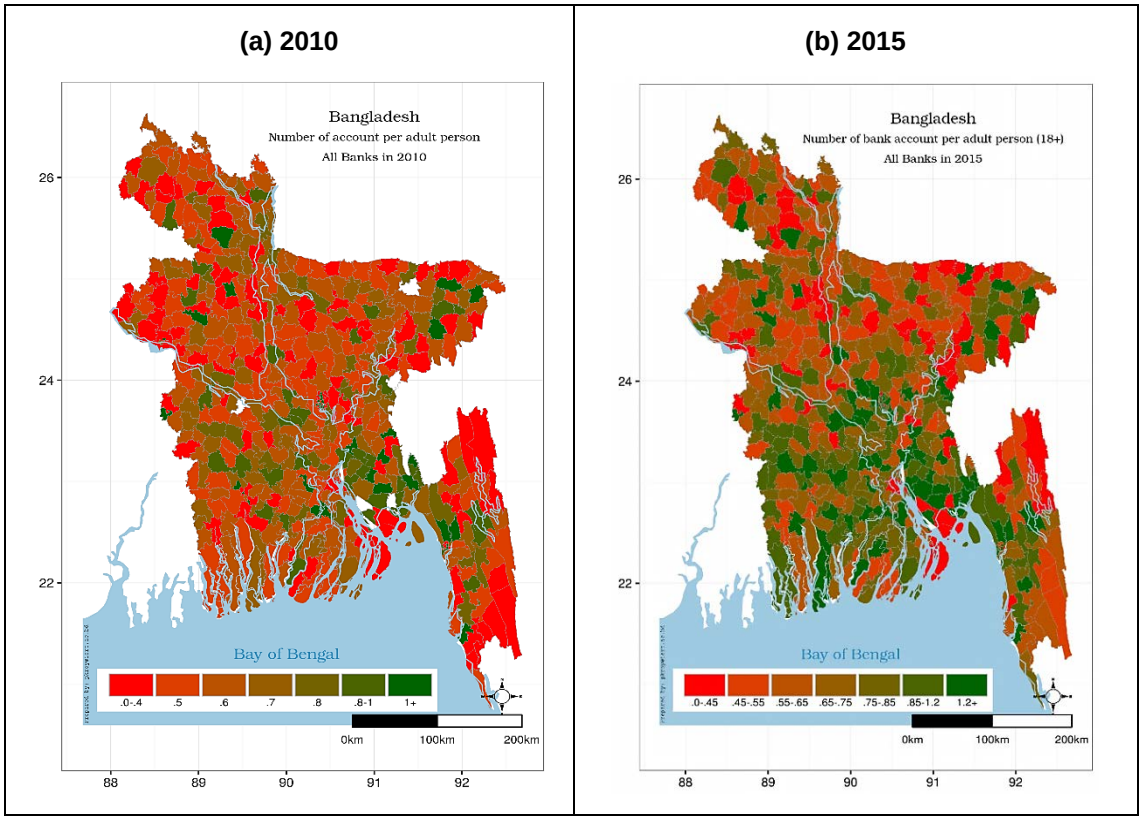
disbursed through these accounts. NFAs were made available for the underprivileged population, who remained excluded from financial services under the 15 categories. To get these accounts active, BB introduced a refinance scheme of $25.70 million (BDT 2 billion). Moreover, school banking and banking for street children were also introduced in this period, resulting in a sharp increase in the number of bank accounts in 2010–2015.

Table 1 shows that in rural areas there were about 53 bank accounts for every 100 adults in 2010 and this number increased to 72 in 2015. There had been a substantial increase in the number of private bank accounts, even in the rural areas during the period of 2010–2015.

The figure on the left (Figure 2a) shows the sub-district wise distribution of bank account per adult in 2010. The majority of the country corresponded to a concentration of less than or equal to 0.5 accounts per adult person, with the CHT and northern parts of the country having the lowest number of average bank accounts. Note that population density of CHT is also very low.

The largest number of account holdings, more than one account per adult on an average, can be observed in patches of areas in Dhaka, western parts of Chittagong division (including Chandpur, Feni, and Noakhali), parts of Chittagong and Rangamati, in and around Khulna district, in Noagaon and Joypurhat in the west, and in parts of Sylhet and Moulvibazar. A large number of sub-districts in the south also had a relatively high average of 0.8 accounts per adult. Several pockets of areas, with much higher number of bank account holdings than their surroundings, can also be found in many parts of the country, examples of which include parts of Dinajpur and Rangpur.

Figure 2: Number of Accounts per Adult



On the right (Figure 2b), we have the same distribution of bank account per adult, but updated for the year 2015. The first thing one can immediately notice is that the concentration of bank accounts per adult has increased significantly over the span of five years from 2010. In particular, the southern part of the country has witnessed substantial increases in the average number of bank accounts per adult person. Additionally, the patches of areas that were previously highly concentrated, not only saw their numbers increase further (from an average of more than one to greater than 1.2 accounts per adult) but the areas surrounding them also witnessed very large increases in concentration. This is particularly noticeable in the southern regions of Dhaka division, western parts of Chittagong division, parts of Chittagong and Rangamati districts, and parts of Sylhet and Moulvibazar. These are apparently booming regions of the country. In 2105, Motijheel, Dhaka had, on average, almost 24 accounts per adult, while the lowest account holding was observed in Gendaria, Dhaka (only 0.009 accounts per adult).

At the same time, major portions of both the Khulna and Barisal divisions experienced a significant increase in bank account concentration, from a low of about 0.4 accounts per adult to a high average of more than 1.2. The increase in the average number of accounts has been particularly significant in the districts of Satkhira, Bagerhat, Patuakhali, Jhalokathi, and Bhola in the south, and Jessore and Narail in the northern parts of Khulna. Similar patches of areas with increased growth in the number of accounts can also be observed in parts of the North, in particular in the districts of Noagaon, Joypurhat, Thakurgaon, and Nilphamari.

While we observe that the average number of bank account holdings per adult in a sub-district has generally increased in the country over the span of five years, the growth in number of accounts per adult has been largely skewed toward the southern parts of the country relative to the north. While the account holding concentration in the southern regions have markedly increased, the CHT regions are still relatively largely lagging behind. The *haor* regions of the northeast experienced some growth in accounts per adult while parts of the northern areas (previously Monga affected areas) of Kurigram and Gaibandha had seen more moderate increase.

