PUBLIC OWNERSHIP AND ANTI-PREEMPTION*

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Abstract

Financial access is important. Market forces create variation in financial access when public and private providers interact. We document, model, and resolve puzzling anti-preemptive patterns in the expansion of a public bank. A two-player dynamic spatial-competition entry game on the actual graph of villages is solved explicitly, and estimated, yielding these patterns. Unconventionally, the public bank maximizes profit when on its own but gets out of the way of commercial banks otherwise. The chosen parsimonious model is validated though simulations on hold-out provinces. Counterfactuals entertaining alternative strategic, collusive, or political economy motivations produce significantly different financial-access patterns.

Key words: Banking, Government, Ownership, Financial Access
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1 Introduction

In this paper, we study the interaction between a government development bank and private commercial banks in providing financial services in the context of a developing economy, Thailand. Using geo-spatial financial access data at the individual village-level from the Thai Community Development Department, CDD, and detailed on-the ground household level data from the Townsend Thai project, we empirically document an asymmetry not only in the way a public and private banks place branches in response to village-level characteristics (wealth, population, and proximity to markets), but more importantly, in the way the public and private banks react to each other's presence in the local market.

In particular, we find that the government development bank (BAAC) places branches consistent with profit maximization in those Thai provinces in which there is virtually no presence of commercial banks. Namely, it expands into more populous and wealthy areas. However, in provinces with sizeable (current or eventual) commercial banks' footprint, the BAAC rather than attempting to preempt entry or compete with commercial banks for most lucrative locations, instead focuses on serving poorer and less populated areas. Thus, BAAC's behavior is inconsistent with pure (own) profit maximization and with any stylized view of its original charter. That is, the motive does not seem to be the targeting of under-served locations either. We term such behavior "anti-preemption". All the while, commercial banks seem to maximize own profits regardless of the BAAC's local market foot print.

These patterns are all the more puzzling since BAAC does not seem to be offering financial services that are inferior to those of commercial banks. Conditionally on having a branch open in a local area, if anything, the BAAC seems to be more efficient in attracting customers than the commercial banks. The BAAC has a wider financial outreach from each of its branches than the commercial banks: i.e., the BAAC discounts distance less than commercial banks and is more likely to reach out to more distant villages from each of its branches. This heterogeneity in financial outreach technology suggests that the observed anti-preemptive behavior by the BAAC is unlikely to stem from the inability to compete with commercial banks but rather comes from the BAAC's objective.[1]

To rationalize these patterns, we develop a two-player dynamic spatial competition entry game model on a network of markets connected by roads taken from the data. The game allows the two FSPs to make moves (i.e., to open new branches) dynamically, with the timing of moves taken from the actual data. Following the approach in Holmes (2011), identification comes not from a decision about *when* to open a new branch but rather *where* to open it. We also draw on the insight from Rysman et al. (2022), who show that, while in reality there are typically several commercial banks, pre-emptive patterns across commercial banks are consistent with the entire sector acting as a monopolist, motivating the 2-player game. Our primary innovation is to add the BAAC and study the interaction of that public bank with commercial banks.

Motivated by institutional background and stylized facts on the behavior of financial service providers, BAAC and commercial bank in Thailand from 1986-1996, we make the following modeling choices. First, the financial system expanded with no branch closures, motivating the focus on entry decisions in a non-stationary environment. Second, financial services are provided through a network of roads connecting villages to bank branches. Third, there are clear differences in the expansion of BAAC and commercial branches in the CDD data, suggesting that they may pursue different objectives. This motivates us to allow the objective function of public banks to differ from the profit-maximizing behavior of private banks. Fourth, the presence of commercial banks changes BAAC behavior, motivating the modeling as a strategic forward-looking entry game. Fifth, the outreach of BAAC branches is wider than commercial bank branches, motivating heterogeneity in parameterized outreach technologies.

To keep the model tractable we assume that a given village can get financial services from any branch in a province, thus imposing no within-province market boundaries (though we show numerically that only the three closest potential branch locations matter in practice). Entry in each one of the possible locations is sequential; earlier location choices may preempt profitable future moves of a competitor. As we consider a finite entry game, we solve for the subgame-perfect equilibrium by backward induction. This a relatively complicated high dimensional game, which

[1] In section 2, we provide extensive institutional background on products, contract terms, and markets shares which further suggest that the BAAC offers financial products that, if anything, are more attractive to clients than those of commercial banks'.

requires a super-computer for estimation.

In the model, the BAAC's altruistic, anti-preemption behavior arises out of an estimated concern for the commercial bank, parameterized by the weight on commercial bank's payoff in the BAAC objective function. Our estimates indicate that the BAAC puts equal weight on the commercial bank's and own branches payoff, which allows us to rationalize the observed anti-preemptive behavior. As we discuss in more detail, such "altruistic" behavior by the BAAC might represent several (non-mutually exclusive) mechanisms. On the one hand, the BAAC might be a genuine benevolent actor who cares about consumers' welfare from financial services, regardless of which FSP provides those services. That is, its motive is increased financial access for the Thai population. When acting alone it goes to high population centers first. When acting under the presence of commercial banks, it takes into account that commercial banks will serve high population centers given their selfish profit motive. On the other hand, the BAAC might care about "leaving money on the table" for commercial banks, due to the political pressure those banks might put on the government if BAAC were becoming a competitive threat.

In order to assess the quality of fit of our baseline model, we go beyond statistical criteria and use the baseline model at estimated parameter values to simulate the profiles of financial access. We then contrast the simulated data with observed CDD financial access patterns. It is worth noting that for tractability purposes model estimation is conducted on the subset of 10 provinces of Thailand while the goodness of model fit is evaluated on the whole population of villages. This, in effect, represents a model cross-validation exercise. We show that the data generated by our model exhibit the same dichotomy in the BAAC's behavior as the actual data: the BAAC going to less lucrative locations when the presence of commercial bank is high and displaying seeming profit maximizing behavior when such presence is low.

Using similar simulation exercises, we are also able to rule out other objective functions (and therefore behavior). We construct counterfactual predictions for financial access outcomes for alternative parameter values and alternative behavioral assumptions, and contrast those predictions with financial access patterns predicted by baseline model. We show that the baseline model not only differs statistically from the counterfactuals, but can also be distinguished from other counterfactuals in terms of economic predictions about which villages get financial access and when.

As the BAAC puts some weight on commercial bank's payoff , it seems that a "political" capture story may be at work. However, our analysis rejects two counterfactual scenarios, one under which the BAAC cares *only* about commercial banks, and a second under which the BAAC and commercial banks act in secret as collusive monopoly. Neither of these is consistent with empirical evidence in terms of the characteristics of populations served. In this sense the capture motive is neither overly strong nor innocuously weak.

That said, our findings are also consistent with benevolence towards consumers lying behind estimated BAACs "altruism". Using the same simulation approach, we calculate counterfactual financial access under a hypothetical (first-best) scenario, when the economy is served by the single benevolent FSP maximizing total financial access and having the same as BAAC wide financial outreach. We find that our baseline scenario (with BAAC and commercial bank present and with BAAC anti-preemption) achieves similar, albeit slightly lower, levels of total financial access with few differences in the characteristics of villages served. Therefore, our results speak to the efficacy with which the government development bank in Thailand, the BAAC, was able to extend credit and financial services to maximize total financial access. To what extent the lessons from Thailand could be extended to other developing and developed economies remains the focus of future research.

Our paper is related to several strands of literature. On the IO side, our paper is related to the literature on preemption, spatial competition and dynamic entry. As in much literature, our paper features the supply side of the problem at the cost of simplifying the demand side.[2] Specifically, we make the demand at the village level an inelastic function of population or wealth (as in Holmes (2011)) insensitive to pricing (equivalently imposing same pricing at all stores/bank branches), drawing on large preexisting literature and on the fact that interest rates are set at the national level in Bangkok. In our analysis distance is used in determining the probability of a village receiving financial access, implying that banks are competing in space, but not on price.

While the concept of preemption is widely understood, much of the extant literature on the subject is theoretical. Our paper adds to a still limited empirical literature on the topic. Schmidt-Dengler (2006) studies the preemption motivation of MRI adoption decision in US hospitals. He finds that preemption plays a limited, although significant, role in the adoption timing decisions.

[2]See e.g., Holmes (2011), Ellickson et al. (2013), or Houde (2012).

Igami and Yang (2016) study cannibalization and the preemptive entry of hamburger chains in Canada using the BBL approach. To the best of our knowledge, there is no literature that features anti-preemption.

Our paper also makes a methodological contribution to the IO literature on spatial competition by proposing a novel way to model the relevant market structure dynamically. Most papers featuring spatial competition are largely static and/or incorporate some form of segmentation of markets as a salient feature of the analysis.[3] By contrast, we do not utilize the concept of geographically fixed sub-markets at any level within a given province. In this regard, there is a connection between what we do with Eaton and Kortum (2002) in that the option for a village to be served by any branch on the entire map is received probabilistically. In addition, our approach features transitional dynamics and does not involve steady-state or stationarity assumptions. In fact, in our model the nature of the game (and the relevant market "boundaries") changes every period following each player's move.

The rest of paper is organized as follows. Section 2 describes the background of the Thai economy during the 1986-1996 period, institutional details for the FSPs, and documents empirical facts that motivate our model. Section 3 presents the model and uses key examples to illustrate the strategic and dynamic aspects embedded in it. Section 4 discusses baseline model estimates, model fit, and counterfactual exercises. Section 5 concludes.

2 Stylized facts on BAAC and Commercial Banks as Financial Service Providers.

2.1 Institutional Background.

Thailand changed its status as low income country to upper middle income in less than a generation, with particularly high growth subsequent to the financial liberalization of 1986.[4] This came with substantial financial deepening (Townsend and Ueda (2006)). Thinking of the long haul, both BAAC and commercial banks had a preponderance of their branches in and around Bangkok and

[3]See e.g., Jia (2008), Ho and Ishii (2011), Gowrisankaran and Krainer (2011).
[4]https://www.worldbank.org/en/country/thailand

major cities and then expanded into the outer provinces. Motivating our study here, from l986-l996, the number of BAAC branches increased from 592 to 955 or approximately a 60 percent increase, and for commercial banks the corresponding numbers are 996 in 1986 to 2046 in 1996, or over a 100 percent increase.

The BAAC as an agricultural development bank is not stereotypical, i.e., defies easy categorization. While initially there was indeed the difference between the commercial banks and the BAAC in terms of target client base, with BAAC focusing on rural areas and commercial banks operating primarily in urban areas, over time there was a convergence in their mandates. As Seibel (2000) writes: "In 1975, the Bank of Thailand adopted an agricultural credit policy stipulating that commercial banks would initially have to lend 5 percent – and 20 percent subsequently – of their portfolios to the agricultural sector. Under this policy, the banks could either lend the amount directly to farmers or deposit with BAAC any portion of the quota that they could not disburse directly." Additionally, the definition of agricultural sector broadened over the years, so that commercial banks easily met their mandate within their own operations, and in turn eventually BAAC was allowed to lend to all types of rural credit and a stringent cap on interest rates was relaxed. Therefore, we argue that during the time of our analysis, 1986-1996 the BAAC was competing for the similar customers with commercial banks (See Section 2.4 in BAAC (2010)).[5]

2.1.1 Contractual features

Below, we provide a more detailed description of BAAC and commercial banks' contract offerings to support this conclusion.

Interest Rates: As described in Ahlin and Townsend (2007), the BAAC adopts a pre-specified, uniform national schedule, mapping loan sizes into interest rates, lower for smaller loans. From the Townsend Thai data, interest rates of BAAC are lower than those of commercial banks. From the Bank of Thailand (`www.bot.or.th`) interest rates on deposit savings are virtually identical and move in tandem. Interest rates for both financial service providers are set at the national level and

[5]It is also worth mentioning that the choice of the time period 1986-1996 for our analysis is motivated both by data availability (since financial access data are available from CDD biannually starting from 1986) as well as by the fact that during this period there were no macroeconomic shocks hitting Thai economy. Prior to 1986 (in 1983) Thailand experienced financial crisis related to world oil price shocks, while in 1997 it was hit by Asian Financial crisis. See Townsend and Ueda (2006) for more details.

are the same at all branches, i.e., not tailored to a particular FSP configuration in a given local market (an assumption that is explicitly embedded in our model).

Loan Performance: The BAAC does not have laxer lending standards than the commercial banks. Townsend and Yaron (2001) find (see Figure 3 on p. 44 of their paper) that the levels of loan defaults were at least similar between the BAAC and commercial banks, and if anything, slightly lower for the BAAC. On average, 85% of loans are paid at the due date. This fraction rises to over 95% in the course of 2-3 years after the initial due date. Likewise, the Townsend Thai data monthly shows high repayment rates to the BAAC.

Product Variety: The BAAC loans *are* smaller than loans from commercial banks with medians of 35K vs 100K; have a slightly shorter duration, 12 vs 13 months; and involve lower collateral. But the BAAC offers not only joint liability smaller short-term loans, but also offers longer-term collateralized loans above the 60,000 baht threshold. These types of loans are much closer in all characteristics to commercial bank loans. There is also slight product differentiation on the deposit-side, as the BAAC offers (in addition to other deposit products) a type of savings accounts with a lottery component.

Payoffs And Profitability: In addition, BAAC provides financial (loan) contracts that are de facto an insurance scheme that is valued by households. Alem and Townsend (2014) establish in instrumented regressions that users of BAAC loans have consumption and investment that are smoothed against income shocks relative to non users. Commercial banks do worse in terms of client smoothing. Here we report on the way in which this part is financially supported by the government. When a client experiences an adverse shock, the reason is reported and verified if necessary by a BAAC field officer. The BAAC can then extend the loan, and sometimes forgive some of the (compound) interest due and/or forgive some of the principal. The funds for this come from the central government and are a line item in the BAAC accounts, denoted as an interest recompense fund. In effect, the government is paying a premium for insurance on behalf of the farmers. As shown by Yaron (1994) the BAAC could entirely fund its own operations if it raised the interest rate a relatively small amount, (on the assumption demand is locally inelastic). The rate at which BAAC lends money is on average less than the lending rate of commercial banks.

Regarding commercial banks, by the early 1990s, Thailand's banks were profitable in the sense that they could charge up to 4 percentage points more interest for loans than they paid on deposits. However their efficiency during this period came into question in the light of the financial crisis, which came in mid 1997 (Laplamwanit (1999)).

2.1.2 Market Shares and Geographical Outreach

Credit: For facts on the ground, we turn to Townsend Thai urban data 2005-2011, which covers 7 provinces, comparing loans and saving accounts across the two financial service providers. We focus on urban rather than rural statistics because from the (incorrect) stereotypical view from its initial charter, one might not expect the BAAC to be prominent, e.g., lending, in urban areas to small business. Yet, this is exactly what is found in the data. In the randomly sampled population of the survey, the percent of (urban) households holding a loan in 2005 were 6.2% from commercial banks versus 11.9%, from the BAAC. So, in fact, the BAAC was more successful in generating loans in urban areas, relative to commercial banks. Other years are similar.

Savings: In contrast, differences are the opposite on the savings side. In 2005 the percentage of households with BAAC savings accounts was lower than for commercial bank, but there is variation across provinces. The BAAC saving account ownership ranges from 2.1% to 36.7%. Commercial bank saving account ownership ranges from 39.2% to 79.6%. Nevertheless, in some provinces these percentages are within 10 percentage points of each other.

