Emerald International Journal of Bank Marketing

The determinants of bank branch location in India: An empirical investigation

Journal:	*International Journal of Bank Marketing*
Manuscript ID	IJBM-07-2020-0395.R2
Manuscript Type:	Research Paper
Keywords:	bank branch, India, financial inclusion, financial exclusion, panel data, public policy

The determinants of bank branch location in India:
An empirical investigation

Abstract

We present the first study that examines the determinants of bank branching activity in one of the largest developing countries, India. Using a unique panel data consisting of 25 Indian states covering the 2006-2017 period, we examine the factors that are associated with regional disparities in bank branches. We obtain two key findings. First, region and bank specific factors such as size of population and bank deposits influence location of bank branches. Second, the relationship between these factors and branch locations is heterogeneous across different types of banks and across states with different business environments. Considering that banks are the major financial intermediary not only in India but also in many developing countries, our findings carry important policy implications for promoting financial inclusion across the developing world.

Key words: bank branch, India, financial inclusion, financial exclusion, panel data, public policy

1. Introduction

Bank branching activity plays a significant role in a wide range of economic activities, yet the literature on the determinants of bank branch location is scant. Existing studies suggest that two groups of factors influence bank branch location - those unique to regions and those unique to banks. The first group of literature show that regions that are more populated and have high level of income, education, and economic activity have better coverage of bank infrastructure (Castellanos, Castellanos and Flores 2009; Ansong, Chowa and Adjabeng 2015), and that market size, presence of high performing companies, and branching regulations in the region are crucial factors for banks entering new region (Amel and Liang 1997; Bierman et al. 1996; Feinberg 2009; Harimaya 2014; Cohen and Mazzeo 2010). The second group of literature suggests that bank-specific factors such as the location of headquarters and legal origin of home country influence bank branching activity (Harimaya and Kondo 2012; Brealey and Kaplanis 1996; Hryckiewicz and Kowalewski 2008).

Very few studies consider both region-specific and bank-specific factors (see, e.g., Calcagnini et al. 1999; Alessandrini et al. 2005). This paper aims to contribute to this group of literature[1]. Using a unique panel data consisting of 25 Indian states from 2006 to 2017, we show that both region-specific and bank-specific factors, such as size of population and bank deposits, influence location of bank branches. We also show that the relationship between these factors and bank branch locations is heterogeneous across different types of banks and states with different business environments. Our findings carry important implications for different stakeholders. First, from the perspective of banks, considering the relationship between region-specific and bank-specific factors and branch locations are crucial to set out their branching strategy. Irrespective of policy measures aimed at promoting financial inclusion in India, we show that banks consider economic activities in the region in locating their branches. Second, from the perspective of policy makers and regulators, such a branching strategy could have potentially contributed to financial exclusion. Population in the less developed regions may be excluded from accessing financial services. Hence, policymakers and regulators should take into this account when formulating policies aimed at promoting financial inclusion.

The contribution of our paper is threefold. First, while existing studies largely focus on developed countries such as Italy and Spain, studies devoted to developing countries are scant. To the best of our knowledge, we have not come across any study that investigates the determinants of a bank branch location in India, so we reasonably believe that ours is a first-of-its-kind. Second, our study

[1] Our study examines factors influencing location of bank branches. Thus, examining the impact of bank branches on development outcomes is not on the agenda. For studies on this topic, readers may refer to classic studies such as Burgess & Pande (2005) and Jayaratne & Strahan (1996).

provides a new perspective concerning how regional and bank-specific factors influence banks of different ownership, namely public and private banks, in locating branches. Third, while traditional regression, i.e., cross-sectional or panel regression, used to be a method of choice among early studies, we employ Poisson regression that is better suited for modelling counted dependent variable. Our approach is consistent with recent studies (see, e.g., Boďa & Čunderlíková 2020; Ansong et al. 2015). Considering banks are the major financial intermediary in India and in many developing countries, our findings carry important policy implications for promoting financial inclusion across the developing world.

The rest of our paper proceeds as follows. Section 2 and Section 3 provides the literature review and context. Section 4 describes the data and methodology. Section 5 presents the results and discussions. Finally, Section 6 concludes with some policy implications.

2. Literature review

2.1 Why does bank branch matter?

Theoretically, capital mobility is not restricted by physical factors such as the location of a financial institution. For example, bank credit to borrowers may not necessarily originate from the deposits mobilized from that region. As Kendall (2009) observe,

> The key is to note that while local banks are the vehicles for delivery of both types of financial service within a district, the market that matches deposits (loanable funds) to credit (investment projects) equilibrates above the district level. In fact, most banks in a district are members of regional or national branching networks and so will have access to internal capital markets that span districts as well as to the national money market. They will easily be able to transfer excess deposits from one district to the national market and borrow from the national market to meet excess local credit demand. The banking sectors of individual districts will be able to function as truly open economies.

This suggests that the location of bank branches may not matter. Recent studies even argue that due to the advancement of new technologies in the financial sector (widely referred to as fin-tech or financial technology) and changing customers' needs, branches may no longer be necessary (Baldwin 2011; Harvey 2016). For example, fin-tech enables customers to make online payments obviating the need to visit physical bank branches (Gulamhuseinwala, Bull & Lewis 2015; Buckley and Webster 2016).