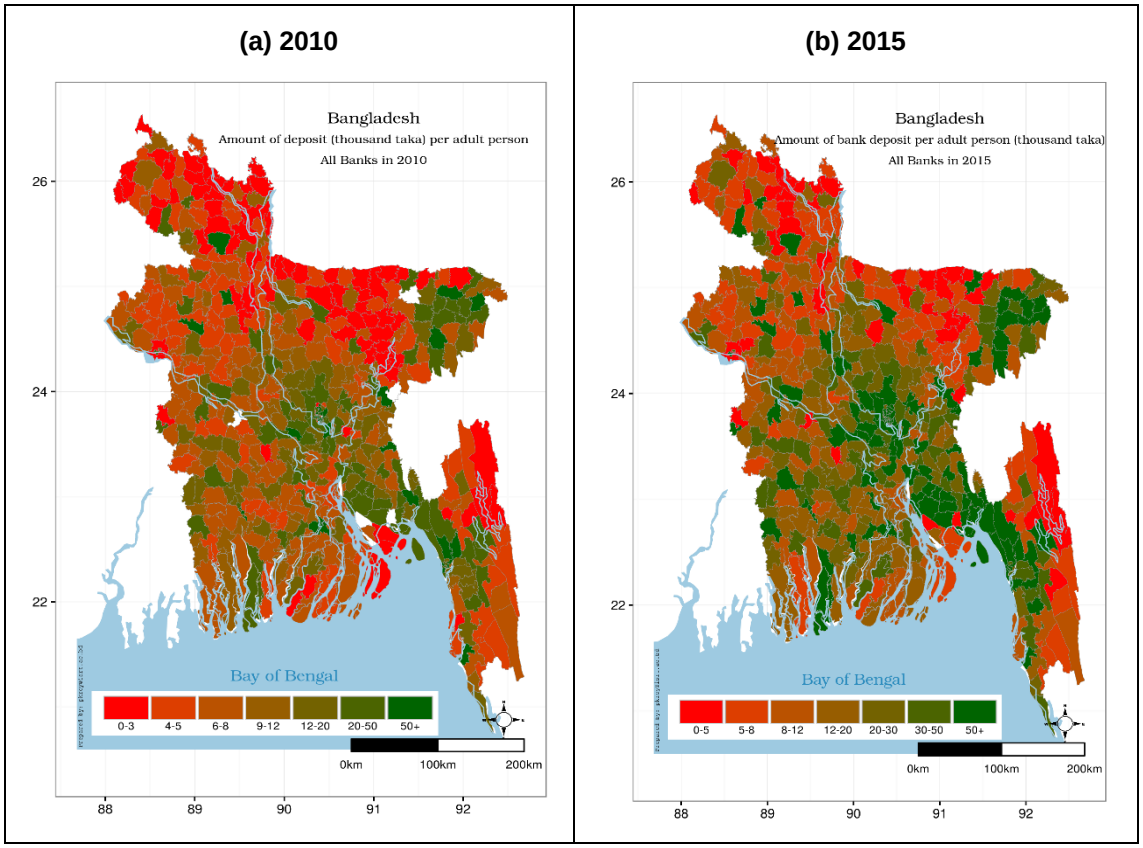
3.3 Bank Deposit

In order to capture the spatial distribution of bank deposit at the sub-district level, we consider the amount of deposit (thousand taka) per adult person. Table 1 shows that, on average, there were about Tk45,000 of deposits in 2010, which increased to Tk118,000 in 2015, registering about a 262% increase over a period of five years. The amount of deposits had increased substantially both in public and private banks in the period of 2010–2015. In the rural areas the amount of deposits per adult in a sub-district was about 9,000 in 2010 and 22,000 in 2015, experiencing about 50% increase per year in five years. While the amount of deposits in public banks doubled during the period 2010–2015, the amount of credit outstanding saw more than a three-fold increase in this period, signifying increased access to the credit market.

It has to be noted that a person can have a bank account in a sub-district that is different from his or her place of residence. This is more relevant for urban areas. In urban areas there are some business hubs where most of the branches are located. The substantial increase in deposits in rural bank branch indicates greater flow of money to the rural areas through the banking channels. Improvement in payment services, higher savings, and remittances, both domestic and international may have contributed to this increase in deposits.

The figure on the left (Figure 3a) shows the distribution of the average size of bank deposit (in thousand takas) per adult person at the sub-district level in the country for the year 2010. The majority portion of the country accounted for small sized bank deposits with an average deposit value of Tk1,500. The largest size of deposits per adult, greater than or equal to Tk50,000, are found to be concentrated in the regions of Sylhet and Moulvibazar in the North, Lakshmipur, Feni, and Chittagong in the south, and in the surrounding parts of the Dhaka district. All these districts have exhibited high remittance inflow.

Figure 3: Amount of Bank Deposits (thousand taka) **per Adult**



A general observation is that the northern parts of the country and parts of CHT have fared poorly in comparison to the south. While several regions of the south were in the highest deposit bracket (more than Tk50,000), the majority of the north corresponded to the lowest deposit size bracket (with an average of only Tk1,500). There are also some pockets of areas which have much larger average size of bank deposits compared to their neighboring areas, like parts of Bagerhat in the south and parts of Rangpur and Dinajpur in the north.

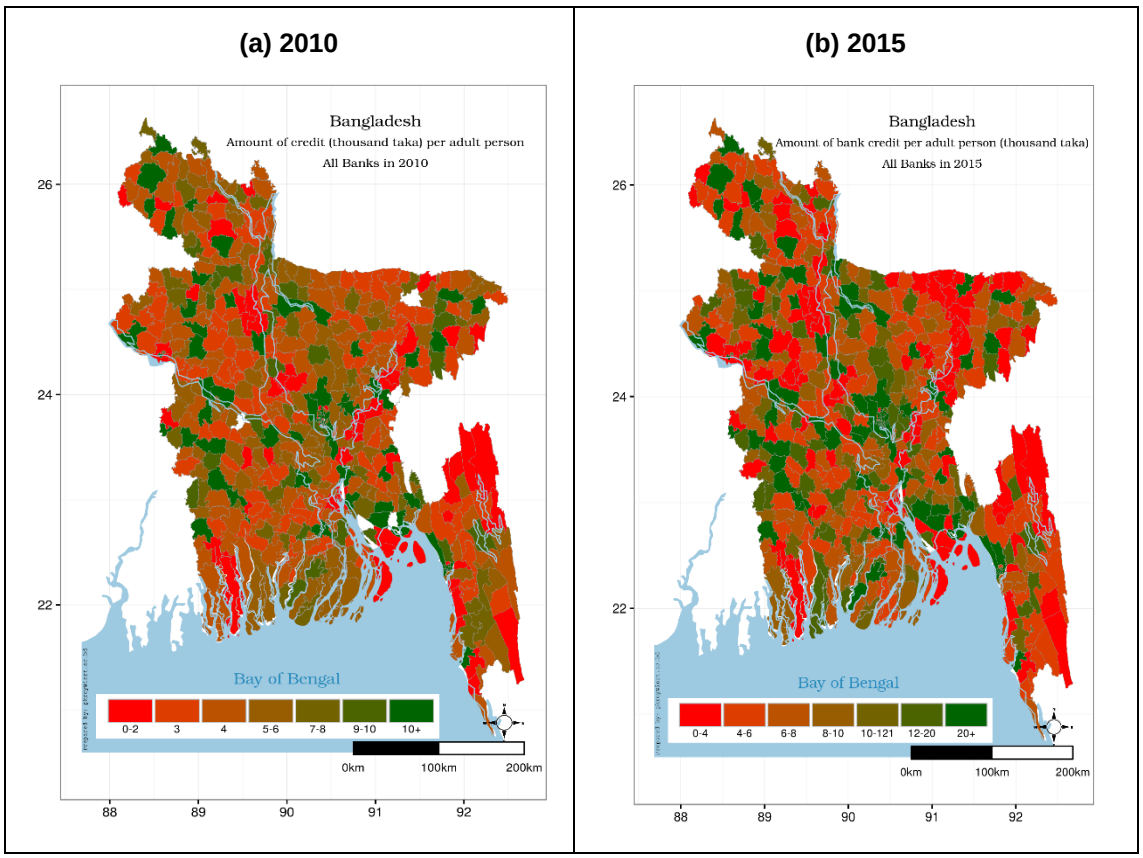
The figure (Figure 3b) displays the distribution of the size of bank deposits five years onward in 2015. It can be observed that while the size of deposits has increased in several parts of the country, the distribution of deposits by size have remained more or less the same. Size of bank deposits have increased with greater concentration in the regions of Sylhet, Moulvibazar, western parts of Chittagong division, the Chittagong district, and the surrounding regions of the capital Dhaka. Additionally, several regions of the South also witnessed an increased size of bank deposits per adult and in particular, parts of Narail and Gopalganj experienced large increase in average deposit size. From