Geographical Outreach: The operations of the BAAC are decentralized. Branches and field officers are the front line of contact with local communities. Each field office has an average of three to five officers, each one being responsible for around 700 clients. Field officers personally travel to nearby villages providing financial services. This establishes a two-layer approach in which provision is given by the interaction of branch location and the outreach provided by the individual officers. At the same time, commercial banks are usually more standard brick-and-mortar operations. As a result, the BAAC has a wider outreach from any of its branches. Using baseline Townsend Thai data from 1996 and subsequent four years in the annual panel, Alem and Townsend (2014) find a much lower distance discounting (in terms of savings and credit provision). In fact, they show that for BAAC "time to district center" is on average a positive, not negative, predictor of client use for both savings and credit. For commercial bank, the opposite is always true: the greater the distance the less the use.[6]

Conclusion: Overall, we conclude that the BAAC and commercial banks operate in the same markets catering to the similar customers. Product offerings by the BAAC are comparable to those (more attractive to the customers on some dimensions, less on others) offered by the commercial banks. There tends to be a difference in financial outreach technologies, with BAAC being able to reach more distant customers from each of its branches. Therefore, in our modelling exercise below we focus on locational aspects of interaction/competition between FSPs assuming that they offer the same financial products. We do explore the effects of differences in product quality in a robustness check in Appendix Section D.

2.2 Empirical Evidence: the Anti-preemptive Behavior of the BAAC

In this Section, we document the differences in financial access patterns for the BAAC and commercial banks that we address in our structural model. Namely, we investigate the expansion of financial services by the two FSPs at the village level. We look at two pieces of evidence. First, we look at longer-term horizon evidence by relating FSPs expansion patterns over our whole sample period (1986-1996) to the initial level (i.e., circa 1986) village characteristics (population, wealth etc). Second, we consider bi-annual frequency data (as our CDD wave survey happens every two years) and for each biannual cycle $t \in \{1986, 1988, 1990, 1992, 1994\}$ relate the village characteristics measured in t to subsequent $t \to t+2$ expansion of FSPs.

2.2.1 Evidence from long-term expansion patterns

Denote $FSP_{i,t}$ a dummy indicating that village i reports having a loan contract with financial service provider FSP ($FSP \in \{BAAC, COMM\}$) in a given year t. In this subsection, our dependent variable, $\Delta FSP_{i,1986\to1996}$, is the change in financial access to financial service provider FSP between 1986 and 1996 for a given village i:

$$\Delta FSP_{i,1986\to1996} = FSP_{i,1996} - FSP_{i,1986} \tag{1}$$

[6] This difference in financial outreach technologies is also found in our study and is an essential building block of our structural model.

We relate this dependent variable to the following observable village characteristics measured at the beginning of the sample period, 1986. To account for the potential market size of a given village we include (log of) villages' population, $log(population)_{i,1986}$, and a wealth per capita index, $Wealth^{*}_{i,1986}$.[7] To account for the effect of geographical connectedness of village's position to regional centers we include the log of time travel (in minutes) from a given village to the nearest marketplace location.[8] Namely, we consider the following empirical specification:

$$\begin{aligned}\Delta FSP_{i,1986\rightarrow 1996} &= \beta_1 log(population)_{i,1986} + \beta_2 Wealth^{*}_{i,1986} + \beta_3 log(Travel\ time)_i + \\ &+ \gamma_1 BAAC_{i,1986} + \gamma_2 COMM_{i,1986} + (\pi(i)) + \epsilon_i\end{aligned} \tag{2}$$

In all specifications we control for the initial (as of 1986) access to both FSPs, $BAAC_{i,1986}$, $COMM_{i,1986}$, as well as include province fixed effects, $\pi(i)$, which absorb all fixed province-level characteristics that could affect the expansion of services by the two FSP's.

Estimation results (Table 2 Columns 1 Panel A vs Panel B) show estimates for the whole sample for the BAAC and commercial banks, respectively. They show that commercial banks tend to serve more populous and wealthier villages that are closer to regional centers. Contrary to that, the BAAC's response to such characteristics of villages is much more muted: there is virtually no response to the village's distance to the marketplace and the coefficients on population and wealth are considerably smaller than those for the commercial banks (only coefficient on population is statistically significant).

This raises a natural question: "What is the objective function for the BAAC?" Given the patterns above, it is unlikely that the BAAC maximizes own profits only. At the same time, it does not look like targeting of poorer and underserved locations either. The BAAC does not go to the most profitable nor does it go to the poorest areas either. We conjecture that there might be some important strategic interactions considerations in BAAC's behavior depending on whether commercial banks are present in the local area.

[7] The wealth index is based on a principal component analysis based on the number of motorcycles, pick-up trucks and flush toilets per 1000 villagers. Since wealth index data in 1986 is not available for 40% of villages we use wealth index measured in 1988 to impute data in place of missing observations.

[8] As was mentioned above, banks do not open offices in individual villages. Instead, bank branches are usually situated in some central locations/regional centers. Distance to the marketplace measures time to travel from the villages to the nearest such potential bank branch location.

To probe this, we estimate specification (2) for the BAAC separately on the subsamples where the presence of commercial banks is "high" vs. "low". To construct these subsamples, for each province we calculate the percentage of villages that report having financial access to commercial banks. We then divide the sample into two subsamples: "low" – where this percentage/province-level "footprint" of commercial banks is below the 75^{th} percentile and "high" – where the presence of commercial banks is above the 75^{th} percentile. In the main text we use initial province-level "footprint" of commercial banks, measured on the basis of 1986 financial access data.[9]

Estimation results are presented in Table 2 Panel A, Columns 2 and 3. These estimates show striking differences in the BAAC's behavior in provinces with "high" vs "low" footprint of commercial banks. On the one hand, in provinces where commercial banks' presence is low, column 3, the BAAC is more likely to serve more populous and wealthier locations that are closer to market-places/regional centers. On the other hand, in provinces where commercial banks have substantial presence, column 2 , the BAAC is likely to serve more distant and less wealthy villages, and the effect of population becomes indistinguishable from zero.

For completeness (and to further highlight the differences in behavior between commercial banks and the BAAC) in Panel B of Table 2, we explore whether the similar switch occurs in the behavior of commercial banks in response to the province-level "footprint" of the BAAC. We find no change in the commercial bank behavior in response to the presence of the BAAC. Commercial banks discount distant villages and prefer to serve more populous and wealthier locations regardless of whether the BAAC is strongly or weakly present in the area. The order of magnitude of coefficient estimates are quite significant and similar across the relevant columns.

This finding is quite robust and is observed under alternative specifications. Since there could be an asymmetry in villages *getting* vs. *losing* access to financial services, we estimated specification similar to those Table 2 on the subsamples of villages with no financial access to the given FSP in 1986 (hence dropping from Table 2 that control). Estimates presented in Table A1 portray the same patterns as before. We also used a more local definition of footprint of the other FSP provider by dividing the sample on the basis of amphoe-level[10] (rather than province-level) footprint of the

[9] The results are similar when we consider the eventual footprint in 1996. See Appendix Table A4.

[10] Provinces in Thailand (similar to the states in the US) are comprised of amphoes, thus, amphoes are similar to counties in the US context.

other FSP. The results are similar (See Table A2). We also considered an alternative cutoff (90th percentile) for "High" vs "Low" footprint dummy construction. The results are similar (See Table A3).

2.2.2 Biannual Panel data Evidence

Next, we assess whether the similar patterns are observed at shorter time frequencies. Namely, using the biannual panel data on financial access, we relate 2-year expansion decisions of FSPs to the beginning of a biannual period village characteristics. Specifically, denote $FSP_{i,t}$ a dummy indicating that village i reports having a loan contract with financial service provider FSP, ($FSP \in \{BAAC, COMM\}$) in a given year t. Since our data on financial access are bi-annual we consider $t \in \{1986, 1988, 1990, 1992, 1994\}$. Our dependent variable, $\Delta FSP_{i,t\to t+2}$, is the change in the state of financial access to financial service provider FSP between years t and $t+2$ for a given village i:

$$\Delta FSP_{i,t\to t+2} = FSP_{i,t+2} - FSP_{i,t} \tag{3}$$

Then, for every period $t \in \{1986, 1988, 1990, 1992, 1994\}$, we relate the expansion of financial services over the next two-year time period $\Delta FSP_{i,t\to t+2}$ to current (i.e., year-t) village characteristics.

In light of our findings in the previous Section, we also explore whether there is a change in the BAAC's response to villages' characteristics depending on the footprint of commercial banks in a given province. Namely, similar to our analysis above, we define period-t footprint of a given FSP in a given province p, $FSP_{p,t}$, as the percentage of villages in province p that report having access to this given FSP's services. For any given FSP, we denote $\overline{FSP}_{p,t}$ the provincial footprint of the competing FSP. We then consider the following flexible empirical specification:

$$\begin{aligned}
\Delta FSP_{i,t\to t+2} &= \beta_1 log(population)_{i,t} + \beta_2 Wealth^*_{i,t} + \beta_3 log(Travel\ time)_i + \\
&+ \overline{\delta}_1 \overline{FSP}_{p,t} log(population)_{i,t} + \overline{\delta}_2 \overline{FSP}_{p,t} Wealth^*_{i,t} + \overline{\delta}_3 \overline{FSP}_{p,t} log(Travel\ time)_i + \\
&+ \delta_1 FSP_{p,t} log(population)_{i,t} + \delta_2 FSP_{p,t} Wealth^*_{i,t} + \delta_3 FSP_{p,t} log(Travel\ time)_i + \\
&+ \gamma_1 BAAC_{i,t} + \gamma_2 COMM_{i,t} + (\pi(i)) + \epsilon_i
\end{aligned} \tag{4}$$

Here, coefficients β_k show the baseline effect of a given characteristic of a village (population, wealth, distance to market). Coefficients $\overline{\delta}_k$ show the change in the effect of these characteristics for a given FSP expansion depending on the presence/provincial footprint of another FSP, while δ_k show potential differences depending on own footprint. As before, in all specifications, we control for the initial (as of year t) access to the both FSPs, $BAAC_{i,t}$, $COMM_{i,t}$ and include province fixed effects, $\pi(i)$, to absorb province-level heterogeneity in expansion patterns by the two FSP's.

Estimation results are presented in Table 3. In columns (1) vs (4) we consider only the baseline response for the BAAC and commercial banks, respectively. We find the similar positive response to villages' wealth, population, and proximity to a marketplace in the case of commercial banks' expansion. The effects for the BAAC, while the same in sign, are smaller by a factor of 7 to 10.

However, in the case of the BAAC, these results mask important heterogeneity depending on the footprint/presence of the commercial banks. In column (2), we find that when commercial bank's footprint is low the BAAC puts a considerably higher (positive) weight on both population and wealth. At the same time, the interaction coefficients with commercial banks' footprint, $\overline{\delta}_k$, are negative, which effectively counterbalances those baseline effects. Distance discounting is also much higher (3-4 times larger than in the whole sample) in the areas with low commercial bank's presence and, again, the interaction coefficient is attenuating this effect.

Notably, we do not find such heterogeneity in assessment of village's population and wealth by the commercial banks in response to the BAAC's footprint (Column (5), Table 3). Commercial banks seem to assess villages' population and wealth in the same way, regardless of the presence of BAAC in the province. We do find differential response in terms of distance to the market. When the BAAC's presence is low, commercial banks do not seem to discount distance much, but increase distance discounting when BAAC's presence increases.

An interesting question in this regard is whether such heterogeneous assessment is a response to another FSP's presence or the result of its own expansion within the province. To probe this, in columns (3) and (6), we include interactions with own (initial) footprint on top of another FSP's provincial footprint. In column (3), we find that own footprint does have an effect on assessment of population and wealth for the BAAC. As the BAAC becomes more prevalent, it puts less weight on population and wealth, perhaps reacting to its initial position and what is left to choose from. Likewise, the level and interaction effects with commercial banks in column (3) are different from those in column (2) for some variables. However, the estimates suggest that commercial bank's footprint is still relevant, as it changes BAAC's response to villages' population and proximity to the markets. In contrast, for commercial banks, column (6) indicates that (while there might be some heterogeneity with respect to own footprint) the presence of the other provider (the BAAC) is either insignificant (in the case of distance to the market), works towards reinforcing the baseline (positive) effect (in the case of per capita wealth), or even when attenuating the baseline effect would not be able to counter that effect completely (in the case of population).[11]

Overall, we argue that the BAAC and the commercial banks differ considerably from one another in their expansions of financial services. Commercial banks' behavior seems to be consistent with profit maximization: they expand into more lucrative areas that are easier to serve (i.e., closer to the market places). In contrast, it is difficult to reconcile the BAAC's behavior with simple profit maximization. Neither does it seem to target poorer/less populated locations. Instead, we find that the BAAC's expansion exhibits *anti-preemptive* patterns: the BAAC's tends to get out of the way of commercial banks when/if those are present in the area, Yet, it behaves more as a profit-maximizer bank when commercial banks are absent. Below, we posit and estimate a structural model where we try to rationalize such "anti-preemptive" patterns.

3 Model

We now present a dynamic spatial model in which we attempt to rationalize the puzzling "anti-preemptive" behavior by the BAAC's documented above. We conjecture that "anti-preemption" might arise because the BAAC takes into account not only direct payoff received from own branches but also puts some weight on customers served by the commercial banks. Indeed, if the BAAC were to maximize total financial access, then in areas where the footprint of commercial banks is substantial the BAAC might appear to put negligible (or even negative) weight on population/wealth as it would expand into poorer/smaller villages, which are less likely to be serviced by commercial banks, thus, leaving populous/wealthier locations to the commercial banks. However, in areas

[11]We also considered a version of equation (4) dropping all interactions and looking at the effect of footprint only. Estimates presented in Appendix Table A5 portray the same picture: (pre-existing) provincial footprint of commercial banks decreases BAACs expansion, while there is no impact of BAAC's presence on commercial banks' expansion. We wouild like to thank an anonymous referee for this suggestion.

where commercial banks are scarce, maximizing *total* financial access implies that the BAAC would predominantly expand into more populous/wealthier areas.

3.1 Geographic network and marketing

To illustrate this intuition, we consider a dynamic game between two players – the BAAC (B) and the commercial bank (C) that compete for customers on a network of villages connected by roads. It is worth noting that we model commercial banking sector as a single player. Here we build on the results from Rysman et al. (2022), who finds that, while in reality there are multiple commercial banks, the patterns observed in the data are consistent with the whole (commercial banks') sector acting as a single entity.

Assume that there is a finite number of villages M with known coordinates. There is a smaller number N of regional centers indexed by $j = 1, .., N$ which represent potential locations where FSPs might open their branches; also with known coordinates. Villages are connected to regional centers by a network of roads. This setup approximates real life conditions where FSPs do not open branches in individual villages but instead locate in local regional centers and then either (i) the FSPs send their loan officers to nearby villages or (ii) village residents travel to those centers to get financial services.