Nonetheless, the literature suggests that despite the availability of electronic banking services, bank branch still plays a key role in attracting deposits, and its proximity is an important factor for credit availability (Hendrickson et al. 2014, Ansong et al. (2015). For example, Srinivas and Wadhwani (2019) argue that "perhaps most important, branches should be considered the most powerful channels

banks have to provide customers with high touch, person-to-person experiences", "customers still prefer the human touch, which branches can amply provide especially when applying the new products such as opening a checking account." Their overall survey results show that although branch density has gone down, a larger number of consumers still prefer physical bank branches. Alessandrini et al. (2005) suggest, "there are informational advantages that arise from physical proximity to, and personal contact with, borrowers", these advantages "improve both the selection and monitoring of borrowers and constitute a barrier limiting the entry of outside banks". These informational advantages are more vital in a developing country context where considerable informational barriers persist and technological developments are still low. Petersen and Rajan (2002) also find that credit availability is reduced if bank branches are located far away from firms. They note that in the US, the distance between small business borrowers and their banks is less than 35 km for over 75 percent of the firms. In developed countries where banks are undertaking branch cuts in an attempt to reduce cost, the relevance of a physical bank branch still persists. For instance, Srinivas and Wadhwani (2019), in their survey of 17,000 consumers across 17 developed and developing countries, observed, "The survey revealed that most customers prefer branches over digital channels when opening new accounts for both simple (such as savings accounts and debit cards) and complex products (such as loans). This was true in developing countries, such as Mexico and Indonesia, as well as in developed countries, such as Spain, France, Germany, Japan, the United States, Canada, and Switzerland."

Bank branch matters for deposit mobilization and maintaining financial stability. Porter (1966) acknowledge that the spread of bank branches leads to the development of banking habit among the population. Visiting a physical bank branch to carry out banking transactions can subsequently result in increased savings and investment and improve capital allocation . Hendrickson et al. (2014) argue that bank branching activity leads to increased competition among banks, thus preventing monopoly and improving efficiency. Similarly, Carlson and Mitchener (2006) argue that removing branching restrictions in the US and elsewhere leads to increased competition by weeding out inefficient banks, thereby contributing to financial stability.

The bank branch is a key determinant of development outcomes. For example, Burgess et al. (2014) examine the impact of hot weather conditions on mortality in rural and urban areas in India and the role of financial access in mitigating this impact. They find that an increased number of bank branches is associated with lower levels of mortality. The authors argue that access to finance (via bank branches) allows consumption smoothing, especially in the rural areas where incomes may be affected because of hot weather conditions. In another study, Burgess and Pande (2005) examine the impact of opening new rural branches on poverty and output. They find that a one percent increase in the number of rural banked locations reduce rural poverty by 0.36 percent and increase total output by

0.55 percent. Further, if bank branches are unevenly spread across the country, it would exclude some population from accessing financial services or, in other words, lead to financial exclusion (Seaver and Fraser 1979; Pollard 1996; Bierman et al. 1996; Lanzillotti & Saving 1969; Gunther 1997; Evanoff 1988; Ansong et al.2015; Alama et al. 2015).

2.2 What factors influence bank branch location?

Literature suggests that broadly two groups of factors potentially influence bank branch location - those unique to regions such as population and level of income and those unique to banks such as the number of employees and non-performing loans (NPAs). For example, using unique data from Mexico, Castellanos, Castellanos, and Flores (2009) investigate the relationship between socio-economic characteristics and bank infrastructure (defined as bank branches, ATMs, and point of sale terminals). They observe that regions that are more populated and have a high level of income, education, and economic activity have better coverage of bank infrastructure. Similarly, Ansong, Chowa, and Adjabeng (2015) examine the spread of domestic and foreign bank branches in Ghana. They observe a positive association between development indicators such as the percentage of workforce, literacy rate, population size, proportion of urban population, and distribution of bank branches. The authors also find that banks cater poorly to the rural areas. As a result, many rural areas remain financially excluded.

Even in developed countries, region-specific factors such as level of income and size of workforce matter for branch location (Hong, Hong and Kwak 2008; Dick 2007). For example, Amel & Liang (1997) show that in the US, market with high profit, large population size and high population growth are the prime motivating factors for the entry of banks. Other studies show that low-omcp,e areas are more affected in the closing down of bank branches than high-income areas (Tranfaglia 2018; Bierman et al. 1996). For example, Bierman et al. (1996) examine the impact of branching regulations on the number of bank branches in high- and low-income areas in the US. They find that since the change in branching regulations, the number of branches has in fact, declined in the low-income areas. Market size and competition also influence bank branch location. Feinberg (2009) shows that market size and growth are the motivating factors influencing the entry of large banks in rural areas. Kondo and Harimaya (2014) find that in Japan, the presence of high performing companies is a crucial factor for non-local regional banks in entering new regions. Cohen and Mazzeo (2010) examine existing competition faced by the banks to open new branches. They find that a large population and competition influence the opening of new bank branches.

A number of studies examine the relationship between financial exclusion and bank branching activity (Seaver & Fraser 1979; Pollard 1996; Bierman et al. 1996; Lanzillotti & Saving 1969; Gunther

1997 and Evanoff 1988; Ansong et. al. 2015). This group of literature shows that income and population are important factors in bank branching activity. However, apart from Ansong et al. (2015) and Alama et al. (2015), these studies are carried out in the US context and are mostly interested in understanding the impact of removing banking restrictions on the availability of financial services.

Bank specific characteristics such as the location of the bank's headquarters and ownership also influence bank branching activity. For example, using data from Japan on regional banks for the period 2002 to 2006, Harimaya and Kondo (2012) show that the location of headquarters matters. Banks tend to expand their branch network if their headquarters are located in less privileged areas. Compared with public banks, private and foreign banks potentially have more freedom in locating their bank branches. Brealey and Kaplanis (1996) analyse the location of nearly 2,000 branch offices across 37 parents and 82 host countries for the period 1960s to 1980s. They find a strong relationship between foreign bank location and trade and foreign direct investment. Hryckiewicz and Kowalewski (2008) examine determinants of entry of foreign banks into Central Europe. This study shows that local banking market, financial development, and legal origin of home country are key factors.