2010 to 2015, while a general trend of increasing deposit size per adult can be observed throughout the country (the middle of the country has become greener and darker), the disparity in the size of deposits between the north and CHT and the southern regions have only attenuated a little over the course of five years. It is important to note that the nominal GDP has doubled over the last seven years and, other than in a few pockets, the benefit of growth seems to reach every corner of the country.

3.4 Bank Credit

The amount of bank credit per adult person captures the extent of use of banking services in a sub-district. In 2010, the amount of credit outstanding was Tk34,000 per adult person for all sub-districts. This amount increased by more than two-fold in 2015 to about Tk85,000. In the case of public banks, the amount of credit per adult person increased from about Tk10,000 in 2010 to about Tk20,000 in 2015. While the public sector credit increased two-fold, the credit of private banks saw a nearly three-fold increase in the period of 2010–2015. We observe similar pattern in rural areas. Growth of private banks' credit per adult person was faster than that of public sector banks.

Figure 4: Amount of Bank Credit (thousand taka) **per Adult**



Several initiatives by the Bangladesh Bank are worth noting. Bangladesh Bank has directed all private and foreign banks to disburse at least 2.5% of their total loan and advance as agricultural loan. There is also a penalty for not meeting the target. The banks are required to deposit the undisbursed amount for one year in BB at a 5% interest rate. Bangladesh Bank has opened up several innovative refinancing schemes for poor farmers and small and medium entrepreneurs. For example, a Tk5 billion refinancing line for landless sharecroppers and a Tk6 billion refinancing scheme for SMEs have been introduced. Women are given special priority in SME financing, as 15% of the fund was allocated for them.

The figure on the left above (Figure 4a) shows the distribution of bank credit by size in the country for 2010. While deposits are seen to be concentrated within some regions of the country, distribution of credit is found to be more scattered. Specifically, areas with the highest credit bracket (greater than Tk10,000) are found to be in greater proportion in the northern part of the country (compare this with the fact that deposits were generally more concentrated in the south). But still the majority portion of the country corresponded to a low average credit size, less than or equal to Tk3,000 per adult person.

Some of the regions with the highest credit sizes are found to be clustered in parts of Sylhet, Moulvibazar, western parts of Chittagong division, and parts of Jessore and Jhenadiah. The lowest credit sizes are observed in the CHT, the southern parts of Khulna and Barisal divisions, Sunamganj in the east, Nawabganj, Natore, and Bogra in the north.

The figure on the right (Figure 4b) displays the same variable for the year 2015. While the average size of bank credit has increased over the course of time, the region-wide distribution has stayed more or less the same. Regions which were previously in the highest credit bracket (more than Tk10,000) generally experienced positive growth and entered the new high bracket of greater or equal to Tk20,000. These regions include parts of Jessore and Jhenadiah in the west, Noagaon and Joypurhat in the north, the western parts of Chittagong division, and parts of Chittagong district. It indicates greater thrust in the growth of businesses in these areas during this period. Additionally, these regions also witnessed an increase in the average credit size of their surrounding areas, e.g., like Noagaon and Joypurhat in the north and Lakshmipur, Feni, and Chittagong in the south.

Parts of CHT, Noakhali, and Khulna in the south and Bogra and Rangpur in the north experienced little growth in size of credit, and hence their position remained almost unchanged. And since we are using a new larger credit bracket, and not all regions could maintain the same growth in average credit size, several regions of Sylhet and Sunamganj in the east, Rajshahi and Natore in the west, and Bandarban in the south were relegated to lower credit brackets in 2015. An interesting observation is that Bagerhat district in 2010 had an average credit size of only Tk5,500, but in 2015, its average had increased to Tk11,000.

4. ASSOCIATION BETWEEN ACCESS TO BANKING SERVICES AND POVERTY REDUCTION

We begin our analysis by comparing the sub-district level poverty maps produced by WB-WFP with the maps of the four banking variables we have created.[15] We observe from the poverty maps of Upper Poverty Line (UPL) and Lower Poverty Line (LPL) in

[15] We reproduced the sub-district level poverty maps in the Appendix. These maps are also available at the World Bank website. http://documents.worldbank.org/curated/en/916761468211763695/pdf/904870WP0WB0Po00Box385319B00PUBLIC0.pdf

2010 that the worst incidence of poverty is in the northern districts of Kurigram, parts of Gaibandha and Jamalpur, and in the southern regions of Barisal, Shariatpur, parts of Pirojpur, Bhola, and Chandpur districts. Additionally, several sub-districts of Mymensingh and Sylhet had large fractions of poor people as well. A more moderate level of poverty can be seen in Satkhira, Khulna, parts of Bagerhat and Bandarban in the south, and in parts of Rangpur and Dinajpur in the north. Magura, Gopalganj, and parts of Rajbari also had similar incidences of poverty. On the other hand, Bogra and Noagaon in the north, Meherpur and Kushtia in the west, and Noakhali and Chittagong in the south were the regions with the lowest poverty incidence in 2010.

First consider the variable of average number of bank branches per km^2, which captures the outreach of banking activity at the sub-district level in the country. We observe that the clusters of regions with the highest density of bank branches (parts of Sylhet and Moulvibazar, western parts of Chittagong division including Noakhali and Feni, the surrounding regions of Dhaka district, and major portions of Chittagong) also happen to be the regions with the lowest incidences of poverty. On the other hand, regions like Kurigram, Gaibandha, and Jamalpur in the north and Satkhira, Khulna, and Bandarban in the south, all of which have high incidences of poverty, are also found to have low concentrations of bank branches. It therefore appears that the branches of banks have been concentrated in the relatively well-off regions of the country.

In the case of number of accounts per adult person, we also find patterns of regional variations very much similar to that of bank branch density. The most well-off regions are found to have the largest average number of accounts per adult, while regions with a greater concentration of poverty usually have much lower average account holdings. But there are a few regions, like parts of Rangpur and Gopalganj, which have both high poverty incidence and high average number of accounts. The average size of bank deposits per adult also appears to be higher in the case of developed regions, while regions mired by poverty generally have lower average deposits. Take, for example, Bagerhat district, which had one of the lowest poverty incidences in 2010. The average size of bank deposits in Bagerhat in 2010 was in excess of Tk50,000 (our highest deposit slab). Turning to the case of the average size of bank credit per adult, we observe that the regions with the highest average credit size are more scattered across the country and not clustered in some areas (as in the case of deposits). But the general pattern we have found so far holds true here as well: affluent regions generally tend to have greater average credit size than the poverty-prone ones.