If an FSP k, $k \in \{C, B\}$, has a branch in a given regional center j, it could send loan officers to service nearby villages that are connected to this location by roads. We assume that the probability that a particular village i would be visited by a loan officer from a FSP k's branch location j exponentially declines with distance/travel time, D_{ij}, between that village and the branch location and is given by the following function:

$$r_{ij}^{k} = \Upsilon_k exp(-\tau_k D_{ij}). \tag{5}$$

In this expression, parameters τ_B and τ_C represent the impact of distance on bank financial outreach, which could differ between the two providers (which would be consistent with Ahlin and Townsend (2007)). These parameters could reflect an FSP's unwillingness to lend to borrowers located far away due to higher monitoring costs or village residents' unwillingness/inability to travel to distant branches. We also allow for the difference in overall financial outreach efforts between the BAAC and commercial bank using parameters Υ_B and Υ_C.[12] Appendix C discusses alternative formulations for the outreach technology and shows evidence that this specific functional form fits our data well.

3.1.1 Endogenous market "boundaries"

The state of the economy in each period is described by a vector indicating whether the BAAC or the commercial bank has a branch in each one of the possible locations $j = 1, ..., N$. Denote this state vector as $F = (F_B, F_C)$, where $F_k = (f_1^k, ..., f_N^k)$, $k \in \{B, C\}$, and $f_j^k = 1$ if FSP k has a branch in location j, and $f_j^k = 0$ otherwise.

Given the branch locations of each FSP and the geographical data of travel times, we define the $j(i,m)$ as the index of the mth closest branch location to village i. Based on that, denote $q_{i,m}^k = f_{j(i,m)}^k r_{i,j(i,m)}^k$ the probability that village i is served by the FSP k located in the mth nearest location. We also define the complementary probability by $\tilde{q}_{i,m}^k = 1 - q_{i,m}^k$.[13]

To keep the model tractable we assume that a given village can get financial services only from up to np closest potential branch locations, provided there are FSPs in those locations. This is not very restrictive as the impact of more distant locations is likely to be minimal due to distance

[12]In Appendix E we show that this functional form could be obtained from a latent index model with the error terms being exponentially distributed. This formulation is also related but not identical to the random utility approach usually used in the IO literature, which results in logit demand system. We treat all these parameters to represent financial outreach technology but one could think of $\delta_B \equiv \log(\Upsilon_B)$ and $\delta_C \equiv \log(\Upsilon_C)$ to be components of random utility resulting from contracts offered by the BAAC and Commercial banks, respectively. We pursue this approach for tractability since it results in log-linear demand at the village level. But in Appendix Section D, we consider a more general (logit demand) system based on random utility (albeit in simplified geographical framework) and show that such (more general) demand-side formulation does not provide additional compared insights compared to the simplified-demand version considered here.

[13]For tractability purposes, we assume "no path dependence", i.e. the probability that the village is reached from a given FSP branch does not depend on whether it happened to be served by this branch in the previous period. What determines villages' access to financial services in our model is, thus, the contemporaneous configuration of FSPs branches F, and the resulting probabilities $q(F)$. Such formulation could be a reflection of a more general model of demand with a stochastic component where each period agents face logistically distributed shocks to demand, such as in Gowrisankaran and Krainer (2011).

discounting. For example, when $np = 2$ the expected population reached by bank k is given by:

$$\begin{aligned}\Psi^k(F) = & \sum_{i=1}^{M} Y_i[q^k_{i,1}\tilde{q}^{-k}_{i,1}\tilde{q}^k_{i,2}\tilde{q}^{-k}_{i,2} + \tilde{q}^k_{i,1}\tilde{q}^{-k}_{i,1}q^k_{i,2}\tilde{q}^{-k}_{i,2} \\ & +\tfrac{1}{2}(q^k_{i,1}q^{-k}_{i,1}\tilde{q}^k_{i,2}\tilde{q}^{-k}_{i,2} + 2q^k_{i,1}\tilde{q}^{-k}_{i,1}q^k_{i,2}\tilde{q}^{-k}_{i,2} + q^k_{i,1}\tilde{q}^{-k}_{i,1}\tilde{q}^k_{i,2}q^{-k}_{i,2} + \tilde{q}^k_{i,1}q^{-k}_{i,1}q^k_{i,2}\tilde{q}^{-k}_{i,2} + \tilde{q}^k_{i,1}\tilde{q}^{-k}_{i,1}q^k_{i,2}q^{-k}_{i,2}) \\ & +\tfrac{1}{3}(2q^k_{i,1}q^{-k}_{i,1}q^k_{i,2}\tilde{q}^{-k}_{i,2} + q^k_{i,1}q^{-k}_{i,1}\tilde{q}^k_{i,2}q^{-k}_{i,2} + 2q^k_{i,1}\tilde{q}^{-k}_{i,1}q^k_{i,2}q^{-k}_{i,2} + \tilde{q}^k_{i,1}q^{-k}_{i,1}q^k_{i,2}q^{-k}_{i,2}) + \tfrac{1}{4}(2q^k_{i,1}q^{-k}_{i,1}q^k_{i,2}q^{-k}_{i,2})]\end{aligned} \tag{6}$$

where the sum is taken over all villages i and Y_i is the population of a given village i. $-k$ denotes the *other* FSP.

Each term in the expression above is associated with a possible configuration of the two nearest locations case, in which village i is served by one, two, three or four branches simultaneously, with all possible type branches at the two locations. For example, $q^k_{i,1}\tilde{q}^{-k}_{i,1}\tilde{q}^k_{i,2}\tilde{q}^{-k}_{i,2}$ represents the probability of having only FSP k serving village i from the nearest branch location $j(i,1)$, with neither the other FSP in this nearest location $j(i,1)$ nor any of the FSPs having offices in the second nearest potential location for the FSP branch, $j(i,2)$. These probability values differ across villages, reflecting the road network and specific distances to branch locations. Note also, that when multiple FSP branches reach a given village then customers are split equally between them.

The complexity of the expression above increases exponentially with the number of nearest locations included in the computation. We focus on the two nearest locations ($np = 2$) here for exposition purposes. In our empirical application we consider the three nearest locations case ($np = 3$). The resulting expression has 56 terms where each term is a product of six probabilities.[14]

Thus, in our model, as in many real-life applications, the effective market size that a branch/office of a given FSP is facing is not fixed. Terms inside the sum in equation (6) shows how "boundaries" of a market shift over time depending on actions of any particular FSP and its competitors.

[14]We choose $np = 3$ for tractability. We performed a robustness check by comparing the cases $np = 3$ vs $np = 2$ and found very similar results. We conjecture that if the choice of number of branches *were* to matter much then going from $np = 2$ to $np = 3$ should have the larger impact than for further np increases. Therefore, we would argue that choosing np=3 seems to be the appropriate choice to balance model complexity vs. its ability to fit the data.

3.1.2 FSPs' payoffs

Now let's define payoffs of financial services providers. We assume a constant per capita profit represented by π^k, considering an inelastic demand for financial services.[15] Thus, total profits received by an FSP are proportional to the expected population served/reached. Thus, the total profits obtained by provider k in a given period with the state F will be $\Pi^k(F) = \pi^k \Psi^k(F)$, where $\Psi^k(F)$ is the expected number of customers (see equation (6) above). Since we focus on branch locational rather than entry decisions, we do not model explicitly branch opening costs.[16]

Similarly, the households welfare will be represented by $\Omega(F) = \omega(\Psi^B(F) + \Psi^C(F))$. This welfare gain ω and FSP profits π^k can come out of some bargaining solution between households and banks that we do not model.

We assume that the commercial bank cares about own profits, which in our setup, is proportional to the expected population served/reached out of commercial bank's branches. Thus, commercial bank's payoff could be written as:

$$\Phi^C(F) = \Pi^C(F) \sim \Psi^C(F). \tag{7}$$

where "$\sim$" denotes equality modulus some positive multiplicative constant.

For the BAAC, we consider a broader objective function, which combines the BAAC profits (with weight α^B), the commercial bank profits (with weight α^C), and the households' welfare (with weight $1 - \alpha^B - \alpha^C$):

$$\Phi^B(F) = (1 - \alpha^B - \alpha^C)\Omega(F) + \alpha^B \Pi^B(F) + \alpha^C \Pi^C(F) \tag{8}$$

[15] We consider such a simple model of demand for tractability purposes. As in the IO literature dealing with complex spatial competition models (e.g. Jia (2008), Ellickson et al. (2013)), the primary determinants of demand for financial services at the village level in our paper are geographical factors: distance to bank branches, which is determined by the village's position within the network of roads and current configuration of FSPs branch locations. In Appendix D we consider an alternative demand system based on random utilities. To keep that model tractable we consider a simplified stylized version of our model akin to the one described in Section 3.4 below. We show that such (more general) demand system does not provide much additional insights about FSPs' expansion behavior compared to the inelastic demand approach considered here.

[16] If such costs are similar across locations for a *given* FSP they are netted out from the decision *where* to open a branch. Our approach could also accommodate the case when such costs vary linearly with location size either in terms of population or wealth (or, have linear + fixed cost structure). In this case, π_k in our model should be interpreted as the *net* payoff (after branch opening costs have been subtracted out) and the rest of the analysis would go without much modification.

Since all three of the terms in the expression above are proportional to (expected) population serviced, we can write BAAC's objective in terms of expected populations, Ψs, served by BAAC and the commercial bank as:

$$\Phi^B(F) \sim \Psi^B(F) + \lambda\Psi^C(F) \tag{9}$$

where $\lambda = \dfrac{(1-\alpha^B-\alpha^C)\omega + \alpha^C\pi^C}{(1-\alpha^B-\alpha^C)\omega + \alpha^B\pi^B}$.

This weight λ is the crucial parameter in our model as it allows for the BAAC to pursue goals other than simple own profit maximization. In the case when the BAAC maximizes own profits only, we have $\alpha^B = 1$, $\alpha^C = 0$ and $\lambda = 0$. This is the only case consistent with $\lambda = 0$.

We term $\lambda > 0$ the "altruism" of BAAC parameter, but we would like to add a qualification that we use this term broadly as a placeholder for several (non-mutually exclusive) motives. Positive weight $\lambda > 0$ could arise because of the following motives. First, BAAC might genuinely care about consumer welfare, in which case $1-\alpha^B-\alpha^C > 0$ and λ is necessarily positive. Second, BAAC might put a positive weight on commercial banks' payoff $\alpha_C > 0$. This might reflect a political economy story when commercial banks put pressure on the government. These stories are not mutually exclusive, of course. Note though that in the extreme case when BAAC puts disproportionately high weight on commercial banks' payoff, $\alpha_C >> 0$, this results in $\lambda >> 1$, which potentially allows to reject this story as the *only* explanation for BAACs actions.

3.2 Dynamics

The FSPs make emtry decisions deterministically. Denote their order of moves as $S = (s_1, ..., s_T)$, where $s_t = k$ if the financial provider k is choosing a location in period t, $t = 1, ..., T \leq 2N$. The two FSPs are allowed to enter in the same location. The entry timing is exogenous in the model and is taken from the actual entry decisions observed in the data.[17]

Given the state of financial access F, we define the set of feasible actions for the FSP k,

[17] Optimality conditions for financial providers dictate that both timing and location of branch opening should be chosen to maximize the FSP's payoff. Since we take the timing of new branch openings from actual data, the locational choices of new branch opening should be chosen to maximize the FSP's payoff. Thus, the main identification of structural parameters in our model comes not from *when* different financial providers open new branches but rather from *where* the new branches are being opened (conditionally on branch opening being fixed at equilibrium values). This is the same identification approach as used in Holmes (2011).

$k \in \{B, C\}$ as the set of possible states F' that differ from state F in one single possible entry location: $\Gamma_k(F) = \{F'_k : F'^{i_0}_k - F^{i_0}_k = 1$ for only one i_0, and $F'^{i}_k = F^i_k$ for all $i \neq i_0\}$. We also say that financial provider k is active (A) if $s_t = k$ and non-active (NA) otherwise. When all the locations are occupied, there is no feasible action for either bank, but payoffs continue to arrive in each period discounted into the infinite future.

From the commercial bank's payoff in Equation (6), we can write the value function of the **active** and **non-active** commercial banks, respectively, as:

$$V^C_A(F) = \max_{F'_C \in \Gamma_C(F)} \Psi^C(F'_C, F_B) + \beta[1_{\{s'=A\}} V^C_A(F'_C, F_B) + 1_{\{s'=NA\}} V^C_{NA}(F'_C, F_B)] \tag{10}$$

$$V^C_{NA}(F) = \Psi^C(F) + \beta[1_{\{s'=A\}} V^C_A(F') + 1_{\{s'=NA\}} V^C_{NA}(F')] \tag{11}$$

Here S' indicate whether the given FSP is active or non-active in the next period.

In the payoff for the BAAC, on the other hand, we explicitly incorporate the possibility that it takes into account not only its own customers, but also the customers served by the commercial bank and potentially commercial bank profit, as per Equation (9). The value functions for the **active** and **non-active** BAAC are:

$$V^B_A(F) = \max_{F'_B \in \Gamma_B(F)} \lambda \Psi^C(F_C, F'_B) + \Psi^B(F_C, F'_B) + \beta[1_{\{s'=A\}} V^B_A(F_C, F'_B) + 1_{\{s'=NA\}} V^B_{NA}(F_C, F'_B)] \tag{12}$$

$$V^B_{NA}(F) = \lambda \Psi^C(F) + \Psi^B(F) + \beta[1_{\{s'=A\}} V^B_A(F') + 1_{\{s'=NA\}} V^B_{NA}(F')] \tag{13}$$

3.3 Equilibrium

Although we formulate the problem with an infinite time horizon, the number of possible locations is finite, $N < \infty$. Since the entry game is finite, we can solve for the subgame-perfect equilibrium by backward induction. In order to solve the game, we start with a payoff matrix of all possible paths with columns representing periods and different rows represent all possible game paths. Each entry in the matrix is the payoff of the respective active FSP in that period. We then eliminate dominated paths (rows) sequentially in a backward induction exercise. The algorithm starts in period $T - 1$, when the respective active FSP has to choose one among two possible choices. In period T there is no effective choice to be made and we set the terminal value functions, V_T, to be equal to the present (as of period T) value of an infinite stream of payoffs from the locations occupied by FSPs in a given terminal financial access state F_T. For each possible subgame in $T-2$, we eliminate the dominated strategies/rows (those with lower payoffs) in $T-1$. We then move sequentially to periods $T-2$, $T-3$, ..., 1, eliminating dominated rows. The resulting set of paths are the subgame-perfect equilibria.

3.4 Exploring the model through examples

Before estimating the model parameters from the actual data, we present a set of semi-artificial examples to explore the mechanics of the model, emphasizing how the behavior of the BAAC and commercial bank change with the parameter values. We assume that FSPs operate on a artificial economy of 7 villages connected by roads (See Figure 1). Namely, we consider a setup with three clusters of villages. In the upper right-hand corner, there is a cluster of "rich" villages located at coordinates $(2,2)$, $(2,3)$, and $(3,3)$ with payoff 5, 6, and 7 units, respectively. In the lower left-hand corner, there is a "poor" cluster of villages at coordinates $(0,0)$, $(0,1)$, and $(1,1)$ with payoff 3, 4, and 3 units, respectively. Finally, there is an isolated location located at $(0,4)$ with payoff of 3.