So far, only a few studies take into account the region-specific and bank-specific factors that influence bank branch location. For example, Calcagnini et al. (1999) study entry factors for 206 large banks from 1992 to 1996. They find both region and bank-specific factors influence the entry of banks. Alessandrini et al. (2005) distinguish between operational distance and functional distance. They argue that although a bank may physically present in a less developed region, it may still be unable to lend to locals due to functional distances (understood as the structure of decision-making in a bank). This implies that in a less developed region, its own economic and social characteristics and characteristics that are specific to banks influence lending decisions.

3. Bank branching activity in India

Prior to independence in 1947, most of the banks in India were concentrated in the private sector and were primarily based in very limited regions. As early as 1940, the total number of bank branches in the country was 1,964, increasing to 5,201 by 1945. However, this expansion was fraught with several weaknesses and as many as 365 banks failed during this period (RBI 2008). Failure of these banks was due to external factors such as World War II and global depression and internal factors such as illiquidity of assets and absence of regulations. It was only much later that policymakers paid attention to the geographical distribution of bank branches across the country. At the end of 1952, the total number of bank branches was 4,061, rising to 6,133 in 1965 and further to 6,987 in 1967. As a result, the average population covered per bank branch declined from 136,000 in 1951 to 65,000 in 1967 (RBI

2008). These branches were, however, mostly located in the urban and metropolitan regions. Neglect of agriculture and rural areas, nexus between industry and banks, and the need to develop the economy after the independence caused increasing concerns among the policymakers and eventually led to social control and subsequent nationalisation of 14 banks in 1969[2]. Since then, authorities made rigorous effort to direct credit flowing into targeted sectors, activities, and population that were previously unbanked.

Foremost among the effort was India's bank branch expansion policy of 1:4 for commercial banks, which was implemented in 1977 and discontinued in 1990.[3] This rule mandates that banks could open a new branch in an area where there are one or more existing bank branches provided they open four branches in an area where there are no bank branches. Another measure to boost bank branching activity was the introduction of a lead bank scheme (LBS). Under this scheme, the lead bank for the district was designated a lead role in assessing banking needs, including credit needs of the population. Districts were allocated to banks based on their resource base and their regional orientation. As RBI (2008) observed, "The allotment of districts to various banks under the LBS had a major role in the spread of banking to unbanked centres. In about five years after nationalization of banks, the branch network expanded by 129 percent." Consequently, the total number of branches increased from 8,187 in 1969 to 18,730 in 1975 and further to 59,752 in 1990. During the same period, the population per bank branch too declined from 65,000 in 1969 to 31,660 in 1975 and further to 13,756 by December 1990 (RBI 2008). The expansion was accompanied by increase in deposits mobilized from the rural areas from 3 percent in 1969 to 16 percent in 1990. Credit to rural sector also increased from 3.3 percent in 1969 to 14.2 percent in 1990 (RBI 2008).

Recent years have seen relaxation in branching regulations. For example, banks have been granted permission to shift, merge and close all branches. However, stringent regulations continue to persist on the closing, shifting, and merging of branches particularly in semi-urban and rural areas. According to the latest policy, banks do not need the central bank's permission to open branches in Tier 1 to Tier 6 centres in sharp contrast to earlier stringent policy controls on opening/closing of branches[4]. The reporting requirements have also been relaxed considerably in the recent period. Further reforms since 1991 include opening new private banks, liberalizing policies related to the opening of foreign bank branches, etc. In order to promote financial inclusion, in August 2014, the

[2] In 1980, 6 more banks were nationalised.

[3] Commercial banks in India refers to both scheduled and non-scheduled banks that are regulated under Banking Regulation Act 1949. Scheduled commercial banks include public sector banks, private banks, foreign banks and regional rural banks.

[4] Reserve Bank classifies banking centres based on population (as per 2001 census). Accordingly, Tier 1 centres cover population of 100,000 and above; Tier 2 cover 50,000 to 99,000; Tier 3 20,000 to 49,999; Tier 4 10,000 to 19,999; Tier 5 5000 to 9,999; and Tier 6 less than 5,000.

Indian government launched a scheme - Prime Minister Jan Dhan Yojana (PMJDY) under National Financial Inclusion Mission, aiming for universal access to financial services. This scheme was implemented in two phases: phase one from August 2014 to August 2015, and phase two from August 2015 to August 2018. As a result, the number of bank branches had a significant increase. Between 2014 to 2018, the scheme covered 80 percent of the Indian adult population.

4. Data and methodology

4.1 Data

Our data covers 25 Indian states from 2006 to 2017[5]. It is collected at the state level from various sources: the number of bank branches is sourced from Bank Branching Statistics, RBI[6]; statistics on income and population from Ministry of Statistics and Programme Implementation, Government of India[7]; mortality rate from Census India[8]; and statistics on bank deposits, credit to states, factory and length of state highways from RBI[9]. Table 1 presents a description of those variables. It shows that apart from *income*, *mortality*, *factory,* and *highway*, other variables have complete observations. Thus, we derive an unbalanced panel[10].