With all information taken together, we can summarize that the access and use of banking services are spatially negatively correlated with the incidence of poverty in sub-districts, with some pockets of exceptions.

Next, we plot lower and upper poverty lines against the four key banking variables for rural sub-districts only. All the figures show that most of the observations are vertically piled up in the vicinity of the origin. It implies that there is a wide variation in both extreme and moderate poverty for the same low level of banking variables. Let us take the example of the scatter plot of lower poverty line against number of branches per 10 square kilometers (Figure 5a). We see that most of the observations lie between 0 and 0.5 branches per 10 kilometers, and for the same number of branches the extent of poverty varies from 5% to 50%. It indicates that the correlation between poverty and concentration of branches is very weak for these observations. However, we also observe that the fitted line is negatively sloped, implying an inverse relationship between them.

Figure 5

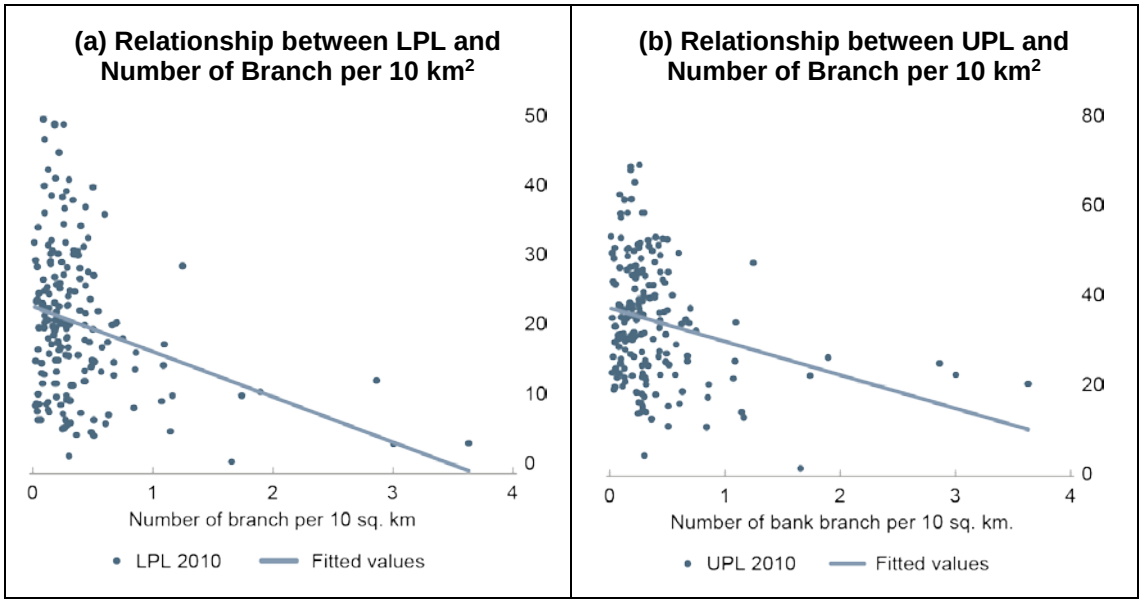


Figure 6

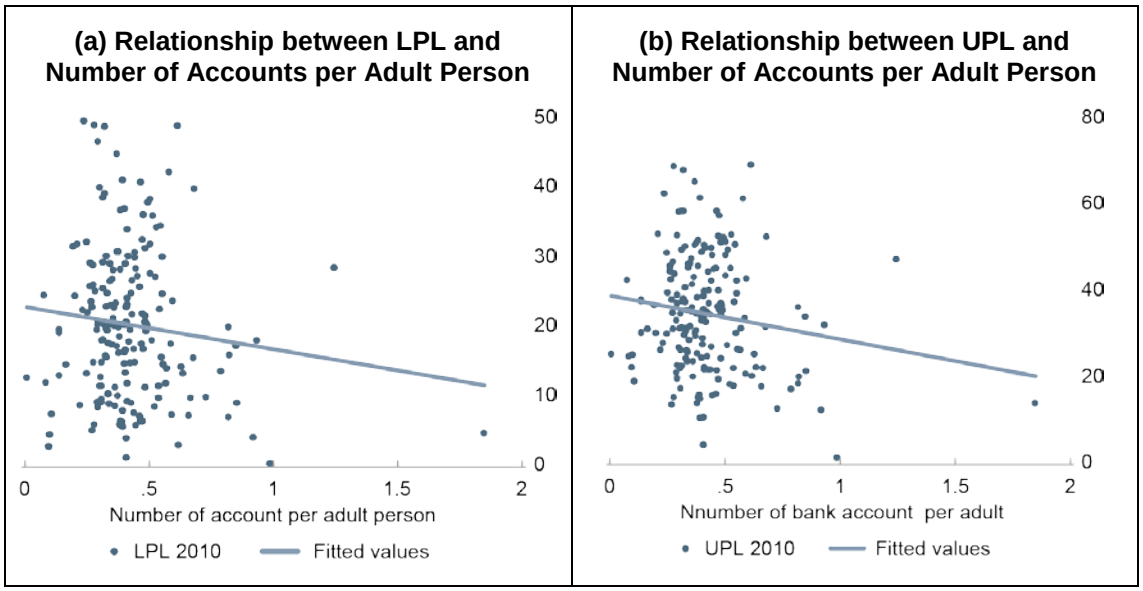


Figure 7

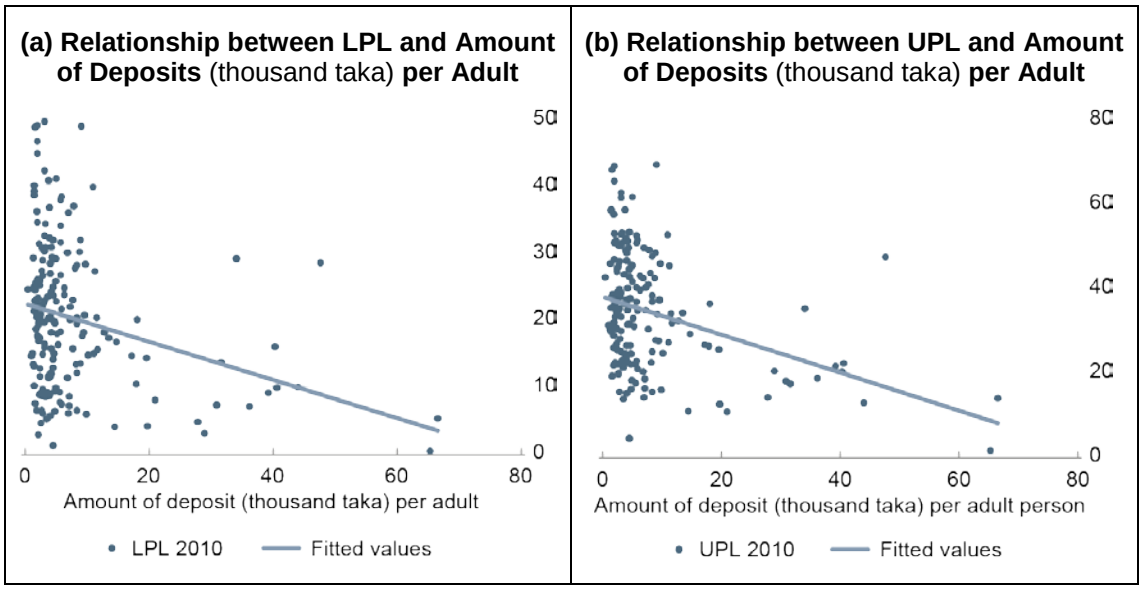
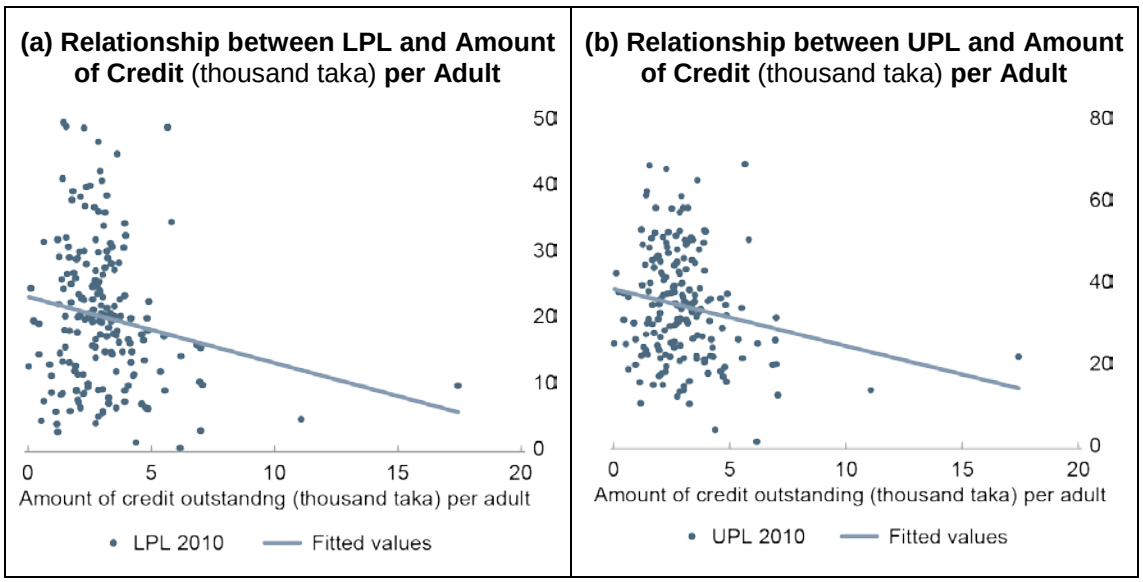


Figure 8



All eight figures 5a–8b suggest that there is a negative relationship between poverty and access to banking services for the sub-districts with higher banking penetration and use. It also implies that a lower level of banking service can be associated with both high and low levels of poverty. But, a higher level of banking service is largely coupled with lower poverty. It is also important to note that this is a simple correlation that does not control for other co-variates that have bearing on both banking variables and poverty levels.

5. EMPIRICAL STRATEGY

5.1 Banking Regulation of Branch Placement and Rural Sample

We argue that banking regulations have profound influence on the placement of branches in rural areas. The circular letter issued in 2006 by the Bangladesh Bank promulgates that banks have to set up one rural branch for every four branches in urban areas.[16] Later, in 2012, the regulation on opening bank branches becomes more pro-rural – one rural branch for every urban branch.[17] This regulation resulted in a substantial increase in rural branches: our data show that rural branch density and amount of deposits grew at a faster rate than the national average, particularly in the case of private banks (Table 1a). Anecdotal evidence suggests that these new rural branches were not the results of a profit maximizing motive of branch placement.[18] Taken together, we argue that our rural sample represents the branches that were set up largely by banking regulations. Therefore, selection bias is very minimal in our rural sample.

5.2 Regression Models

We estimate the following regression specification at the sub-district level. Our unit of analysis is a sub-district.

$$Poverty_i = \alpha_0 + \alpha_1.Banking\ service_i + \alpha_2.Control_i + u_i \quad \text{(I)}$$