Unlike in the general model, we make the simplifying assumption that the FSPs open their branches directly in villages and we do not allow multiple FSPs per village. We also simplify financial outreach from each branch by postulating that a bank branch captures half of the people only from adjacent linked villages, provided those villages do not have a bank branch opened there. Furthermore, we assume that FSPs make their moves sequentially (again, in the actual model estimation we use the *observed* timing of moves), until all locations are occupied.

In the first figure, Figure 1a, we assume that both types of banks care about own payoff only ($\lambda = 0$). We clearly see both FSPs going into most lucrative locations not yet occupied. For example, bank 1 ("red" dots) first expands into the most profitable village positioned at $(2,3)$ with profit of 7. The second bank ("green" dots) immediately undercuts by expanding into the adjacent and next most profitable location with profits of 6 units. The banks proceed to occupy more profitable locations before reaching the isolated location at $(0,4)$ with payoff 3.

The expansion path changes drastically when we designate one of the banks as BAAC by setting $\lambda = 1$ for that bank. In this case, there is asymmetry between the two banks, the solution of game might depend on who makes the first move. So, we present two figures (Figures 1b and 1c) depending on which bank moves first. However, the patterns we see in both pictures are similar.

Regardless of whether it moves first or second, the BAAC does not immediately expand into the "richer" cluster of villages (in the upper-right) and focuses first on the "poorer" cluster at the bottom-left instead. Only after the "poorer" cluster and the isolated village at $(0, 4)$ is served, does the BAAC move into (the least profitable location in) the "richer" cluster on the upper-right, which was left empty after prior expansion of the commercial bank. On the other hand, the commercial bank expands first and foremost into the "richer" cluster in the upper-right. It never reaches out to the "poor" cluster nor does it ever go to the isolated location.

This highly stylized version of the model provides crucial insights into the functioning of our more general model. Maximization of total financial access by the BAAC is equivalent to own-profit maximization when commercial banks are completely absent from the area. Note, that in Figures 1b and 1c when reaching into poorer villages (which are never or only later reached by the commercial bank) the BAAC expands into the most lucrative location (richest among the under-served by the commercial banks) at $(0, 1)$ with profits 5. At the same time, the BAAC tends to avoid competition with the commercial bank in the "richer" upper-right cluster, where commercial bank is (will be) present. Even when the BAAC makes the first move, it does not go into the "richer" cluster since it anticipates that those villages would be served by the commercial bank immediately in the next period. Instead, the BAAC expands into poorer and more distant locations. Only when most of poorer locations are served does the BAAC expand into the remaining (poorer among the rich) location at $(2, 2)$.

This dichotomy is the crucial mechanism in our model which allows to rationalize the observed switch in the empirical behavior of the BAAC depending on the local presence of commercial banks. To what extent such formulation could fit the data, is, of course, an empirical question. In the following Sections, we provide evidence that the model where BAAC cares about total financial access seems to provide reasonably accurate description of reality and alternative counterfactuals about BAAC's objective function are rejected by the data.

4 Estimation Results and Counterfactual analysis

4.1 Baseline Model Estimates

We estimate model presented in the previous section using a two-step procedure discussed in Computational Appendix Section B. Namely, in the first step we estimate financial outreach technologies from equation (5), which gives us estimates of Υs and τs for both FSPs. In the second step, we use backward induction to form a likelihood function and estimate weight parameter λ in BAACs objective via Maximum Likelihood. Standard errors are computed by bootstrap with 100 repetitions.

Estimation results for our baseline model using this two-step procedure outlined above are reported in Table 4. Column 1 reports the estimates for the complete model, where FSPs are allowed to have different outreach technologies and $\lambda \geq 0$. Column 2 considers the case where the BAAC and commercial bank have the same outreach technology. Column 3 presents the case where λ is set to 0 to approximate the behavior of own profit-maximizing BAAC.

We find that the BAAC put the same weight on its own customers and the customers of the commercial banks: estimated λ is very close to 1. Conditional on being present in a given node the BAAC additionally provides a wider outreach of financial services from each of its branches. The baseline probability of getting access to finance from the BAAC is higher ($\Upsilon_B > \Upsilon_C$) and the discounting effect of distance is much lower (in effect almost absent) for the BAAC branches than for commercial banks' branches ($\tau_C > \tau_B \approx 0$).[18]

We would like to emphasize that Υs, which show the probability of financial access for the locations closest to bank branches (travel time ≈ 0), are higher for the BAAC's branches than for the commercial bank's ones. In a way this makes the "anti-preemptive" patterns found in Section 2.2 even more striking, as the estimates of this outreach technology indicate that (conditionally on having a branch open) BAAC *can* and *will* compete with the commercial banks. But it apparently chooses to "get out of the way" of commercial banks when those are (or likely will be) present in

[18] In economic sense, the distance discounting coefficient of 0.0035 for commercial banks suggests that an increase in travel time by one hour (60 minutes) is associated with a decrease in probability of financial access by 19 percent (as $exp(-0.0035 * 60) = 0.81$). There is effectively no distance discounting within the support of observed travel times for the BAAC. In our model estimation, we do effectively have distance discounting for the BAAC since we consider travel only to the $np = 3$ closest branches.

the local market.[19]

We also estimate two restricted models. In the first model we restrict financial outreach technology to be the same for the BAAC and commercial banks (columns 2 and 5 of Table 4). In this case we find that the estimated weight that the BAAC puts on commercial banks' population is still positive but less than one $\lambda \approx 0.5 - 0.6$. Financial outreach technology parameters are somewhat closer to those of commercial banks from the unrestricted model (τ_C and Υ_C from columns 1 and 4). When we perform a likelihood ratio test of this model and the baseline, we find that this restricted model is rejected. In the second model we effectively shut down the second stage by setting $\lambda = 0$, i.e., we assume that the BAAC maximizes own profits only. The financial outreach technology estimates do not depend on choice of λ and as a result estimates of τ's and Υ's are the same as under the baseline. When we perform a likelihood ratio test of this model it is decisively rejected in favor of the baseline.

An important question is whether this statistical superiority translates into economically meaningful advantage of our baseline model in explaining the patterns observed in the data. Does our baseline model predict patterns that are different (in substantive economic sense) from those of the two competing restricted models or other counterfactual models? We perform such assessment in the subsections below. First, we compare the profile of financial access predicted by the baseline model with what is observed in the data. Second, we perform counter-factual exercises to evaluate how financial access in Thailand could be affected by changes in anti-preemption motive in the BAAC's objective function, alternative strategic interaction configurations, and ownership.

4.2 The profile of financial access: baseline model versus actual data

To what extent does the baseline model capture the empirical patterns of financial access observed in the data? How well can it explain the differences in financial access to the BAAC and commercial banks depending on village characteristics? In order to answer these questions, we consider the

[19] In Appendix C we also consider a flexible specification for financial outreach technology and show that it results in the similar pattern of distance discounting as the assumed exponential distance discounting functional form (5). We further estimate financial outreach technology on the sample of all provinces and contrast it to the ones presented here for the sample of 10 selected provinces. Estimated Υ's for the BAAC and commercial banks are almost the same, at 0.94 and 0.53, respectively. τ_C is even higher at 0.006 vs 0.003 for the 10 selected provinces, and τ_B is, in fact, estimated to be even more negative at -0.0007 vs -0.000022.

data generated by the baseline model on financial access for the period of 1986 – 1996 for the selected provinces and regress the resulting (model-predicted) change financial access (to the BAAC and commercial banks) on village characteristics: population, per capita wealth and distance to market places, as we did for the actually observed data in Section 2.2. Since model evaluation and counterfactual analysis do not involve computation-intensive backward induction, we perform the analysis of the goodness of fit using the whole sample of Thai provinces. This exercise has an additional benefit, as it allows us to evaluate model performance not only on the subset of 10 provinces used in estimation, but also enables us to assess "out-of-sample" behavior of the model.

Namely, as in Table 2 for the actual data, we estimate the following specification similar to equation (2) on the financial access data generated by the model:

$$\begin{aligned}&\Delta FSP^{PR}_{i,1986\rightarrow 1996} = \beta_1 log(population)_{i,1986} + \beta_2 Wealth^*_{i,1986} + \beta_3 log(Travel\ time)_i + \\ &+\gamma_1 BAAC_{i,1986} + \gamma_2 COMM_{i,1986} + \pi(i) + \epsilon_i\end{aligned} \tag{14}$$

Here, the dependent variable $\Delta FSP^{PR}_{i,1986\rightarrow 1996}$ is the change in financial access between over 1986-1996 predicted by our model for village i. As before, to analyze potential antipreemption effects we estimate specification (14) for a given FSP on the whole sample and on subsamples: where the initial footprint of the other FSP is "High" (above 75^{th} percentile) vs "Low" (below 75^{th} percentile).

Estimates from the whole sample of simulated data (columns 1 and 4 in Table 5) exhibit the empirical patters that resemble our findings on the whole sample in the actual data in Table 2. The BAAC pays much less (and even negative) attention to village's population and wealth, while commercial banks tend to focus on more populous/wealthier locations that are closer to marketplaces.

More importantly, estimates presented in Table 5 portray the same "anti-preemption" story as the estimates from the actual data in Table 2 above. Our model predicts a clear shift in the behavior of the BAAC in response to the (initial) footprint of commercial bank. Namely, in provinces where commercial banks have higher presence, the BAAC pays less attention to population and wealth (columns 2 vs 3 and columns 5 vs 6). In fact, in areas where the footprint of commercial banks is above the 75^{th} percentile, both the village's population and wealth have a negative effect on (predicted) propensity of the village to have access to BAAC's financial services. At the same time, the effect of wealth becomes positive in provinces with low (below the 75^{th} percentile) presence of commercial banks. The effect of population also increases (as a real number) and from a negative (and statistically significant) becomes positive (and statistically indistinguishable from zero). Statistical tests reject the equality of coefficients between the two subsamples.

At the same time, (as in the actual data in Table 2) we find no anti-preemption on a part of the commercial bank in our model predicted data. Regardless of the presence of the BAAC, commercial bank prefers to expand into more populous, wealthier, and closer to the marketplace villages. The only exception to the anti-preemption observed in the actual data is heterogeneity for distance to the marketplace for the BAAC, which goes in the opposite way to the data. Thus, we argue that the model (for the most part) does a good job at capturing the anti-preemptive behavior of the BAAC and the absence of such behavior for commercial banks.

It is worth noting that these results indicate that the model performs quite well "out-of-sample", as the data generated by the model estimated on the subset of villages from the ten selected Thai provinces exhibit similar qualitative patterns as the actual data for the *full* set of Thai villages. Moreover, in our estimation population was used to proxy for the payoff attainable at a given location. This makes it even more intriguing that the model-generated data deliver anti-preemptive patterns for per capita wealth of the correct sign. We argue that our parsimonious model estimated on a subset of provinces captured some salient aspects of the BAAC and commercial banks' behavior.

4.3 Counterfactuals on anti-preemption and strategic interaction

We now present counter-factual exercises to better understand the implications of different objective functions for the BAAC. Our goal in these counterfactuals is to assess whether alternative assumptions about model structural parameters result in economically meaningful differences in financial access from the baseline model and the actual data. As in the previous section, we take the baseline parameters estimated on the 10 selected provinces as above, but conduct (counterfactual) simulations on a set of all Thai provinces, for which we have income and population data.

For each counterfactual exercise, we apply the estimated parameters from Table 4 that pertain to a particular objective function (λ) and financial outreach technology configuration ($\tau's$ and $\Upsilon's$)

and compute the probability of financial access at the village level. We then calculate the difference between the probability of financial access in each counterfactual and the probability of financial access in the baseline model at the village level. Finally, we relate these differences in financial access between the counterfactual and baseline model to village-level characteristics.

Table 6 examines how the counterfactual simulations affect the profile of the financial access for a particular FSP. Effectively, each coefficient in these tables shows to what extent a particular counterfactual exercise changes the effect of some village characteristic (population size, per capita wealth, proximity to the markets) on financial access compared to the effect of this characteristic in the baseline model. More formally, we are taking the difference in probabilities of access, counterfactual minus baseline and regressing on these characteristics.

First, we evaluate the role of the BAAC putting positive weight on commercial bank's payoff. In columns 1-2 in Table 6, we eliminate this weight by setting $\lambda = 0$ in the BAAC's objective. In this case, the BAAC and commercial bank are competing against each other. Our estimates indicate, that in this counterfactual scenario the BAAC would expand into wealthier locations and locations closer to marketplaces compared to the baseline. This is consistent with our conjecture that, absent any weight on commercial bank's payoff ($\lambda = 0$), the BAAC increases the competitive pressure on the commercial bank. At the same time, the commercial bank, facing such increased competition from the BAAC, occupies less lucrative (i.e., less populous) locations compared to the baseline.

Next, we examine the opposite case — collusion. That is, we assume that both FSPs are altruistic towards each other ($\lambda = 1$ for both). We call this a "collusion" counterfactual, as the placement of branches is done as if by a single monopolist, while still respecting the heterogeneous outreach technologies for the two types of FSPs. This counterfactual is presented in columns 3 and 4 in Table 6. In this case, the BAAC serves more populous locations than under the baseline while commercial banks tend to focus on less populated ones. This counterfactual resembles the pure competition case in the sense that the BAAC gains ground at the expense of the commercial bank. Yet, the important difference is that distance to the market place works in opposite directions between these two counterfactuals. In the pure competition case, the BAAC was going into more central locations (which resulted in villages closer to the market place being served). In the collusion scenario, the BAAC and commercial bank have the same common objective (they do not compete with each other per se but try to maximize the common goal). Thus, they split the markets respecting the difference in their outreach technologies with the BAAC placing its branches to serve more distant locations (which commercial bank cannot reach).[20]

Finally, in Table 6 columns 5 and 6, we consider a counterfactual with a very large $\lambda >> 0$ ($\lambda = 100$). One might consider this counterfactual as a political economy story, in which the BAAC completely gives in to potential political pressure from the commercial banks and does not care much about consumer welfare (or own profits).[21] In this case, the BAAC expands to poorer/less populated locations compared to the baseline.[22] As a result, facing less competition from the BAAC, commercial banks place branches in wealthier more centrally located areas (compared to the baseline).

Overall, we argue that the results in Table 6 illustrate that different counterfactual scenarios produce patterns of financial access that are dramatically different from those predicted by our baseline model. In this regard, alternative parameter values are not only rejected statistically (as in Table 4) but they result in economically meaningful differences in predicted behavior of the two FSPs compared to the baseilne.

Those results indicate that the BAAC is not concerned only with own profit maximization, nor does it seem to be "captured" by the industry. While we cannot fully refute this latter motive of taking into account commercial banks' profits ($\alpha_C > 0$) this motive alone does not seem to fit the observed data well, and some degree of benevolence (caring about consumer welfare) seems to be present in BAAC's objective.

4.4 Implications for total financial access

Above, we found that the baseline model does a reasonably good job in fitting the anti-preemptive patterns of the BAAC and competitive behavior of commercial bank observed in the actual data. Alternative assumptions about objective functions of either the BAAC or commercial bank are

[20]Even though the coefficient on distance to the market place in column 3 is not statistically different form zero, it is different from the respective coefficient in column 1. We also get somewhat of a puzzling pattern for the wealth effect: with *both* FSPs focusing on wealthier locations compared to the baseline. We conjecture that this might stem from the fact that in our model simulation population was the variable proxying for the bank payoff from the village.