[Insert Table 1 here]

4.2 Methodology

We specify the following empirical model:

$$log\ Y_{it} = \beta' log\ S_{it} + \gamma' log\ B_{it} + POLICY + \varepsilon_{it} \quad (1)$$

[5] There are a total of 29 states in India.
[6] https://dbie.rbi.org.in/DBIE/dbie.rbi?site=publications#!17 (accessed on May 26, 2020).
[7] https://mospi.gov.in (accessed on May 26, 2020).
[8] https://www.censusindia.gov.in/vital_statistics/SRS_Bulletin_2014.pdf (accessed on May 26, 2020).
[9] https://www.rbi.org.in/Scripts/publications.aspx (accessed on May 26, 2020). According to Ministry of Programme and Implementation, Govt of India, factory refers to any premises where 10 or more workers are working on any day of preceding 12 months where manufacturing process is carried out with the aid of power. Also classified as factories are those units where 20 or more workers are working in preceding 12 months and manufacturing process is being carried out without the aid of power
[10] Ideally, exploration of bank branch locations factor at a lower level (e.g. district or county) is more desirable. However, data unavailability prevents us from taking up such approach. That said, our analysis at the state level is consistent with literature such as Demurger (2011) whose investigation is conducted at the state level.

where subscript *i* and *t* denote state and year, respectively; *Y* denotes the number of bank branches; *S* denotes state-related variables; *B* refers to bank-related variables; *POLICY* is a dummy that controls for the Prime Minister Jan Dhan Yojana policy[11]; and ε is a mean zero error term.

(1) Dependent variable

The dependent variable *Y* is measured with two variables, the number of public bank branches (*public*) and the number of private bank branches (*private*). The reason for this exercise is twofold. First, public and private banks account for the majority of the banks in India[12]. For example, in 2017, public and private bank branches comprise 77.47 and 22.31 percent of all bank branches. Second, existing literature suggests that the factors that influence bank branching activity may differ across banks with different ownership, so this exercise enables us to investigate such heterogeneity. We aggregate these two categories of bank branches plus foreign bank branches to construct the total bank branches (*total*)[13].

(2) State-related variables

S represents state-related variables. Ideally, variables such as average level of education and market size should be included. However, such detailed longitudinal data are not available at the state level. In this study, *S* include population (*population*), income per capita (*income*), infant mortality (*mortality*), number of factories (*factory*), and length of state highways (*highway*).

Population, which is a key determinant of bank branching activity, has long been considered by scholars (e.g., see Alama and Tortosa-Ausina 2012; Lanzillotti and Saving 1969; Evanoff 1988; Amel and Liang 1997; Dick 2007). Intuitively, an increased population would lead to an increased demand for financial services, thus motivating banks to locate their branches. A number of studies, such as Bernad et al. (2008) and Hannan and Hanweck (2008), find a positive relationship between the two variables[14].

---

[11] As previously mentioned, the Indian government launched the Prime Minister Jan Dhan Yojana (PMJDY) in 2014 aiming at promoting financial inclusion. As a result, the number of bank branches experienced a significant increase. Therefore, in addition to state- and bank-related explanatory variables, we construct *POLICY* to control for this important policy.

[12] In India, public banks are those where a majority stake (i.e. more than 50 per cent) is held by the government. On the other hand, private banks are the ones where a majority stake is with private shareholders. In the literature, the term 'public banks' and 'public sector banks', and the term 'private banks' and 'private sector banks' are often used interchangeably. In this study, public (private) bank branches refer to branches of public (private) banks.

[13] Foreign banks are defined as banks from a foreign country working in India through branches. We do not construct a separate variable, namely the number of foreign bank branches, as dependent variable. The reasons are twofold. First, foreign bank branches account for only a very small proportion of all bank branches across the country (e.g. 0.22 per cent in 2017). In this study, we are interested in the factors that influence the majority of bank branches, namely public and private bank branches. Second, the number of foreign bank branches does not have much variation at the state level. For example, states such as Arunachal Pradesh, Jharkhand, Manipur and Meghalaya records a zero value for the entire period.

[14] Evanoff (1988), however, argue that although population per bank branch is an important variable in considering access to financial services, it does not take into account the time, cost and convenience in accessing financial services.

Income per capita is another key determinant of bank branching activity. Bank managers are motivated to locate branches in an area where residents are high-income earners and thus potentially have a high demand for financial services. Several studies, such as Gunther (1997) and Alama et al. (2015), find evidence that income per capita has a strong impact on the location of bank branches[15].

Business activities heavily influence bank branching activity. Compared with areas with less business activities, areas, where there are rigorous business activities, are more likely to attract bank branches. In other words, the higher number of businesses, the higher need for financial services, and the higher need for financial services, the higher number of bank branches. For example, Kondo and Harimaya (2014) find that the presence of high performing companies is a crucial factor in non-local regional banks entering new regions. In this study, we employ a number of factories as a measure of business activities[16].

Furthermore, as mentioned previously, Burgess et al. (2014) find that bank branching activity is associated with infant mortality. Their study not only shows that one standard deviation increase in high temperature days in a year reduces agriculture output and wages, thus increasing mortality among rural population, but also reveals that greater financial access allows consumption smoothing (which in many cases requires presence of bank branches) mitigating this mortality effects of high temperatures. Following Burgess et al. (2014), we include infant mortality rate in our model.

Finally, we include the length of state highways as an explanatory variable. Most existing studies on determinants of bank branch location focus on developed countries where infrastructure is well developed. However, this is often not the case in many developing countries. As a result, infrastructure availability could significantly influence business locations such as banks as well as economic growth. For example, using a panel data consisting of 24 provinces in China, Demurger (2001) find that transport and telecommunications facilities are a key differentiating factor in explaining inter-provinces differences in economic growth.

(3) Bank-related variables

B represents bank-related variables. In locating branches, banks not only consider state-related factors but also take into account their balance sheet, NPAs, etc.[17]. However, data on these bank-related variables are not available at the state level. In this study, *B* includes three key variables: the amount

[15] However, Hannan and Hanweck (2008) argue that high income individuals in such areas not only save in banks but also have opportunities to invest in non-bank sources, thus reducing their demand for banking products and services.
[16] We acknowledge such an approach is not ideal. However, data on business activities are quite limited for developing countries like India.
[17] The definition of nonperforming loan can vary from country to country. In India, loans are considered as non-performing when loans are overdue and principal and interest has not been repaid for 90 days.

of deposits (*deposits*) and credit (*credit*) and a competition measure Herfindahl-Hirschman Index (HHI).