Here *i* denotes a sub-district. We use two measures of poverty—percentage of population below upper poverty line (UPL) and percentage of population below lower poverty line (LPL). As discussed before, we use four sets of banking variables—number of bank branches per square kilometer, number of bank accounts per adult person, amount of deposits per adult person and amount of credit per adult person at the sub-district level. For each banking variable we run separate regressions for full sample and rural sample, and for upper and lower poverty lines. Since we have data since 2008, we use average of the years 2008–2010 for the banking variables. Since poverty is influenced by a wide range of socioeconomic variables that are inherently sluggish, and hence poverty itself changes very slowly over time, the current poverty is more likely to be correlated with present as well as past values of its co-variates.

Note that regression model (I) specifies that poverty of a sub-district *i* depends on the banking variables of the same sub-district only. This may not be true. That is, households at the border of the sub-district may go to other neighboring sub-districts for banking. Therefore, we construct a banking variable of a sub-district, taking into account other sub-districts with common border. Suppose, sub-district *k* shares its border with *n* other sub-districts. Therefore, we create a banking variable (*x*) for sub-district *k* in the following way:

[16] BRPD Circular Letter No. 02, 9 January 2006, Bangladesh Bank.

[17] BRPD Circular No. 18, 29 November 2012.

[18] New Age, 9 June 2018. http://www.newagebd.net/article/11658/9-new-banks-pressing-bb-for-relaxing-licence-conditions

$$x_k^n = \frac{\sum_i^n X_i + X_k}{n+1}$$

where *X* is the measure of banking services. That is, we take average of all the bordering sub-districts including the one of our interest. Data show that there is no island sub-district in Bangladesh; all sub-districts have at least one bordering sub-district. The maximum number of sub-districts a sub-district shares a common border with is 16. Most of the sub-districts share a border with 5–8 sub-districts. This also highlights the importance of taking into account the neighboring sub-districts while studying the impact of banking service on poverty at the sub-district level. Therefore, in addition to model (I), we also run the following regression model:

$$Poverty_k = \beta_0 + \beta_1 . x_k^n + \beta_2 . Control_k + u_k \quad \text{(II)}$$

Model (II) shows that we regress poverty of a sub-district *k* on the average of the banking service available in *k* and its neighboring *n* number of sub-districts sharing the common border.

It is also important to note that the banking variables are highly endogenous. Banks' decision to expand their branches to a certain region is solely determined by profit motive, especially for the private banks. That is, a bank tends to locate their branches in commercially advanced regions where there is a sufficient demand for banking services. Therefore, if we observe strong correlation between banks' penetration and low poverty in a sub-district, it could simply be the case that the banks have located their branches in developed regions. Therefore, if we want to draw causal inference even in a very crude form, we need to either control for or rule out the cases when banks' decision to open a branch depends on a region's development. Technically speaking, there are omitted variables in the error terms (u), which influence both the dependent variable (poverty) and the variable of our interest (banking service). One such strong candidate is the level of development of the sub-district. That is, both poverty and banking service can have a strong correlation because both are responding to an omitted variable, such as level of development, without having any causal impact.