[21]In this case, the BACC still must open some branches since it is forced to make moves by our simulations.

[22]Oddly, the BAAC tends to discount the distance and expands to closer markets.

rejected both in statistical and economic senses. In this regard, we think our model might be useful in evaluating the performance of the BAAC in terms of providing total financial access, one of the attributes of state-owned banks discussed in the introductory motivation.

Namely, we compare the total financial access at the village level (i.e., both from the BAAC and the commercial bank) predicted by our model with the counterfactual outcome where the economy is served by the single FSP who (by the setup of the problem) maximizes total financial access and possesses the same (wider) outreach technology as the BAAC.

Table 7 (column 1) presents this analysis. For completeness, we also contrast the baseline model with the case when the economy is served by two commercial banks competing with each other with a narrower financial outreach technology (as estimated for commercial banks). This latter comparison is presented in column 2 of Table 7.[23] Additionally, Figure 3 depicts the predicted probability of financial provision under each scenario: the baseline and the two counterfactuals.

We start our discussion with the latter case, when both financial providers compete against each other ($\lambda = 0$ for both) and both possess narrower (commercial banks') financial outreach technology. Compared to the baseline, estimates presented in column 2 of Table 7 suggest consistently less financial provision in more isolated locations and higher access for wealthier/more populous villages, with overall financial access being lower.

If the economy were to be served solely by the single benevolent FSP (the BAAC), with a wider outreach technology[24], there would be no significant changes in the effect of village population and wealth in this counterfactual case when compared to the baseline (column 1 of Table 7). The estimated coefficient on distance to the market is negative, suggesting that in the baseline total financial access occurs in villages *farther* to market than in this counterfactual. At the same time, as shown in Figure 3, the total financial access in this case is only slightly higher compared to the baseline.

Therefore, we argue that the operation of the BAAC in the baseline, with its anti-preemptive behavior towards a private sector competitor (commercial bank), seems to drive financial provision quite close to the situation in which the market is solely served by a single benevolent financial

[23] As before, in Table 6 the estimated coefficients show the difference in the effects of population, wealth, and distance between the single BAAC provider prediction and the baseline model prediction for financial access.

[24] This is equivalent to setting $\lambda = 1$ for both FSPs and assigning them the same/wider outreach technology.

services provider. Our results indicate that limited government participation in the market can go a long way towards maximizing total financial access.

5 Conclusion

Road networks, village location, and logistics infrastructure all determine firms' catchment areas given point-of-sale location decisions and, thus, firms' entry decisions. Given this interdependence, and the rich variety of geographical configurations in the data, it is unrealistic to try to come up with a fixed a priori definition of a "market"; an abstraction that works well in one context does poorly in another. This issue is particularly relevant in the analysis of the dynamic and spatial interaction between the BAAC and commercial banks in the provision of financial services. However, dynamic entry models with endogenous market boundaries are inherently computationally complex. With the benefit of parallel computing and the appropriate structure of the model, we are able to implement a full backward induction procedure estimating key parameters of financial service providers' objective functions and financial outreach technologies.

The model is then used for the analysis of the dynamic interaction (in spatial context) between the BAAC and commercial banks in Thailand. The model at estimated parameters explains surprising patterns found in the data, rationalizing the anti-preemptive behavior of the BAAC. Ironically, this, in conjunction with the strategic behavior of private players, improves financial access resulting in financial access patterns quite close to the those obtained in the case when a single benevolent FSP with a wider outreach technology were to provide financial services.

The exercise of using IO methods to study ownership and financial provision also illustrates the potential of bridging the fields of development economics and industrial organization. In particular, the interaction between government and private players in the provision of relevant services has important welfare implications. Though we focus on financial provision, analogous issues can be formulated in other markets such as education or health and can be applied to many countries.

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Table 1: Descriptive Statistics - Village-level Data

	all provinces			selected provinces		
	N	mean	st.dev	N	mean	st.dev
ln(population in 1986)	44652	6.21	0.64	7520	6.21	0.59
per capita wealth in 1986	29235	0.51	0.34	5633	0.49	0.31
ln(distance to the market place in 1986)	42762	3.28	0.76	7289	3.24	0.67
BAAC						
financial access - 1986	44515	0.801	0.40	7504	0.826	0.42
financial access - 1996	44536	0.947	0.23	7512	0.944	0.21
change in financial access - 1986-96	44393	0.146	0.40	7496	0.118	0.44
Commercial banks						
financial access - 1986	44175	0.267	0.44	7468	0.336	0.43
financial access - 1996	44280	0.436	0.50	7477	0.493	0.50
change in financial access - 1986-96	43802	0.169	0.59	7425	0.158	0.59

Table 2: Financial access provision by a FSP and the province footprint of another FSP

Panel A: Change in access to the BAAC over 1986-1996	(1)	(2)	(3)
ln(population in 1986)	0.0052***	0.0010	0.0069***
	(0.0020)	(0.0040)	(0.0023)
Per capita wealth 1986 (with 1988 imputation)	0.0065	-0.0038	0.0119**
	(0.0048)	(0.0089)	(0.0058)
ln(distance (minutes) to market place in 1986)	-0.0015	0.0079**	-0.0044**
	(0.0017)	(0.0035)	(0.0019)
Observations	41,297	9,618	31,679
R-squared	0.738	0.697	0.746
Panel B: Change in access to commercial banks over 1986-1996	(1)	(2)	(3)
ln(population in 1986)	0.0964***	0.0961***	0.0961***
	(0.0039)	(0.0076)	(0.0045)
Per capita wealth 1986 (with 1988 imputation)	0.1492***	0.1034***	0.1638***
	(0.0087)	(0.0178)	(0.0100)
ln(distance (minutes) to market place in 1986)	-0.0341***	-0.0334***	-0.0341***
	(0.0033)	(0.0067)	(0.0037)
Observations	41,058	10,145	30,913
R-squared	0.391	0.420	0.381
Provincial footprint of other FSP	Any	High	Low
Dummy for the financial access to the BAAC in 1986	Yes	Yes	Yes
Dummy for the financial access to commercial banks in 1986	Yes	Yes	Yes
Province FE	Yes	Yes	Yes

Notes: Sample includes all Thai villages in 1986-1996. The dependent variable is the change in access to BAAC (Panel A) commercial banks (Panel B) over 1986-1996. Access to a given FSP is dummy variable indicating whether a given village was serviced by the FSP in a particular year. “Provincial footprint of other FSP in 1986” is percentage of villages in a given province with access to (commercial banks in Panel A, the BAAC in Panel B) in 1986. Sample in columns (2)/(3) is restricted to observations on villages from provinces where “Provincial footprint of other FSP” is “High”/“Low”: above/below the 75th percentile. “ln(distance (minutes) to market place in 1986” is the log of travel time (in minutes) from a village to the nearest provincial center (market place). ”ln(population in 1986)” is the log of village’s population in 1986. ”Per capita wealth” in a given year is calculated as the first principal component calculated on the basis of assets that a village’s residents own, as described in the data Appendix. “Per capita wealth in 1986 (with 1988 imputation)” is calculated as Per capita wealth in 1986 with 1988 Per capita wealth data imputed whenever 1986 data on wealth were not available. All specifications control for the financial access to both BAAC and commercial banks in 1986. Province fixed effects are included but not reported. Regression equation is estimated by OLS. Standard errors are in parentheses (clustered at the province level). *, **, And * indicate significance at 10%, 5%; and 1% respectively.

Table 3: Financial access provision by a FSP and the province footprint of another FSP

	(1)	(2)	(3)	(4)	(5)	(6)
	Access to the BAAC			Access to Commercial banks		
ln(distance (minutes) to market place)	-0.00229***	-0.00817***	-0.00980	-0.0255***	-0.00712	-0.0102
	(0.000863)	(0.00194)	(0.0101)	(0.00138)	(0.0106)	(0.0107)
Per capita wealth	0.00995***	0.0306***	0.205***	0.0797***	0.0760***	0.0724***
	(0.00180)	(0.00363)	(0.0205)	(0.00311)	(0.0230)	(0.0233)
ln(population)	0.0180***	0.0362***	0.132***	0.0738***	0.0936***	0.0948***
	(0.00111)	(0.00257)	(0.0122)	(0.00167)	(0.0128)	(0.0129)
ln(distance (minutes) to market place) X		0.0174***	0.0156***			-0.0249***
Footprint of COMM		(0.00469)	(0.00515)			(0.00866)
Per capita wealth X Footprint of COMM		-0.0526***	0.00737			-0.0915***
		(0.00764)	(0.00818)			(0.0156)
ln(population) X Footprint of COMM		-0.0526***	-0.0294***			0.0145
		(0.00631)	(0.00676)			(0.0102)
ln(distance (minutes) to market place) X			0.00342		-0.0213*	-0.00769
Footprint of BAAC			(0.0118)		(0.0123)	(0.0130)
Per capita wealth X Footprint of BAAC			-0.225***		0.00443	0.0492*
			(0.0233)		(0.0262)	(0.0285)
ln(population) X Footprint of BAAC			-0.120***		-0.0228	-0.0302*
			(0.0142)		(0.0147)	(0.0155)
Observations	207,843	207,843	207,843	207,124	207,124	207,124
R-squared	0.302	0.303	0.305	0.257	0.257	0.257

Notes: Sample includes all Thai villages in 1986-1996. The dependent variable is the change in access to BAAC (Panel A) commercial banks (Panel B) over consecutive two-year periods in 1986-1996. Access to a given FSP is dummy variable indicating whether a given village was serviced by the FSP in a particular year. "Provincial footprint of a given FSP" is percentage of villages in a given province with access to a given FSP. "ln(distance (minutes) to market place " is the log of travel time (in minutes) from a village to the nearest provincial center (market place). "ln(population)" is the log of village's population. "Per capita wealth" in a given year is calculated as the first principal component calculated on the basis of assets that a village's residents own, as described in the data Appendix. In 1986 year per capita wealth data imputed with 1988 data whenever 1986 data were not available. All specifications control for the financial access to both BAAC and commercial banks in the current period. Province fixed effects are included but not reported. Regression equation is estimated by OLS. Standard errors are in parentheses (clustered at the province level). *, **, And * indicate significance at 10%, 5%; and 1% respectively.

Table 4: Bootstrap estimation of λ, Υ_k and τ_k
Selected Provinces

parameters	Baseline model (1)	Population Homogeneous outreach tech (2)	$\lambda = 0$ (3)
	BAAC weight on commercial bank payoff		
λ	1.01***	0.61***	0
	(0.52,1.38)	(0.05,1.05)	
	BAAC financial outreach technology parameters		
Υ_B	0.961***	0.801***	0.961***
	(0.952, 0.973)	(0.788, 0.811)	(0.952, 0.973)
τ_B	-0.000022	0.0021***	-0.000022
	(-0.0003,0.0004)	(0.0016, 0.0251)	(-0.0003,0.0004))
	Commercial bank outreach technology parameters		
Υ_C	0.615***	0.801***	0.615***
	(0.589, 0.636)	(0.788, 0.811)	(0.589, 0.636)
τ_C	0.0035	0.0021***	0.0035
	(-0.0003,0.0004)	(0.0016, 0.0251)	(-0.0003,0.0004)
Log likelihood	-7216.73	-8016.91	-8158.74
Model comparisons: likelihood-ratio test against the complete model			
Test statistic (D)	-	1600.36***	1885.45***
N. bootstrap samples	100	100	100
N. of provinces	10	10	10
N. of villages	3036	3036	3036

Notes: Table shows estimates of the financial outreach technologies parameters for the two FSPs (Υ_k, τ_k) and the BAAC's weight on payoff of the commercial bank (λ). The Sample used in estimation is restricted to 10 provinces, as described in the main text. Bootstrap estimation with 100 repetitions was used. For each bootstrap sample, the financial outreach parameters Υ_k and τ_k are estimated by Non-linear least squares (NLLS) from the equation $r^k_{i,j} = \Upsilon_k exp(-\tau_k D_{ij})$, using the 1996 data. Then λ is estimated by MLE, using those NLLS estimates. Likelihood-ratio tests consider the complete model as the alternative model, taking the versions with homogeneous outreach technology and $\lambda = 0$ as null models. ***, **, And * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 5: Model prediction: Financial access provision by a FSP and the province footprint of another FSP

	(1)	(2)	(3)	(4)	(5)	(6)
	Predicted change in access to a given FSP over 1986-1996					
	to the BAAC			to commercial bank		
ln(population in 1986)	-0.0077***	-0.0230***	0.0000	0.0160***	0.0054	0.0219***
	(0.0023)	(0.0056)	(0.0022)	(0.0024)	(0.0046)	(0.0028)
Per capita wealth 1986 (with 1988 imputation)	-0.0187***	-0.0489***	0.0022	0.0533***	0.0820***	0.0397***
	(0.0058)	(0.0113)	(0.0060)	(0.0047)	(0.0093)	(0.0052)
ln(distance (minutes) to market place in 1986)	0.0024	-0.0048	0.0050***	-0.0128***	-0.0081*	-0.0151***
	(0.0019)	(0.0047)	(0.0019)	(0.0022)	(0.0043)	(0.0024)
Observations	16,283	5,333	10,950	16,283	5,572	10,711
R-squared	0.814	0.683	0.883	0.876	0.848	0.887
Provincial footprint of other FSP in 1986	Any	High	Low	Any	High	Low
Dummy for the financial access to the BAAC in 1986	Yes	Yes	Yes	Yes	Yes	Yes
Dummy for the financial access to commercial banks in 1986	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Sample includes all Thai villages in 1986-1996. The dependent variable is the predicted change in access to BAAC (columns 1, 2) commercial banks (columns 3, 4) over 1986-1996. Access to a given FSP in 1996 is the model's prediction indicating whether a given village would be serviced by the FSP. Access to FSP in 1986 is taken from actual data. "Provincial footprint of other FSP in 1986" is percentage of villages in a given province with access to (commercial banks in Panel A, the BAAC in Panel B) in 1986. Sample in columns (2) and (5)/columns (3) and (6) is restricted to observations on villages from provinces where "Provincial footprint of other FSP in 1986" is "High"/"Low": above/below the 75th percentile. "ln(distance (minutes) to market place in 1986" is the log of travel time (in minutes) from a village to the nearest provincial center (market place). "ln(population in 1986)" is the log of village's population in 1986. "Per capita wealth" in a given year is calculated as the first principal component calculated on the basis of assets that a village's residents own, as described in the data Appendix. "Per capita wealth in 1986 (with 1988 imputation)" is calculated as Per capita wealth in 1986 with 1988 Per capita wealth data imputed whenever 1986 data on wealth were not available. All specifications control for the financial access to both BAAC and commercial banks in 1986. Province fixed effects are included but not reported. Regression equation is estimated by OLS. Standard errors are in parentheses (clustered at the province level). *, **, And * indicate significance at 10%, 5%; and 1% respectively.