The core function of a bank branch is to facilitate credit and deposit for residents and businesses. Several studies show that proximity to bank branches matters for deposit mobilization and access to credit (Petersen and Rajan 2002). Therefore, it is reasonable to assume that a higher amount of credit and deposits requires a higher number of bank branches to facilitate intermediation. It is worth noting that following Bôda and Cunderlíková (2020), we include a competition measure, namely the Herfindahl-Hirschman Index (HHI), in *B*. The reason is that bank branching activity is affected by each other. In order to reflect the competitive environment in each state, we construct a standard HHI among different types of banks.

(4) Modelling approach

The literature review in Section 2 deserves a further remark. As Boďa & Čunderlíková (2020) point out, an appreciate modelling approach should consider the fact that bank branch number is a discrete variable. Logarithmic transformation may "assure that the dependent variable has support upon the real axis", yet "discreetness of values remains" (Boďa and Čunderlíková 2020). Traditionally, scholars employ cross-sectional or panel regression. For example, Alana & Tortosa-Ausina (2012) employ Ordinary Least Squares (OLS) to investigate bank branch geographic location patterns in Spain. In their study, the dependent variable is a log of branch numbers. Similarly, studies such as Bierman et al. (1996) and Maudos (2017) use OLS even though their dependent variable, i.e., branch numbers, is discrete. We argue that such an approach is not appropriate. One of the key assumptions of the linear model is that the residual errors follow a normal distribution. To meet this assumption, when a continuous dependent variable is skewed, a transformation of the dependent variable can produce approximately normal errors. Often, however, the dependent variable is discrete rather than continuous. Under such circumstances, a simple transformation cannot produce normally distributed errors. For example, our dependent variable is the counted number of bank branches. The distribution of counts is discrete, not continuous, and is limited to non-negative values. Thus, applying OLS is not appropriate. The better approach is to use Poisson, negative binomial regression or other approach resembling Generalized Linear Modelling (GLM). Recent studies such as Alama et al. (2015), Ansong et al. (2015), and Boďa & Čunderlíková (2020) have employed such method. Consistent with this group of literature, we employ Poisson regression to estimate Eq. (1)[18].

[18] We conduct Fisher-Augmented Dickey-Fuller (ADF) Test for stationarity and did not find evidence of nonstationary. Refer to Maddala & Wu (1999) for a detailed description of Fisher-ADF Test.

5. Results and discussions

The estimated Poisson regression results of Eq. (1) are presented in Table 2. Column (1) reports results that employ the log of total bank branches (*total*) as the dependent variable. In contrast Columns (2) and (3), the dependent variable is the log of private bank branches (*private*) and the log of public bank branches (*public*), respectively. Across columns, the Wald Chi-Square *p*-value is significant at 1 percent level, indicating that our model is statistically significant; and all regression coefficients come with reasonable signs. Turning to Column (1), the coefficient on *population* is positive and statistically significant at 5 cent level, suggesting that a large population is associated with a strong presence of bank branches. The same holds for *deposits* as states with more bank deposits are served by more bank branches. If a state were to increase log *deposits* and log *population* by 20.72 (log 1 billion=20.72) and 6.91 (log 1,000=6.91), the rate ratio for log *total* would be expected to increase by a factor of 1.04 and 1.43, respectively, *ceteris paribus*. The coefficient on *mortality* is negative and statistically significant, indicating that states with high mortality rates have fewer bank branches. Finally, the coefficient on *POLICY* is positive and statistically significant, demonstrating that the PMJDY policy has potentially increased total bank branches.

Literature suggests that the factors that influence bank branching activity may differ across banks with different ownership. In order to examine such heterogeneity, we conduct sub-sample analysis focusing on public and private banks. Results for this exercise are reported in Column (2) and (3). Specifically, Column (2) observes a statistically significant and negative coefficient on *HHI*, indicating that a competitive branching environment is associated with fewer private bank branches. Whereas, Column (3) observes a negative coefficient on *mortality* and a positive coefficient on 4 variables, i.e. *deposits*, *population*, *factory,* and *POLICY*. It demonstrates that the branching activity of public banks is heavily driven by the size of population and deposits, the number of factories, and the PMJDY policy.

Furthermore, we examine if the relationship between bank branching activity and bank-and state-related explanatory variables varies across states with different business environments. Existing literature, such as Lall & Mengistae (2005), suggests that local business environment heavily influences locations of industry within countries. They find that excessive regulation of labor and other industrial activities reduce the probability of a business locating in a city. Thus, in order to better understand how the business environment shapes the relationship between bank branching activity and bank- and state-related explanatory variables, we conduct sub-sample analysis. Specifically, we divide all states into two groups, namely states that are advantaged in business environment (*advantaged*

states) and states that are disadvantaged in the business environment (*disadvantaged states*). This distinction is based on the Reform Evidence Score from the Business Reform Action Plan (BRAP) from the Department for Promotion of Industry and Internal Trade[19]. We estimate Eq. (1) for each group. Results for this exercise, reported in Table 3, elicit several interesting findings. First, within state groups (*advantaged states* and *disadvantaged states*), the heterogeneity between public and private banks we observe in Table 2 is still at play. For example, Column (2) and (3) demonstrate that in *advantaged states*: branching activity of public banks are influenced by the PMJDY policy, whereas branching activity of private banks is influenced by the size of the population, mortality rate as well as the competitive environment. Second, within bank groups (public and private banks), branching activities are influenced by various factors depending on the business environment. For example, in *advantaged states*, public bank branching activities are influenced by the PMJDY policy. However, such branching activity in *disadvantaged states* is influenced by the amount of credit to the states.