To this end, it requires the use of a set of controls that captures the extent of development of a sub-district. A typical bank tends to move into a sub-district that is accessible and commercially vibrant. That is, for a given level of development in a sub-district, variations in banking variable can explain the variations in poverty. Therefore, we control for the extent of development in a sub-district in both models (I) and (II). However, we cannot control for the omitted variable bias that stems from unobserved characteristics of the sub-districts that are collated with banks' decisions. As discussed before, since our sample of interest is the rural sample, we use a set of variables, such as cropping intensity, length of paved roads, most remittance-recipient districts, and river erosion, to control for level of development of the sub-districts. We discussed the rationale for using these controls in detail in section 2. We also used an alternate set of controls, which are described in section 6.

In addition to serving as a proxy for rural development, inclusion of remittance in the regression model helps exclude another type of omitted variable bias. There is evidence of a robust link between financial development and remittances (Aggarwal et al. 2011; Gupta et al. 2009). These studies, which use cross-country variations, show that remittances promote financial inclusion and also help reduce poverty. Therefore, remittances could be one possible candidate that may create omitted variable bias if not included in the regression.

Also note that the decision to open a branch of public banks is not solely determined by a profit motive. There are public banks' branches in poverty-stricken regions. In the case of the rural sample, the source of endogeneity that stems from the profit-seeking motive of the banks is much less. Private banks are less likely to move to rural areas. To ensure their greater presence in rural areas, there is a law that a private bank has to set up a branch in rural areas for every five urban branches. Therefore, the decision by a private bank to open a branch in a rural area can be partly policy-driven. Therefore, we run model (I) and (II) for rural samples separately and we focus particularly on rural sample in these regression models.

5.3 Regression Results

We run Ordinary Least Square (OLS) to estimate the parameters of the regression models specified above. The first four tables (Tables 2-5) correspond to model (I), whereas Tables 6 corresponds to model (II). In the case of model (I), the results of four banking variables are reported in four tables. In Tables 2–5, the first four columns correspond to the upper poverty line, while the last four columns are for the lower poverty line. In the case of both the upper and lower poverty lines, the first column of each case (column 1 and 5) reports results for the full sample and the other three columns (columns 2–4 and 6–8) are for the rural sample. Standard errors are clustered at district level for all specifications.

Table 2: Impact of Number of Bank Branches per 10 Square Kilometers on Poverty

	Upper Poverty Line				Lower Poverty Line			
	Full Sample	Rural Sample			Full Sample	Rural Sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank branch per 10 km^2	–0.11***	–7.49***	–12.79***	–9.57***	–0.07***	–6.53***	–8.38***	–6.65**
	(0.023)	(1.700)	(3.329)	(3.635)	(0.015)	(1.055)	(2.285)	(2.742)
Occurrence of river erosion			1.831**	1.755**			1.631**	1.640**
			(0.816)	(0.833)			(0.659)	(0.678)
Cropping intensity			–0.040*	–0.044*			–0.002	–0.003
			(0.024)	(0.025)			(0.019)	(0.019)
Length of paved road (km)				–0.009				–0.001
				(0.019)				(0.014)
Dummy: top remittance-recipient district				–5.366*				–3.058
				(2.836)				(2.302)
Constant	31.33***	36.97***	30.25***	30.19***	17.91***	22.49***	21.68***	21.47***
	(0.605)	(1.190)	(4.344)	(4.834)	(0.467)	(0.960)	(3.370)	(3.760)
Observations	535	186	174	172	535	186	174	172
R-squared	0.088	0.068	0.123	0.144	0.063	0.079	0.099	0.109

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Consider Table 2 first, which reports results for the number of bank branches per 10 square kilometers. This variable is strongly statistically significant for both upper and lower poverty lines as well as for the full and rural samples. The marginal impact is higher in the rural sample than the full sample. It implies that branch concentration is more strongly associated with the reduction of poverty in rural areas. In the case of the upper

poverty line, an increase in one bank branch in 10 square kilometer is associated with about a 10 percentage-point reduction of moderate poverty (column 4) and about an eight percentage-point reduction in extreme poverty (column 8) in rural areas. The number of years experiencing river erosion in the last three years is statistically significant at a 5% level for all specifications. It indicates that incidence of poverty is highly correlated with river erosion in a sub-district. The incidence of poverty has also been found significant and negatively correlated with cropping intensity for the upper poverty line. However, the coefficients are not significant for lower poverty lines, although the signs are negative. The signs of the coefficients of the length of paved roads are negative, although they are not statistically significant. The districts with a higher number of remittance-recipient households are found to have lower poverty, both moderate and extreme.

Table 3: Impact of Number of Bank Accounts per Adult Person on Poverty

	Upper Poverty Line				Lower Poverty Line			
	Full Sample	Rural Sample			Full Sample	Rural Sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of accounts per adult	–4.828***	–4.424***	–4.420***	–4.280***	–2.960***	–3.022***	–3.225***	–3.141***
	(1.045)	(1.262)	(1.438)	(1.185)	(0.660)	(0.841)	(0.997)	(0.858)
Occurrence of river erosion			2.094**	1.815**			1.795***	1.678**
			(0.839)	(0.841)			(0.671)	(0.686)
Cropping intensity			–0.039	–0.044*			–0.001	–0.003
			(0.026)	(0.025)			(0.020)	(0.019)
Length of paved road (km)				–0.016				–0.006
				(0.019)				(0.014)
Dummy: top remittance-recipient district				–7.902***				–4.820**
				(2.741)				(2.111)
Constant	33.703***	36.171***	28.127***	30.132***	19.213***	21.416***	20.474***	21.520***
	(0.843)	(1.129)	(4.518)	(4.908)	(0.616)	(0.911)	(3.447)	(3.798)
Observations	535	186	174	172	535	186	174	172
R-squared	0.081	0.027	0.086	0.140	0.053	0.019	0.078	0.108

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Now, turn to our next banking variable—the number of bank accounts per adult person, which captures the extent of outreach at the individual level. The results are reported in Table 3. In this case, the marginal impacts for both upper and lower poverty lines and for the full and rural samples are also significant at one-percent for all specifications. In the case of the upper poverty line, if the number of bank accounts per adult person increases by one, moderate poverty deceases by about four percentage points (column 4) and extreme poverty by about three percentage points (column 8) in rural areas. In this case, the occurrence of river erosion and remittances also have significant impact on both moderate and extreme poverty. Although the signs of length of paved road and cropping intensities are negative, they are not statistically significant (except for column 4 of cropping intensity).

Table 4 reports the regression results of the impact of the amount of bank deposit (thousand taka) per adult person on poverty. Also in this case, all the coefficients of the amount of deposit per adult are significant, regardless of the types of poverty and sample. In the case of the rural sample, an increase in Tk1,000 of deposit per adult is associated

with a reduction of 0.38 percentage points of moderate poverty (column 4) and 0.26 percentage points of extreme poverty (column 8). In this case, the effect within the rural sample is also larger than in the full sample. In this case, only occurrence of river erosion is found to have a significant and negative impact on incidence of poverty. Interestingly, the variable on remittance becomes statistically insignificant in this case. It could be the case that the amount of deposit per adult person is picking up the effect of remittances. Since remittances largely come through banking channels and are deposited in banks, the amount of deposit may have also captured the flow of remittances in the sub-district.