Table 6: Counter-factual simulations: Pure competition, Collusion, Extreme anti-preemption

	(1)	(2)	(3)	(4)	(5)	(6)
Scenario	Pure competition		Collusion		Extreme Anti-preemption	
	Dependent variable: Change in predicted financial access compared to the baseline for					
	BAAC	COMM	BAAC	COMM	BAAC	COMM
ln(population in 1986)	0.0019	-0.0032**	0.0055***	-0.0058***	-0.0056**	-0.0027
	(0.0014)	(0.0015)	(0.0015)	(0.0016)	(0.0022)	(0.0021)
Per capita wealth 1986 (with 1988 imputation)	0.0100***	-0.0015	0.0070**	0.0087***	-0.0304***	0.0097**
	(0.0030)	(0.0032)	(0.0035)	(0.0029)	(0.0052)	(0.0039)
ln(distance (minutes) to market place in 1986)	-0.0039***	-0.0015	0.0014	-0.0028**	-0.0109***	-0.0084***
	(0.0013)	(0.0013)	(0.0010)	(0.0014)	(0.0020)	(0.0020)
Observations	16,283	16,283	16,283	16,283	16,283	16,283
R-squared	0.0552	0.0571	0.0781	0.0908	0.1499	0.0537
Weight on competitor's payoff λ	$\lambda_{BAAC} = \lambda_{COMM} = 0$		$\lambda_{BAAC} = \lambda_{COMM} = 1$		$\lambda_{BAAC} = 100, \lambda_{COMM} = 0$	
Technology parameters	Same as in the baseline: $\tau_B = -2.22 \cdot 10^{-5}, \tau_C = 0.00351, \Upsilon_B = 0.961, \Upsilon_C = 0.615$					
province-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Dummies for 1986 financial access to both FSPs	Yes	Yes	Yes	Yes	Yes	Yes

Note: The dependent variable is the difference in the probability of financial access between the counter-factual and the baseline models for all Thai provinces. Counterfactual parameters are indicated in the body of the Table. "ln(distance (minutes) to market place in 1986" is the log of travel time (in minutes) from a village to the nearest provincial center (market place). "ln(population in 1986)" is the log of village's population in 1986. "Per capita wealth" in a given year is calculated as the first principal component calculated on the basis of assets that a village's residents own, as described in the data Appendix. "Per capita wealth in 1986 (with 1988 imputation)" is calculated as Per capita wealth in 1986 with 1988 Per capita wealth data imputed whenever 1986 data on wealth were not available. All specifications control for the financial access to both BAAC and commercial banks in 1986. Robust standard errors in parentheses. ***, **, And * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 7: Evaluating performance of the BAAC: Counter-factual simulation for total financial access

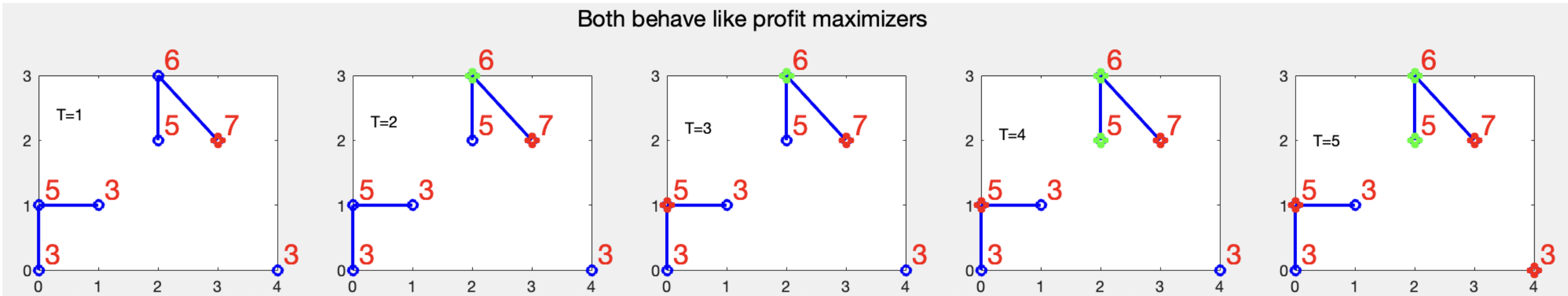
	(1) Δ total access BAAC	(2) Δ total access commercial banks
Per capita wealth 1986 (with 1988 imputation)	-0.0009	0.0066***
	(0.0009)	(0.0010)
ln(population in 1986)	0.0005	0.0016***
	(0.0004)	(0.0004)
ln(distance (minutes) to market place in 1986)	-0.0010***	-0.0023***
	(0.0003)	(0.0004)
Observations	18,222	18,222
R-squared	0.1156	0.4474
province-level fixed effects	Yes	Yes
Dummies for 1986 access to FSP's	Yes	Yes
Parameters	$\lambda_B = \lambda_C = 1$ $\tau_B = \tau_C = -2.22 \cdot 10^{-5}$ $\Upsilon_B = \Upsilon_C = 0.961$	$\lambda_B = \lambda_C = 0$ $\tau_B = \tau_C = 0.00351$ $\Upsilon_B = \Upsilon_C = 0.615$

Note: Dependent variable is the difference in the probability of financial access between the counter-factual and the baseline models for all Thai provinces. Counterfactual parameters are indicated at the bottom of the Table. "ln(distance (minutes) to market place in 1986" is the log of travel time (in minutes) from a village to the nearest provincial center (market place). "ln(population in 1986)" is the log of village's population in 1986. "Per capita wealth" in a given year is calculated as the first principal component calculated on the basis of assets that a village's residents own, as described in the data Appendix. "Per capita wealth in 1986 (with 1988 imputation)" is calculated as Per capita wealth in 1986 with 1988 Per capita wealth data imputed whenever 1986 data on wealth were not available. All specifications control for the financial access to both BAAC and commercial banks in 1986. Robust standard errors are reported in parentheses. ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

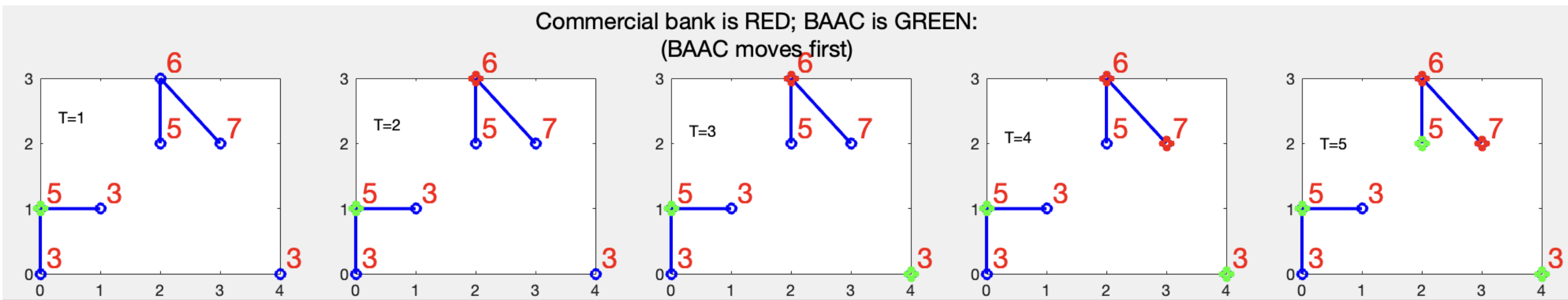
6 Figures

Please use color printing to analyze the following graphs.

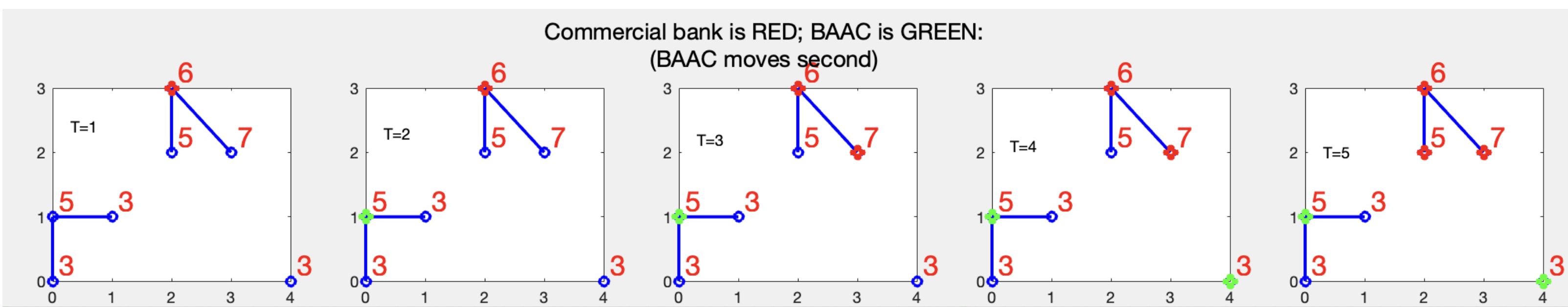
Figure 1: Example economies



(a) Both banks maximize own profits only.



(b) BAAC (in green) moves first. Commercial bank (in red) moves second.

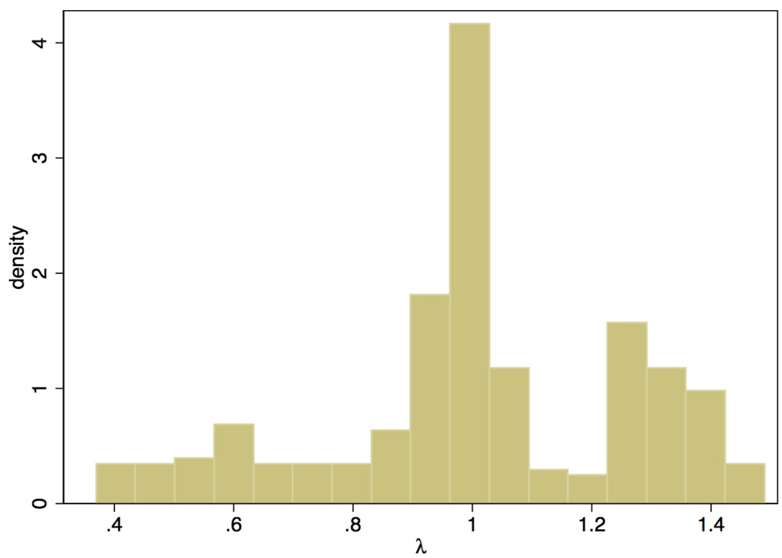


(c) BAAC (in green) moves second. Commercial bank (in red) moves first.

Notes: This figure shows the placement of branches by BAAC and a commercial bank in an example economy as described in Section 3.4. BAAC branches are indicated by red dots, while commercial bank's branches by green ones. Banks open branches sequentially. Panel (a) shows the scenario where BAAC has the same objective function as the commercial bank. Panels (b) and (c) assume that BAAC cares about joint profits (and makes the first/second branch placement decision, respectively). In all scenarios commercial bank maximizes own profits only.

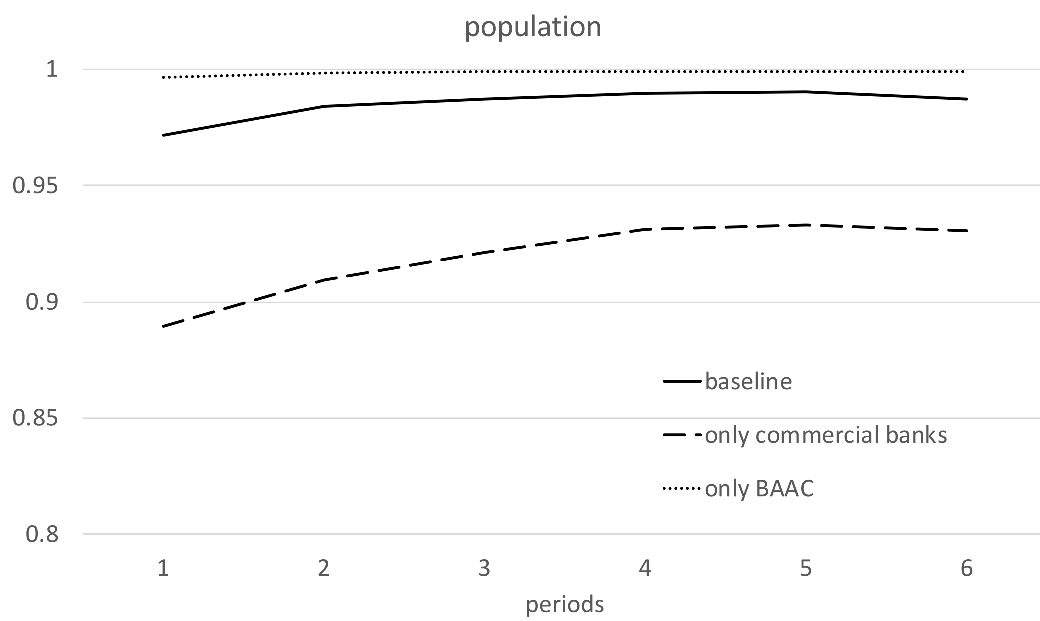
Figure 2: Distribution of the estimated λ across bootstrap samples

(i) Population as proxy for revenues



Notes: The figure depicts the histogram of the ML estimates of λ across 100 bootstrap samples.

Figure 3: Counter-factual simulations for total financial access



Notes: Each line represents the average in the estimated probability of financial access at the village level for the baseline case and the counterfactuals as indicated.

7 Online Appendix: Not for publication.

Table A1: Financial access provision by a FSP and the province footprint of another FSP: Subsample with no financial access in 1986

Panel A: Change in access to the BAAC over 1986-1996					
	(1)	(2)	(3)	(4)	(5)
ln(distance (minutes) to market place in 1986)	-0.0034	0.0219	-0.0095	0.0297**	-0.0110*
	(0.0056)	(0.0142)	(0.0060)	(0.0122)	(0.0062)
ln(population in 1986)	0.0211***	0.0075	0.0242***	0.0050	0.0247***
	(0.0063)	(0.0171)	(0.0067)	(0.0151)	(0.0069)
Per capita wealth 1986 (with 1988 imputation)	0.0204	0.0107	0.0230	-0.0215	0.0338*
	(0.0167)	(0.0367)	(0.0188)	(0.0329)	(0.0194)
Observations	8,010	1,372	6,638	1,575	6,435
R-squared	0.152	0.115	0.162	0.086	0.171
Panel B: Change in access to commercial banks over 1986-1996					
	(1)	(2)	(3)	(4)	(5)
ln(population in 1986)	0.0980***	0.1030***	0.0962***	0.1023***	0.0969***
	(0.0045)	(0.0096)	(0.0051)	(0.0098)	(0.0050)
Per capita wealth 1986 (with 1988 imputation)	0.1586***	0.1249***	0.1672***	0.1280***	0.1648***
	(0.0105)	(0.0243)	(0.0116)	(0.0279)	(0.0113)
ln(distance (minutes) to market place in 1986)	-0.0387***	-0.0416***	-0.0378***	-0.0498***	-0.0358***
	(0.0038)	(0.0086)	(0.0042)	(0.0087)	(0.0042)
Observations	29,896	6,427	23,469	6,226	23,670
R-squared	0.101	0.120	0.093	0.088	0.104
Provincial footprint of other FSP	Any	High	Low	High	Low
Year of footprint measurement	NA	1986	1986	1996	1996
Dummy for the financial access to the BAAC in 1986	Yes	Yes	Yes	Yes	Yes
Dummy for the financial access to commercial banks in 1986	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes

Notes: Sample includes all Thai villages in 1996. The dependent variable is the change in access to BAAC (Panel A) commercial banks (Panel B) over 1986-1996. Access to a given FSP is dummy variable indicating whether a given village was serviced by the FSP in a particular year. "Provincial footprint of other FSP in 1986 (columns 2 and 3)/1996(columns 4 and 5)" is percentage of villages in a given province with access to (commercial banks in Panel A, the BAAC in Panel B) in 1996. Sample in columns (2) and (4)/columns (3) and (5) is restricted to observations on villages from provinces where "Provincial footprint of other FSP" is "High"/"Low": above/below the 75th percentile. "ln(distance (minutes) to market place in 1986" is the log of travel time (in minutes) from a village to the nearest provincial center (market place). "ln(population in 1986)" is the log of village's population in 1986. "Per capita wealth" in a given year is calculated as the first principal component calculated on the basis of assets that a village's residents own, as described in the data Appendix. "Per capita wealth in 1986 (with 1988 imputation)" is calculated as Per capita wealth in 1986 with 1988 Per capita wealth data imputed whenever 1986 data on wealth were not available. All specifications control for the financial access to both BAAC and commercial banks in 1986. Province fixed effects are included but not reported. Regression equation is estimated by OLS. Standard errors are in parentheses (clustered at the province level). *, **, And * indicate significance at 10%, 5%; and 1% respectively.