Table 2 and Table 3 show that the most appropriate model for modelling bank branching activity would include variables such as *deposits*, *population*, *mortality*, *factory*, *HHI,* and dummy of PMJDY policy. Our findings in Table 2 and Table 3 relate to the literature in two ways. On the one hand, they are consistent with existing studies. In Column (1) Table 2, we find a positive relationship between population and the number of bank branches, consistent with Bernad et al. (2008) and Hannan and Hanweck (2008); and a positive relationship between bank deposits and the number of bank branches, consistent with Petersen and Rajan (2002) as their study showed that bank branch location matters for deposits mobilisation, i.e., more bank deposits require more bank branches to mobilise. In the same column, we observe a negative relationship between the mortality rate and the number of bank branches. This finding is consistent with Burgess et al. (2014) who show that greater financial access allows consumption smoothing (in many cases through bank branch), mitigating the effect of high temperature on mortality. On the other hand, our finding that the relationship between different factors and branch locations is heterogeneous across different types of banks and states with different business environments complements existing literature. According to Lall & Mengistae (2005), locations of industry within a country are heavily influenced by local business environment. In Table 3 and Table 4, we find that bank branching activity is sensitive to not only their ownership but also business environment. Finally, our finding that the PMJDY policy (captured by *POLICY* variable) has

[19] https://eodb.dipp.gov.in/Home?year=2017-18 [accessed on May 26, 2020]. The BRAP includes 372 recommendations for reforms on regulatory processes, policies, practices and procedures spread across 12 reform areas. Generally, a higher Reform Evidence Score means advantaged business environment. All states in India are clarified into four categories according to their respective Reform Evidence Score: Top Achievers, Achievers, Fast Movers, and Aspirers. Taking into account the number of states in each category, we consider Top Achievers and Achievers as states that are advantaged in business environment, and Fast Movers and Aspirers as states that are disadvantaged in business environment.

positively impacted bank branching activity is consistent with the existing literature (Agarwal et al. 2017; Chopra et al. 2017). These studies observed that the implementation of PMJDY policy is associated with an increase in the number of bank branches.

6. Concluding remarks

Branch positioning is a strategic decision-making process that involves locating a bank in a region with competitive advantages in terms of geographic, demographic, and socio-economic, characteristics that distinguish a bank from its competitors. This strategic positioning is increasingly becoming important to maintain a sustainable competitive edge over the intense competition for national and international banks. Using a unique panel data covering 25 Indian states from 2006 to 2017, our study is a first-of-its-kind in the Indian context. We investigated the factors determining bank branch positioning amid the changing dynamics and pressures on the banking sector and regulators alike on improving branch efficiency and financial access of the population. Our results show that: first, region specific and bank specific factors such as the size of the population and bank deposits influence location of bank branches; and second, the relationship between these factors and bank branch location is heterogeneous across different types of banks. To investigate how business environment shapes the relationship between bank branching activity and bank- and state-related explanatory variables, we conduct further examination using an indicator that classifies states into two groups, namely states that are advantaged and states that are disadvantaged in business environment. We find that while our main results still hold, the relationship between the region and bank specific factors and branch location is heterogeneous across states with different business environments.

Our findings carry several policy implications. First, from the view of banks, considering the factors of branch location is crucial in order to set out a branching strategy. Irrespective of policy measures aimed at promoting financial inclusion in India, we show that banks consider economic activities in the region in locating their branches. Second, from the view of policy makers and regulators, such branching strategy (of the banks) could potentially contribute to financial exclusion. As a result, population in the less developed regions may be excluded from accessing financial services. Hence, policymakers and regulators should take into this account when formulating policies aimed at promoting financial inclusion. Lastly, considering banks are the major financial intermediary not only in India but also in many developing countries, our findings carry important policy implications for promoting financial inclusion across the developing world.

Reference

Alessandrini, P., et al. (2005). The geography of banking power: the role of functional distance, *Banca Nazionale del Lavoro Quarterly Review*, 58, 235, 129-167.

Agarwal, S., Alok, S., Ghosh, P., Ghosh, S., Piskorski, T.,& Seru, A. (2017, January 26). Banking the unbanked: What do 255 million new bank accounts reveal about financial access? Columbia Business School Research Paper No. 17–12; Georgetown McDonough School of Business Research Paper No. 2906523; Indian School of Business WP 2906523. doi:10.2139/ssrn.2906523. Retrieved from SSRN https://ssrn.com/abstract52906523. Accessed on July 24, 2020.

Amel, D.F. and Liang, J.N. (1997). Determinants of entry and profits in local banking markets, *Review of Industrial Organisation*, 12:59-78.

Alama, L and Tortosa-Ausina (2012). Bank branch geographic location patterns in Spain: Some implications for financial exclusion, *Growth and Change*, 43, 3, 505-543.

Alamà, L., D. Conesa, A. Forte & E. Tortosa-Ausina (2015). The geography of Spanish bank branches. *Journal of Applied Statistics,* 42**,** 722-744.

Ansong, D., G. Chowa & B. K. Adjabeng (2015) Spatial analysis of the distribution and determinants of bank branch presence in Ghana. *International Journal of Bank Marketing,* 33**,** 201-222.

Baldwin, W. (2011), Who needs branches? *Forbes*, pp. 48-49.

Bernad, C., L. Fuentelsaz, and J. Gómez. (2008). Deregulation and its long-run effects on the availability of banking services in low-income communities. *Environment and Planning A* 40(7): 1681–1696.