Table 4: Impact of Amount of Bank Deposits (000) per Adult Person on Poverty

	Upper Poverty Line				Lower Poverty Line			
	Full Sample	Rural Sample			Full Sample	Rural Sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Amount of deposits (000) per adult person	–0.019***	0.449***	0.425***	0.377***	0.011***	0.285***	0.267***	0.261***
	(0.007)	(0.081)	(0.089)	(0.102)	(0.004)	(0.059)	(0.063)	(0.073)
Occurrence of river erosion			1.861**	1.780**			1.660**	1.659**
			(0.809)	(0.824)			(0.656)	(0.674)
Cropping intensity			–0.024	–0.029			–0.008	–0.008
			(0.025)	(0.025)			(0.019)	(0.020)
Length of paved road (km)				–0.010				–0.002
				(0.019)				(0.014)
Dummy: top remittance-recipient district				–3.989				–2.117
				(2.847)				(2.274)
Constant	31.460***	37.569***	32.114***	32.377***	17.838***	22.207***	22.732***	22.975***
	(0.624)	(1.156)	(4.500)	(5.020)	(0.479)	(0.948)	(3.468)	(3.869)
Observations	535	186	174	172	535	186	174	172
R-squared	0.069	0.121	0.159	0.178	0.045	0.075	0.118	0.135

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Impact of Amount of Credit Outstanding (000) per Adult Person on Poverty

	Upper Poverty Line				Lower Poverty Line			
	Full sample	Rural sample			Full sample	Rural Sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Amount of credit (000) per adult	–0.013**	–0.437	–0.447	–0.443	–0.008**	–0.328	–0.345	–0.347
	(0.005)	(0.342)	(0.354)	(0.351)	(0.003)	(0.245)	(0.258)	(0.254)
Occurrence of river erosion			2.126**	1.853**			1.815***	1.703**
			(0.840)	(0.842)			(0.671)	(0.687)
Cropping intensity			–0.042	–0.046*			–0.003	–0.004
			(0.026)	(0.025)			(0.020)	(0.019)
Length of paved road (km)				–0.014				–0.005
				(0.019)				(0.014)
If top remittance-recipient district				–8.108***				–4.978**
				(2.763)				(2.128)
Constant	31.113***	35.617***	27.122***	29.103***	17.624***	21.138***	19.801***	20.830***
	(0.615)	(1.441)	(4.637)	(4.977)	(0.472)	(1.126)	(3.537)	(3.852)
Observations	535	186	174	172	535	186	174	172
R-squared	0.037	0.015	0.075	0.129	0.024	0.013	0.070	0.101

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Our last variable of interest is the amount of bank credit outstanding (thousand taka) per adult person (Table 5). Interestingly, the credit variable is not significant in the rural sample. For the full sample, it is significant at the 5% level. Similar to cases of other banking variables, river erosion is also found to have aggravated poverty. Remittance-receiving districts are also with the districts with lower poverty in this case, unlike with the previous case of bank deposit.

Now, consider model (II) specified above, where the banking variable is constructed by averaging over the neighboring sub-districts, including itself. Table 6 reports the regression results for all four banking variables. We consider the specification with all controls and the rural sample only. We also include the impact on both the lower and upper poverty line for each banking variable. The results are qualitatively very similar to what we have found in Tables 2–5. The access to banking services captured by the number of bank branches and accounts in a sub-district and its neighboring ones have strong impact on the poverty reduction of that sub-district. In the case of use of banking services, the impact of the amount of deposit per adult person on the share of population below poverty lines is negative and statistically significant at a level of 1%. Similar to previous cases where we did not account for neighboring sub-districts (regression model I), amount of credit per adult person in a sub-district is also found to have no significant impact on poverty level.

Table 6: Impact of Four Banking Variables on Poverty (Accounting for Bordering Sub-districts, Rural Sample Only)

	UPL	LPL	UPL	LPL	UPL	LPL	UPL	LPL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank branches in 10 km^2	–7.762**	–28.594**						
	(4.664)	(16.928)						
Number of accounts per adult			–11.26***	–8.99***				
			(3.429)	(2.707)				
Amount of deposits (000) per adult person					–0.347***	–0.204***		
					(0.110)	(0.076)		
Amount of credit (000) per adult person							–0.063	–0.110
							(0.108)	(0.080)
Occurrence of river erosion	1.847**	1.687**	1.837**	1.670**	1.896**	1.706**	1.846**	1.681**
	(0.846)	(0.686)	(0.839)	(0.679)	(0.848)	(0.687)	(0.846)	(0.687)
Cropping intensity	0.032	–0.002	0.025	–0.007	0.014	–0.012	0.032	–0.002
	(0.025)	(0.017)	(0.023)	(0.016)	(0.023)	(0.016)	(0.025)	(0.017)
Length of paved road (km)	–0.010	–0.002	0.001	0.006	–0.000	0.003	–0.009	–0.001
	(0.016)	(0.012)	(0.016)	(0.011)	(0.016)	(0.011)	(0.016)	(0.011)
If top remittance-recipient district	–8.086***	–5.249**	–7.201***	–4.592**	–4.219	–3.031	–8.147***	–5.388**
	(2.706)	(2.037)	(2.654)	(2.024)	(2.864)	(2.082)	(2.728)	(2.074)
Constant	29.646***	20.790***	35.540***	25.261***	34.724***	23.521***	29.925***	21.119***
	(4.585)	(3.236)	(4.565)	(3.160)	(4.335)	(3.150)	(4.608)	(3.255)
Observations	176	176	176	176	176	176	176	176
R-squared	0.105	0.085	0.140	0.120	0.145	0.106	0.105	0.086

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

In short, greater access to bank accounts and deposit services have strong association with the reduction of poverty, both moderate and extreme. But, the amount of bank credit has not been found to be correlated with poverty reduction. How does access to a deposit account have a positive effect on income? From the banking and poverty maps, we found that the maps of number of accounts and deposit match well with the poverty maps of 2010. We know that a large number of entrepreneurs in developing countries do not have any formal bank account, which impedes them from saving for the growth of the firms and also for mitigating shocks. Experimental evidence shows that if these businesses get to have bank accounts, it increases their level of investment (Dupas and Robinson 2013). In the case of households, we know also from experimental evidence that they are impatient, lack self-control, and are tempted to spend now. But when they are offered the opportunity to open a bank account, a large number of them do open bank accounts and their amount of saving increases (Ashraf et al. 2006). It is not only savings that improve, but payments from one household to another, business to business, or people to business also become much easier (World Bank 2017).

Why does credit have an insignificant impact on poverty reduction when Bangladesh Bank has taken up programs to boost up agriculture and small and medium enterprise (SME) loans (Bangladesh Bank 2017)? Our results indicate that it is the non-poor who are the likely recipients of the bank credit. This argument is also in line with Greenwood and Jovanovic (1990), who argued that financial development might not benefit the poor because the high unit cost of a small loan would impede the access of bank credit by the poor. Khalily et al. (2014) estimated that only 4% of the poor have access to bank credit, while this share is 14% for savings accounts.