Table A2: Financial access provision by a FSP and the amphoe-level footprint of another FSP:

	(1)	(2)	(3)	(4)	(5)
Panel A: Change in access to the BAAC over 1986-1996					
ln(population in 1986)	0.0052***	0.0013	0.0069***	0.0012	0.0073***
	(0.0020)	(0.0033)	(0.0025)	(0.0035)	(0.0024)
Per capita wealth 1986 (with 1988 imputation)	0.0065	-0.0022	0.0092	-0.0104	0.0123*
	(0.0048)	(0.0059)	(0.0065)	(0.0068)	(0.0064)
ln(distance (minutes) to market place in 1986)	-0.0015	0.0017	-0.0020	0.0096***	-0.0046**
	(0.0017)	(0.0029)	(0.0020)	(0.0028)	(0.0020)
Observations	41,297	10,506	30,791	10,500	30,797
R-squared	0.738	0.769	0.732	0.756	0.736
Panel B: Change in access to commercial banks over 1986-1996	(1)	(2)	(3)	(4)	(5)
ln(population in 1986)	0.0964***	0.0848***	0.0992***	0.0889***	0.0987***
	(0.0039)	(0.0079)	(0.0044)	(0.0079)	(0.0044)
Per capita wealth 1986 (with 1988 imputation)	0.1492***	0.1270***	0.1535***	0.1171***	0.1641***
	(0.0087)	(0.0180)	(0.0099)	(0.0182)	(0.0100)
ln(distance (minutes) to market place in 1986)	-0.0341***	-0.0282***	-0.0360***	-0.0362***	-0.0337***
	(0.0033)	(0.0067)	(0.0037)	(0.0065)	(0.0038)
Observations	41,058	10,311	30,747	10,327	30,731
R-squared	0.391	0.426	0.385	0.417	0.390
Amphoe-levbel footprint of other FSP	Any	High	Low	High	Low
Year of footprint measurement	NA	1986	1986	1996	1996
Dummy for the financial access to the BAAC in 1986	Yes	Yes	Yes	Yes	Yes
Dummy for the financial access to commercial banks in 1986	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes

Notes: Sample includes all Thai villages in 1996. The dependent variable is the change in access to BAAC (Panel A) commercial banks (Panel B) over 1986-1996. Access to a given FSP is dummy variable indicating whether a given village was serviced by the FSP in a particular year. "Amphoe-level footprint of other FSP in 1986 (columns 2 and 3)/1996(columns 4 and 5)" is percentage of villages in a given amphoe with access to (commercial banks in Panel A, the BAAC in Panel B) in 1996. Sample in columns (2) and (4)/columns (3) and (5) is restricted to observations on villages from provinces where "Amphoe-level footprint of other FSP" is "High"/"Low": above/below the 75th percentile. "ln(distance (minutes) to market place in 1986" is the log of travel time (in minutes) from a village to the nearest provincial center (market place). "ln(population in 1986)" is the log of village's population in 1986. "Per capita wealth" in a given year is calculated as the first principal component calculated on the basis of assets that a village's residents own, as described in the data Appendix. "Per capita wealth in 1986 (with 1988 imputation)" is calculated as Per capita wealth in 1986 with 1988 Per capita wealth data imputed whenever 1986 data on wealth were not available. All specifications control for the financial access to both BAAC and commercial banks in 1986. Province fixed effects are included but not reported. Regression equation is estimated by OLS. Standard errors are in parentheses (clustered at the province level). *, **, And * indicate significance at 10%, 5%; and 1% respectively.

Table A3: Financial access provision by a FSP and the alternative cutoff for footprint of another FSP:

Panel A: Change in access to the BAAC over 1986-1996					
	(1)	(2)	(3)	(4)	(5)
ln(population in 1986)	0.0052***	0.0051	0.0051**	-0.0002	0.0057***
	(0.0020)	(0.0047)	(0.0022)	(0.0061)	(0.0021)
Per capita wealth 1986 (with 1988 imputation)	0.0065	-0.0205**	0.0093*	-0.0190*	0.0109**
	(0.0048)	(0.0096)	(0.0053)	(0.0108)	(0.0053)
ln(distance (minutes) to market place in 1986)	-0.0015	0.0055	-0.0022	0.0111**	-0.0028
	(0.0017)	(0.0034)	(0.0018)	(0.0048)	(0.0018)
Observations	41,297	3,822	37,475	4,149	37,148
R-squared	0.738	0.848	0.732	0.719	0.740
Panel B: Change in access to commercial banks over 1986-1996					
	(1)	(2)	(3)	(4)	(5)
ln(population in 1986)	0.0964***	0.0813***	0.0980***	0.0758***	0.0987***
	(0.0039)	(0.0121)	(0.0041)	(0.0124)	(0.0041)
Per capita wealth 1986 (with 1988 imputation)	0.1492***	0.0476*	0.1612***	0.0763***	0.1577***
	(0.0087)	(0.0270)	(0.0091)	(0.0276)	(0.0091)
ln(distance (minutes) to market place in 1986)	-0.0341***	-0.0493***	-0.0320***	-0.0505***	-0.0323***
	(0.0033)	(0.0105)	(0.0034)	(0.0103)	(0.0034)
Observations	41,058	4,176	36,882	4,187	36,871
R-squared	0.391	0.428	0.387	0.415	0.388
Amphoe-levbel footprint of other FSP	Any	High	Low	High	Low
Year of footprint measurement	NA	1986	1986	1996	1996
Dummy for the financial access to the BAAC in 1986	Yes	Yes	Yes	Yes	Yes
Dummy for the financial access to commercial banks in 1986	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes

Notes: Sample includes all Thai villages in 1996. The dependent variable is the change in access to BAAC (Panel A) commercial banks (Panel B) over 1986-1996. Access to a given FSP is dummy variable indicating whether a given village was serviced by the FSP in a particular year. "Amphoe-level footprint of other FSP in 1986 (columns 2 and 3)/1996(columns 4 and 5)" is percentage of villages in a given amphoe with access to (commercial banks in Panel A, the BAAC in Panel B) in 1996. Sample in columns (2) and (4)/columns (3) and (5) is restricted to observations on villages from provinces where "Amphoe-level footprint of other FSP" is "High"/"Low": above/below the 90th percentile. "ln(distance (minutes) to market place in 1986" is the log of travel time (in minutes) from a village to the nearest provincial center (market place). "ln(population in 1986)" is the log of village's population in 1986. "Per capita wealth" in a given year is calculated as the first principal component calculated on the basis of assets that a village's residents own, as described in the data Appendix. "Per capita wealth in 1986 (with 1988 imputation)" is calculated as Per capita wealth in 1986 with 1988 Per capita wealth data imputed whenever 1986 data on wealth were not available. All specifications control for the financial access to both BAAC and commercial banks in 1986. Province fixed effects are included but not reported. Regression equation is estimated by OLS. Standard errors are in parentheses (clustered at the province level). *, **, And * indicate significance at 10%, 5%; and 1% respectively.

Table A4: Financial access provision by a FSP and the province footprint of another FSP

Panel A: Change in access to the BAAC over 1986-1996	(1)	(2)	(3)	(4)	(5)
ln(population in 1986)	0.0052***	0.0010	0.0069***	0.0001	0.0067***
	(0.0020)	(0.0040)	(0.0023)	(0.0038)	(0.0024)
Per capita wealth 1986 (with 1988 imputation)	0.0065	-0.0038	0.0119**	-0.0161**	0.0175***
	(0.0048)	(0.0089)	(0.0058)	(0.0082)	(0.0059)
ln(distance (minutes) to market place in 1986)	-0.0015	0.0079**	-0.0044**	0.0124***	-0.0058***
	(0.0017)	(0.0035)	(0.0019)	(0.0030)	(0.0019)
Observations	41,297	9,618	31,679	10,375	30,922
R-squared	0.738	0.697	0.746	0.733	0.739
Panel B: Change in access to commercial banks over 1986-1996	(1)	(2)	(3)	(4)	(5)
ln(population in 1986)	0.0964***	0.0961***	0.0961***	0.1012***	0.0950***
	(0.0039)	(0.0076)	(0.0045)	(0.0080)	(0.0044)
Per capita wealth 1986 (with 1988 imputation)	0.1492***	0.1034***	0.1638***	0.1034***	0.1604***
	(0.0087)	(0.0178)	(0.0100)	(0.0203)	(0.0096)
ln(distance (minutes) to market place in 1986)	-0.0341***	-0.0334***	-0.0341***	-0.0411***	-0.0320***
	(0.0033)	(0.0067)	(0.0037)	(0.0069)	(0.0037)
Observations	41,058	10,145	30,913	9,467	31,591
R-squared	0.391	0.420	0.381	0.392	0.391
Provincial footprint of other FSP	Any	High	Low	High	Low
Year of footprint measurement	NA	1986	1986	1996	1996
Dummy for the financial access to the BAAC in 1986	Yes	Yes	Yes	Yes	Yes
Dummy for the financial access to commercial banks in 1986	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes

Notes: Sample includes all Thai villages in 1996. The dependent variable is the change in access to BAAC (Panel A) commercial banks (Panel B) over 1986-1996. Access to a given FSP is dummy variable indicating whether a given village was serviced by the FSP in a particular year. "Provincial footprint of other FSP in 1986 (columns 2 and 3)/1996(columns 4 and 5)" is percentage of villages in a given province with access to (commercial banks in Panel A, the BAAC in Panel B) in 1996. Sample in columns (2) and (4)/columns (3) and (5) is restricted to observations on villages from provinces where "Provincial footprint of other FSP" is "High"/"Low": above/below the 75th percentile. "ln(distance (minutes) to market place in 1986" is the log of travel time (in minutes) from a village to the nearest provincial center (market place). "ln(population in 1986)" is the log of village's population in 1986. "Per capita wealth" in a given year is calculated as the first principal component calculated on the basis of assets that a village's residents own, as described in the data Appendix. "Per capita wealth in 1986 (with 1988 imputation)" is calculated as Per capita wealth in 1986 with 1988 Per capita wealth data imputed whenever 1986 data on wealth were not available. All specifications control for the financial access to both BAAC and commercial banks in 1986. Province fixed effects are included but not reported. Regression equation is estimated by OLS. Standard errors are in parentheses (clustered at the province level). *, **, And * indicate significance at 10%, 5%; and 1% respectively.

Table A5: Financial access provision by a FSP and the province footprint of another FSP

	(1) Access to the BAAC	(2) Access to Commercial banks
Footprint of COMM	-0.0748***	
	(0.0140)	
Footprint of BAAC		0.0362
		(0.0274)
ln(distance (minutes) to market place)	-0.00225***	-0.0255***
	(0.000863)	(0.00138)
Per capita wealth	0.01000***	0.0798***
	(0.00180)	(0.00311)
ln(population)	0.0180***	0.0738***
	(0.00111)	(0.00167)
Observations	207,843	207,124
R-squared	0.302	0.257

Notes: Sample includes all Thai villages in 1986-1996. The dependent variable is the change in access to BAAC (Column (1)) commercial banks (Column (2)) over consecutive two-year periods in 1988-1996. Access to a given FSP is dummy variable indicating whether a given village was serviced by the FSP in a particular year. "Provincial footprint of a given FSP" is percentage of villages in a given province with access to a given FSP. "ln(distance (minutes) to market place " is the log of travel time (in minutes) from a village to the nearest provincial center (market place). "ln(population)" is the log of village's population. "Per capita wealth" in a given year is calculated as the first principal component calculated on the basis of assets that a village's residents own, as described in the data Appendix. In 1986 year per capita wealth data imputed whenever 1986 data on wealth were not available. All specifications control for the financial access to both BAAC and commercial banks in the current period. Province fixed effects are included but not reported. Regression equation is estimated by OLS. Standard errors are in parentheses (clustered at the province level). *, **, And * indicate significance at 10%, 5%; and 1% respectively.

A Data description

We combine three different datasets.

First, the village data is extracted from the Thai Community Development Department (CDD) survey, conducted biannually from 1986 to 1996. Despite the CDD data focus on villages rather than urban centers, there is a significant correlation between population in urban centers and population in surrounding villages. Table 1 depicts summary statistics for the complete sample and for the 10 selected provinces used in the estimation exercise. There are binary variables indicating financial access to financial providers (the BAAC and commercial banks). These variables equal to 1 when the village has at least one loan contract with the respective provider in the survey year as per the headman/headwoman report. We also have information on population, distance to marketplace and a wealth index built as the first factor of a principal component analysis comprising the number of motorcycles, pick-up trucks and flush toilets per 1000 villagers.

Second, the information on bank branch location comes the Bank of Thailand, the Bank of Agricultural and Agricultural Cooperative, Telephone Authority of Thailand, Community Development Center and several non-traditional financial institutes. Combining these data, we get, for each bank branch, the date of opening, closing date (if ever closed), bank name and branch name. We geo-located the branches with the support of the Google Map API. For those branches matched at village level, we assign the village location as the branch location. Branches which can only be matched to tambon or municipal districts were assigned to the nearest road network intersections. In places where there are more than one intersection in the tambon or municipal district, we assign the earliest branches to the intersections with the largest number of segments and then follow the ranking for the next branches in the same tambon/municipal district. During the branch location assignment, we ensure that branches opened by the same bank are at least 500 meters apart from each other.

Third, we get the information on the road network from the Thailand Environment Institute. The data provides spatial geometries of national wide roads and intersections. In total, 59238 junctures are connected by 7 road types. We estimate the average vehicle speed for each type of road based on real time information. The type and length of road segment connecting any two junctures are obtained through a GIS platform. The car travel time between any two junctures is computed as the length of the connecting road segment divided by the average speed.

The average speed considered in each one of the road types is considered as follows:

	Road type	Average speed (km/h)
1	All weather: hard surface, two or more lanes wide	45
2	All weather: loose or light surface, two or more lanes wide	38
3	All weather: hard surface, one lane wide	38
4	All weather: loose or light surface, one lane wide	30
5	Fair or dry weather: loose surface	25
6	Cart track	20
7	Footpath, trail	15

Branch locations, villages and the road network are depicted in Figures 5-9. There is a wide variety of spatial configurations.