Bierman L, Fraser D R, Gimeno J, Fuentelsaz L. (1996). Regulatory change and the availability of banking facilities in low-income areas: a Texas empirical study, *SMU Law Review,* 49, 1421-1446

Boďa, M., & Čunderlíková, K. (2020). Determinants of bank branch density: a case study of Slovakia. *International Journal of Bank Marketing*. 38:4, 933-959

Brealey, R.A. and Kaplanis, E.C. (1996). The determination of foreign banking location, *Journal of International Money and Finance*, 15:4, 577-597.

Burgess, R. and Pande R. (2005). Do Rural Banks Matter? Evidence from the Indian Social Banking Experiment, *The American Economic Review*, 95 (3), 780–795.

Burgess, R., O. Deschenes, D. Donaldson & M. Greenstone (2014). The Unequal Effects of Weather and Climate Change: Evidence from Mortality in India. http://econ.lse.ac.uk/staff/rburgess/wp/WD_master_140516_v3.pdf (last accessed).

Calcagnini, G., Bonis, R. and Hester, D. (1999). Determinants of bank branch expansion in Italy, Working Paper No. 9932, Social Systems Research Institute, Department of Economics, University of Wisconsin-Madison, USA.

Castellanos, S. G., et al. (2009). "Factores de influencia en la localización regional de infraestructura bancaria." Retrieved August 16, 2016, from http://www.economiamexicana.cide.edu/num_anteriores/XVIII-2/05_SaraG.Castellanos_(283-330).pdf.

Carlson, M., and Mitchener, K.J. (2006). Branch banking, bank competition, and financial stability, *Journal of Money, Credit and Banking*, 38: 5, 1293-1328.

Chopra, Y., Prabhala, N., & Tantri, P. L. (2017, May 2). Bank accounts for the unbanked: Evidence from a big bang experiment. Robert H. Smith School Research Paper No. RHS 2919091; Indian School of Business WP 2191091. doi: 10.2139/ssrn.2919091. Retrieved from SSRN https://ssrn.com/abstract5291091. Accessed on July 15, 2020.

Cohen A., Mazzeo M.J. (2010). Investment Strategies and Market Structure: An Empirical Analysis of Bank Branching Decisions, *Journal of Financial Services Research*, 38:1-21.

Demurger, S. (2001). Infrastructure development and economic growth: An explanation for regional disparities in China, *Journal of Comparative Economics,* 29, 95–117.

Dick A.A. (2007). "Market Size, Services Quality, and Competition in Banking, *Journal of Money, Credit and Banking*, 39:49-81.

Evanoff, D. D. (1988) Branch Banking and Service Accessibility. *Journal of Money, Credit and Banking,* 20**,** 191-202.

Feinberg, R.M. (2009). Patterns and determinants of entry in rural country banking markets, *Journal of Industry, Competition and Trade*, 9, 101-115.

Gunther, J. W. (1997). Geographic Liberalization and the Accessibility of Banking Services in Rural Areas. Dallas, Texas: Federal Reserve Bank of Dallas.

Hannan, T. H. and G. A. Hanweck (2008). Recent trends in the number and size of bank branches: An examination of likely determinants, Finance and Economics Discussion Series. 2008-02, Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C.

Harimaya K and Kondo K (2012). Determinants of Branch Expansion by Japanese Regional Banks, *The IUP Journal of Bank Management*, 11:7-25.

Harvey, C. R. (2016). Cryptofinance available at SSRN: https://ssrn.com/abstract=2438299

Hendrickson, J. M., Nichols, M. W., Fairchild, D. R. (2014). Bank branch location and stability during distress. *Journal of Financial Economic Policy,* 6**,** 133-151.

Hong, J. W., et al. (2008). The Study of Location Strategy for Bank's Branch Network through the Analysis of Interregional Financial Transaction Network. Future Generation Information Technology: First International Conference, FGIT 2009, Jeju Island, Korea, December 10-12,2009. Proceedings. Y. H. Lee and D. Slezak. Heidelberg, Springer Berlin Heidelberg**:** 95-103.

Hryckiewicz, A. and Kowalewski, O. (2008). Economic Determinants and Entry Modes of Foreign Banks into Central Europe. Wharton Financial Institutions Center Working Paper No. 08-08. Available at SSRN: https://ssrn.com/abstract=1094284.

Jayaratne, J. and Strahan, P.E., 1996. The finance-growth nexus: Evidence from bank branch deregulation. *The Quarterly Journal of Economics*, 111(3), pp.639-670.

Kondo, K. and Harimaya, K. (2014). Why do Japanese non-local regional banks enter other prefectures under the region-based relationship banking policy? *Journal of Industry, Competetion and Trade* 14: 473-485.

Lanzillotti, R. F. and Saving, T. R. (1969). State Branching Restrictions and the Availability of Branching Services: Comment. *Journal of Money, Credit and Banking,* 1**,** 778-788.

Lall, S. V., & Mengistae, T. (2005). Business environment, clustering, and industry location: evidence from Indian cities. The World Bank.

Maddala, G. S., & Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and statistics*, *61*(S1), 631-652.

Maudos, J. (2017). Bank restructuring and access to financial services: the Spanish case. *Growth and Change*, *48*(4), 963-990.

Petersen, M. and R. Rajan (2002). "Does Distance Still Matter? The Information Revolution in Small Business Lending." *The Journal of Finance*, 57(6): 2533-2570.

Pollard, J. S. (1996) Banking at the margins: a geography of financial exclusion in Los Angeles. *Environment and Planning A,* 28**,** 1209-1232.

Porter, R. C. (1966). The Promotion of the Banking Habit and Economic Development. *Journal of Development Studies,* 2(4): 346-366.