6. ROBUSTNESS CHECK

How robust are our results to the inclusion of alternate control variables? For example, to capture the level of rural development, we use cropping intensity, occurrence of river erosion, length of paved road per square kilometer, and some proxy variable for remittances in our main results. We also check the robustness of these results by using different combinations of other variables to capture the extent of rural development, such as share of area under irrigation for paddy, number of rural industries, and average sub-district wise international employment per year. Note that our choice of variables is constrained by the availability of sub-district level variables. While the first two variables are taken from District Statistics 2011 of BBS, the data on international employment is from Bangladesh Manpower, Employment and Training (BMET). Interestingly, it has only the cumulative number of international migrants of the period 2005–2017 from a sub-district. We, therefore, take the yearly average of this variable for our regression. The regression results reported in Table 7 include a host of alternate control variables that also capture the level of rural development. These results also show that access to banking service as captured by branch density and number of accounts per adult are associated with reduction of poverty, both moderate and extreme. The coefficients are significant at 1% to 5% levels. On the other hand, in the case of use of banking service, amount of deposit per adult has been found to be negatively associated with poverty, but not the amount of credit per adult. Although the signs of the coefficients are negative, they are not statistically significant in any specification.

Table 7: Robustness Check: Role of Alternate Control Variables

	Lower Poverty Line	Upper Poverty Line	Lower Poverty Line	Upper Poverty Line	Lower Poverty Line	Upper Poverty Line	Lower Poverty Line	Upper Poverty Line
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Bank branches per 10 km^2	–9.325***	–13.260***						
	(3.013)	(3.816)						
No. of accounts per adult			–2.188***	–3.247***				
			(0.718)	(0.473)				
Deposits (000) per adult					–0.216***	–0.321***		
					(0.072)	(0.102)		
Credit (000) per adult							–0.320	–0.451
							(0.198)	(0.369)
Occurrence of river erosion	0.887	0.952	1.117	1.277	1.034	1.153	1.081	1.229
	(0.884)	(1.069)	(0.883)	(1.056)	(0.896)	(1.083)	(0.878)	(1.051)
Irrigation	2.677	3.697	1.283	1.734	0.229	0.165	1.428	1.915
	(4.749)	(6.170)	(4.809)	(6.109)	(4.772)	(5.959)	(4.813)	(6.123)
Industry	0.004	0.006	0.002	0.004	0.003	0.005	0.003	0.006
	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)
Migrant	0.000	–0.001	–0.001	–0.002	–0.000	–0.001	–0.001	–0.002
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Constant	28.076***	41.114***	26.334***	38.698***	26.525***	38.989***	26.214***	38.458***
	(5.753)	(6.563)	(5.693)	(6.521)	(5.726)	(6.563)	(5.570)	(6.346)
Division Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	170	170	170	170	170	170	170	170
R-squared	0.296	0.343	0.259	0.298	0.285	0.333	0.261	0.299

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

7. CONCLUSION AND POLICY IMPLICATIONS

In this paper we argue that understanding of the spatial variations of financial services in a country is key to understanding of its inclusiveness and also its potential impact on the reduction of poverty.

This paper studies the regional distribution of outreach and use of the formal banking services at the sub-district level and identifies a number of stylized facts about the distribution that were understudied before. Having studied the regional variations of some key banking variables, we link them to the regional distribution of the incidence of poverty. The most striking observations about the spatial aspect is that there is a north–south divide in the case of bank accounts and deposits, and the south seems to outperform north in the period 2010–2015 (excluding Dhaka and Sylhet). But we do not see such a pattern for the amount of credit per adult person. This indicates that a huge amount of money lies in the southern part of the Bangladesh, but the disbursement of bank credit has been low.

Scatter plots show that low level of poverty can also exist alongside low banking services, but the reverse is not true. For the lower level of banking services, there is hardly any correlation between them and poverty reduction, but a strong negative relationship is found for higher level of banking penetration and use of its services, particularly deposits. Interestingly, regression results indicate a strong negative association between these two sets of variables, except for credit. It sheds light on the fact that even access to savings accounts of commercial banks might have an impact on poverty reduction.

One methodological challenge lies in drawing a robust inference, as the banks tend to locate their branches in the areas that are well-off. In order to minimize this effect, we control for the extent of development of the sub-district by using a set of variables, such as cropping intensity, river erosion, length of paved roads, and whether the respective

district is among the top 10 remittance-recipient districts. We also consider the rural sample. By regulation, banks are required to open a rural branch for every five urban branches. That is, the choice of placement of branches in the rural areas can be the result of government regulations. The strong impact of the access to banking services as well as the amount of deposit per adult in a sub-district on poverty reduction is robust to such controls of rural development and also to the rural sample. We also find similar strong results when we take into account the effect of the banking services of the neighboring sub-districts on the poverty reduction of the sub-district under consideration.

This study has strong policy implications for the government and also for the central bank. We find that the expansion of banking services has very strong negative association with both moderate and extreme poverty. Therefore, identifying the lagging sub-districts in terms of the outreach and the use of the banking service can be an integral part of an anti-poverty program. Policies should be geared toward finding out how to remove obstacles for households and firms for accessing banking services (Beck et al. 2005; Beck et al. 2006).

This study highlights the fact that we have a very poor understanding of the regional variations of financial inclusion, especially in the case of the banking services. The policy makers and practitioners have very little idea about regional peculiarities of the access to banking services identified in this study. The mapping tools developed in this study will help Bangladesh Bank, as well as the government, to identify the regions where greater banking penetration is required. It will also help private sector bankers to take informed decisions regarding opening a branch, upon identifying the potential untapped markets.

We have identified a number of pockets where there is a high penetration of banking services. But we have little knowledge about these areas, for instance, it is unclear why such high penetration has occurred in these areas while their neighboring sub-districts see very low degree of penetration. This calls for the need to conduct rapid appraisals in these sub-districts and learn from them to replicate and scale up in other sub-districts.

In developing countries, household surveys are largely used for targeting lagging regions. But in most of the cases, these household surveys are not representative at the lower administrative level. For example, HIES 2010 is representative only at the divisional level.[19] Therefore, we use out-of-sample information to estimate some outcome variables at the level lower than division. While these estimates are useful for drawing inferences on average, local-level planning and budgeting are required to measure these outcome variables with greater precision. In such cases, administrative data, such as banking variables, can be very useful for complementing household surveys. Moreover, household surveys from which poverty measures are estimated are generally conducted in 4–5 year intervals in developing countries. As a result, regional targeting rests on outdated data in the interim period. Administrative data, such as banking variables at the lower administrative level, can be more useful in the periods without poverty estimates.

Our exercise also has implications for SDG (Sustainable Development Goals) localization. An important theme of SDGs is that the goals and the targets will be taken to the local level to monitor the progress. Use of administrative data, such as banking variables, can be a useful tool for tracking the level of development at the local level.

[19] There were 7 divisions, 64 districts and 544 sub-districts in 2010 in Bangladesh.

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APPENDIX: POVERTY MAP (UPPER POVERTY LINE AND LOWER POVERTY LINE)