RBI (2008). Report on Currency and Finance, 2006-08, Vol 1: The Banking Sector in India: Emerging Issues and Challenges, Reserve Bank of India, Mumbai.

RBI (2014). Master Circular on Branch Authorisation, accessed from https://www.rbi.org.in/Scripts/BS_ViewMasCirculardetails.aspx?id=9014

RBI (2018). Branch Banking Statistics, Reserve Bank of India, Mumbai.

Seaver, W.L. and D.R. Fraser (1979). Branch banking and the availability of banking services in metropolitan areas, *Journal of Financial and Quantitative Analysis*. 14(1): 153–160.

Srinivas, V and Wadhwani, R. (2019). Recognizing the value of bank branches in a digital world: Findings from the global digital banking survey, The Deloitte Centre for Financial Services, Deloitte Insights.

Tranfaglia, A. (2018). Shrinking Networks: A Spatial Analysis of Bank Branch Closures Working Papers, WP 18-12 March 2018, Federal Reserve Bank of Philadelphia, https://doi.org/10.21799/frbp.wp.2018.12

Table 1 Descriptive statistics

Variable	Descriptions	Observations	Mean	Std. Dev.	Min	Max
public	Number of public bank branches	300	2,601.67	2,390.34	28.00	11,612.00
private	Number of private bank branches	300	529.12	652.80	0.00	3,142.00
total	Number of total bank branches	300	3,140.79	2,916.23	28.00	13,171.00
deposits	Bank deposits (in Rs billions)	300	2,041.51	3,289.22	10.00	21,955.11
credit	Credit to states (in Rs billions)	300	1,529.97	3,054.31	4.00	23,273.51
income	Per capita State Domestic Product (in Rs)	274	63,535.23	28,132.65	2,017.00	143,211.40
population	Estimated midyear population (in 000s)	300	46,661.70	46,456.57	946.00	221,469.00
mortality	Infant mortality rate (per 1000 live births)	275	38.87	15.16	9.00	74.00
factory	Number of factories	253	7,558.70	8,599.09	59.00	37,878.00
highway	Length of state highways (in km)	287	6,517.93	8,087.06	67.00	40,144.00
HHI	Herfindahl–Hirschman Index	300	7,485.08	1,418.10	4,597.32	9,968.80

Table 2 Results from Poisson regression

	Dependent variable		
	(1)	(2)	(3)
	log *total*	log *private*	log *public*
log *deposits*	0.044**	0.233	0.045*
	(0.019)	(0.157)	(0.025)
log *credit*	-0.025	-0.105	-0.030
	(0.017)	(0.123)	(0.022)
log *income*	-0.038	-0.083	-0.036
	(0.046)	(0.270)	(0.047)
log *population*	0.360**	1.257	0.353*
	(0.180)	(1.112)	(0.199)
log *mortality*	-0.042***	0.061	-0.034**
	(0.014)	(0.131)	(0.015)
log *factory*	0.027	0.128	0.029*
	(0.017)	(0.085)	(0.017)
log *highway*	-0.000	0.013	-0.003
	(0.014)	(0.089)	(0.013)
log *HHI*	-0.035	-0.394**	-0.012
	(0.032)	(0.159)	(0.036)
POLICY	0.012***	-0.004	0.010**
	(0.004)	(0.019)	(0.005)
Wald Chi-Square	527.575	95.272	403.178
Wald Chi-Square *p* value	0.000	0.000	0.000
Observations	245	242	245

Robust standard errors are in parentheses. ***, **, * represent significance at 1 per cent, 5 per cent, 10 per cent level, respectively.

Table 3 Further investigation using Poisson regression

	Dependent variable					
	Advantaged States			Disadvantaged States		
	(1)	(2)	(3)	(4)	(5)	(6)
	log *total*	log *private*	log *public*	log *total*	log *private*	log *public*
log *deposits*	0.001	0.195	0.002	0.070*	0.167	0.061
	(0.028)	(0.161)	(0.024)	(0.037)	(0.326)	(0.045)
log *credit*	0.014	-0.085	0.013	-0.028	0.024	-0.041*
	(0.023)	(0.116)	(0.020)	(0.018)	(0.285)	(0.022)
log *income*	0.011	0.160	-0.002	-0.109	-0.210	-0.083
	(0.036)	(0.125)	(0.037)	(0.094)	(0.685)	(0.104)
log *population*	0.218	1.117*	0.203	0.560	3.040	0.730
	(0.135)	(0.654)	(0.128)	(0.397)	(4.772)	(0.524)
log *mortality*	-0.034	0.264**	-0.040	-0.042	0.082	-0.029
	(0.030)	(0.123)	(0.030)	(0.026)	(0.244)	(0.024)
log *factory*	0.006	0.030	0.003	0.024	0.099	0.027
	(0.011)	(0.034)	(0.010)	(0.021)	(0.174)	(0.020)
log *highway*	-0.001	0.001	-0.002	0.011	0.089	0.004
	(0.008)	(0.037)	(0.008)	(0.024)	(0.186)	(0.027)
log *HHI*	-0.041**	-0.232**	-0.025	-0.020	-1.002**	0.034
	(0.016)	(0.094)	(0.016)	(0.057)	(0.406)	(0.077)
POLICY	0.011***	0.002	0.011***	0.009	-0.051	0.005
	(0.002)	(0.008)	(0.002)	(0.010)	(0.039)	(0.014)
Wald Chi-Square	1045.816	129.041	878.348	2241.435	112.419	6289.248
Wald Chi-Square *p* value	0.000	0.000	0.000	0.000	0.000	0.000
Observations	141	141	141	104	101	104

Robust standard errors are in parentheses. ***, **, * represent significance at 1 per cent, 5 per cent, 10 per cent level, respectively.