B Estimation of the model

In this section, we describe the procedure that we use to estimate the parameters of our model. We set the annual discount factor to $\beta = 0.9$, which leaves us with five parameters to estimate: four parameters describing financial outreach technology for the BAAC and commercial banks $(\Upsilon_B, \tau_B, \Upsilon_C, \tau_C)$ and the weight the BAAC puts on the payoff of commercial banks λ.

In order to estimate the parameters of the model, we consider 10 selected provinces in the period of 1986-1996, for which the number of entry episodes is less than or equal to 6, for computational tractability. The selected provinces are depicted in Figure 4. We interpret each province of Thailand as an independent economy that can be described by our model above. We exploited the larger sample of provinces in "out-of-sample" exercises to evaluate the model.

The dataset used in the analysis contains, for each province, N possible branch locations, M villages with population $Y_i, i = 1, ..., M$, the travel cost/distance from a given village to the three nearest branch locations D, the sequence S of observed entry decisions, financial access at the village level (B and C), and initial locations of FSPs (F).

The travel distance is computed from the actual road network, considering travel times that take into account the quality of roads. Financial access at the village level is characterized by two dummy variables indicating whether villages have at least one credit contract with the BAAC, B_i, or with the commercial bank, C_i.

The data on availability of services of the financial providers at the village level are collected by interviews with the village headmen/headwomen, asked about whether any of the households in their village have bank loans and whether those loans are from the BAAC or a commercial bank. Headmen in Thai villages play a prominent political role and typically are closely involved in matters facing ordinary villagers. A headman's/headwoman's answer "Yes" to a question about whether his/her village has access to loans from a particular FSP is likely to indicate not that just a single household having access to finance, but that a nontrivial number of village's households do get and might get (if needed) access to financial services from a particular FSP. Hence, such answers are likely to be more accurate representation of actual access to financial services at the village level for our estimation purposes.[25]

The location of branches in 1986 is considered to be the initial state. The set of possible locations is given by the actual branch locations in 1996. The sequence of decisions S is exogenous and is taken from the observed sequence of branch openings. See Data Appendix for more data description.

B.1 Likelihood

Our model yields an analytical expression for the probability of a given village to get services from a given FSP. Considering the three nearest branch locations case, the probability of observing financial access to the BAAC and commercial bank, respectively, can be written as:

$$Pr\{B_i = 1\} = q^B_{i,1} + q^B_{i,2} + q^B_{i,3} - q^B_{i,1}q^B_{i,2} - q^B_{i,1}q^B_{i,3} - q^B_{i,2}q^B_{i,3} + q^B_{i,1}q^B_{i,2}q^B_{i,3} \tag{15}$$

$$Pr\{C_i = 1\} = q^C_{i,1} + q^C_{i,2} + q^C_{i,3} - q^C_{i,1}q^C_{i,2} - q^C_{i,1}q^C_{i,3} - q^C_{i,2}q^C_{i,3} + q^C_{i,1}q^C_{i,2}q^C_{i,3}. \tag{16}$$

Thus, we can write the likelihood function on the basis of our data as:

$$l(\lambda, \Upsilon_B, \tau_B, \Upsilon_C, \tau_C) = \prod_{i=1}^{N} Pr\{B_i = 1\}^{B_i} Pr\{B_i = 0\}^{1-B_i} Pr\{C_i = 1\}^{C_i} Pr\{C_i = 0\}^{1-C_i}. \tag{17}$$

B.2 A two-step procedure

The likelihood above suffers from a curse of dimensionality. We propose a two-step procedure to estimate the five parameters of the model $(\lambda, \Upsilon_B, \tau_B, \Upsilon_C, \tau_C)$ with reduced computing time. First, given the distance to the nearest branch locations $D_{i,j}$ and the information on whether each village has access to the BAAC or the commercial bank, we estimate Υ_k and τ_k directly from equation (5) by non-linear least squares. Second, given these parameters, we choose λ through maximum likelihood, relying on equation (17) above. This way, we can implement a much finer grid for λ in a reasonable amount of time. Together with our baseline model we also estimate and assess the

[25]Tailoring our estimation approach to the available data at hand, we model only the probabilities of each village being served by a financial provider (extensive margin) without modeling the degree/depth of such services (intensive margin). However, as just mentioned, given our data, those probabilities should be interpreted as "substantial" access to financial services by a given village. It is worthwhile noting that even such (necessarily) simplified approach is able to capture vital patterns in financial access exhibited by the data and shows decent performance "out-of-sample". See Section 4.

relative performance of two restricted models. In the first, we restrict financial outreach parameters to be the same for the BAAC and commercial banks ($\Upsilon_B = \Upsilon_C$ and $\tau_B = \tau_C$). In the second model we shut down the altruistic or anti-preemption motive in the BAAC's behavior and set $\lambda = 0$.

We use bootstrap to obtain point estimates and standard errors for the parameters of financial outreach technologies ($\tau_B, \tau_C, \Upsilon_B, \Upsilon_C$) and the weight that the BAAC puts on commercial bank payoff λ. We consider 100 bootstrap subsamples of villages. For each bootstrap subsample we perform our two-step procedure described above. Given the actual data on profile of financial access to the BAAC and commercial banks in a given bootstrap subsample we estimate τ's and Υ's via non-linear least squares and then we run a grid search for λ on a grid from 0 to 2 with a 0.01 step.

This procedure gives us a distribution of $\tau_B, \tau_C, \Upsilon_B, \Upsilon_C$ and λ. We take the means from this bootstrapped distribution to be point estimates of the corresponding parameters and use 5^{th} and 95^{th} percentiles to construct confidence intervals.

Figure 4: Selected provinces

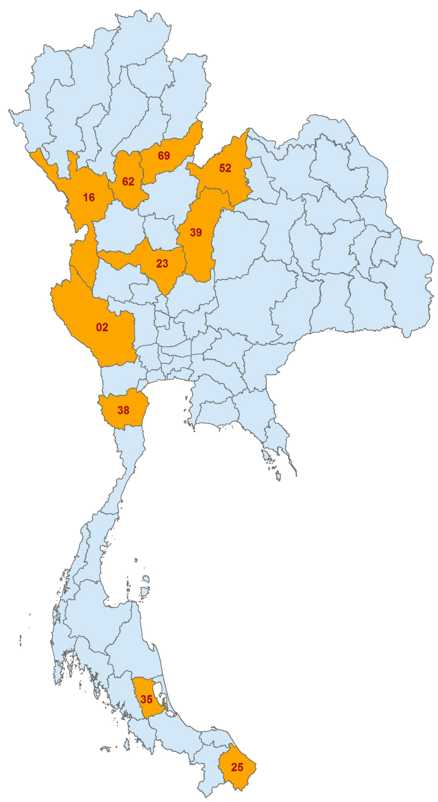
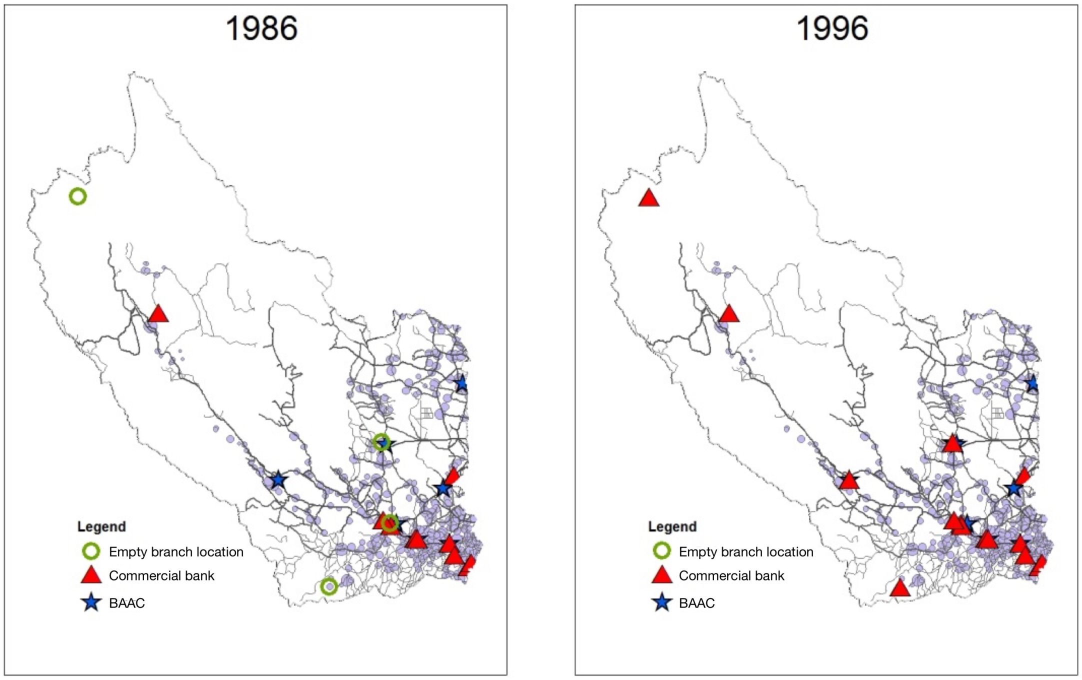
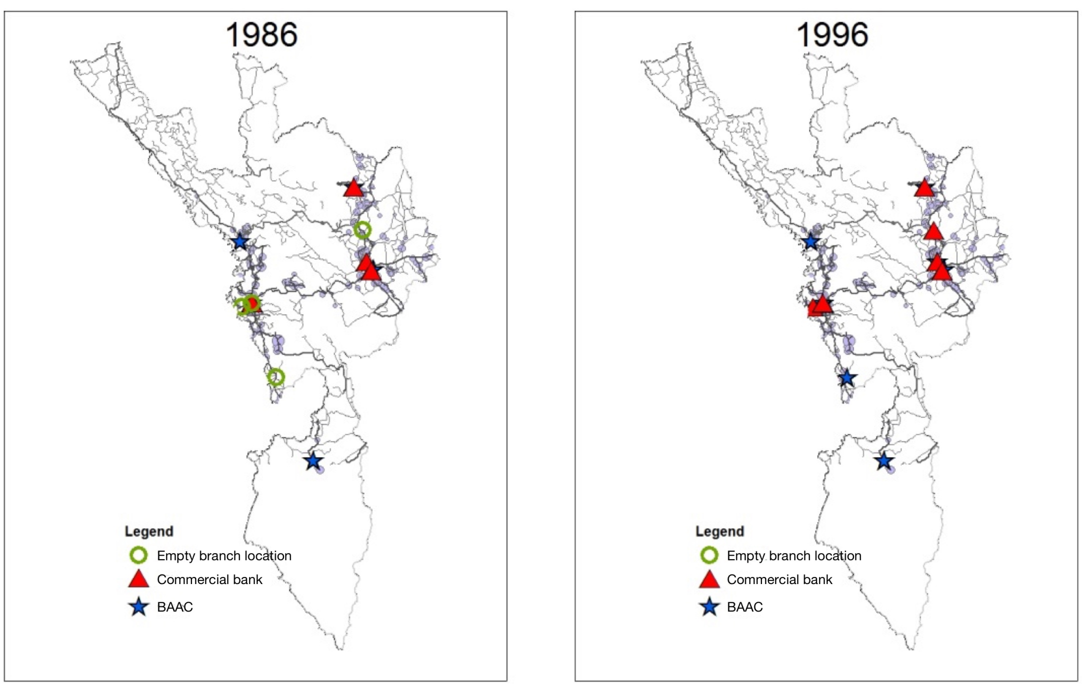


Figure 5: Selected provinces - Branch locations in 1986 and 1996

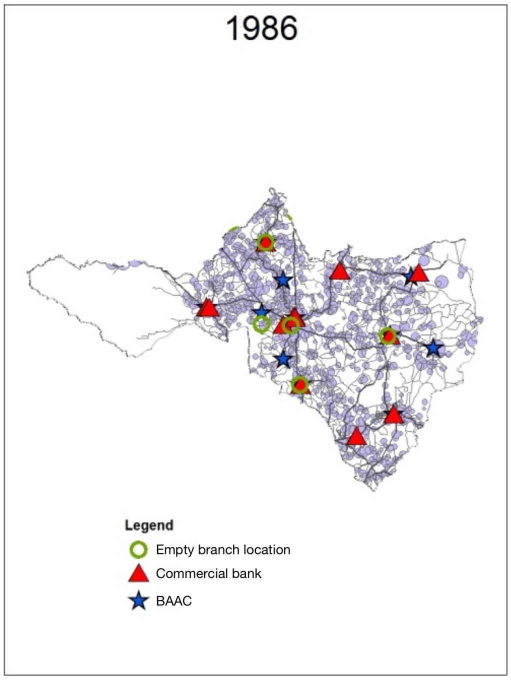


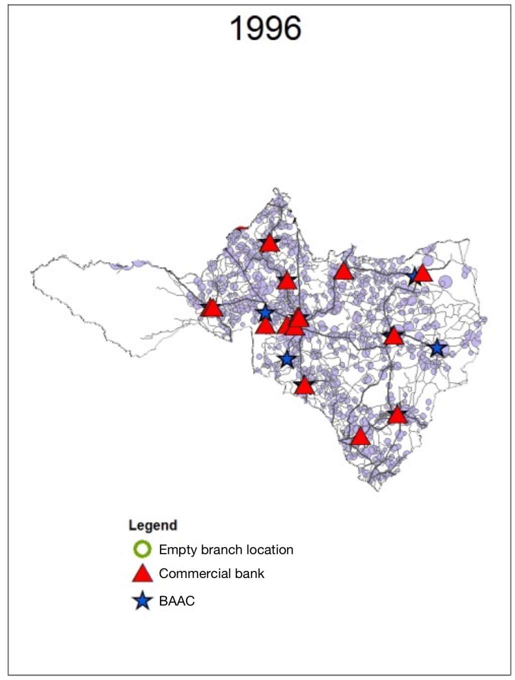
Province KANCHANABURI (02)



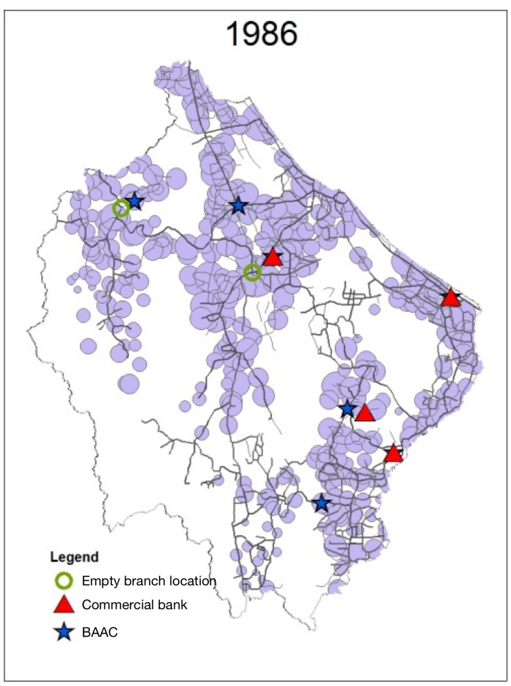
Province TAK (16)

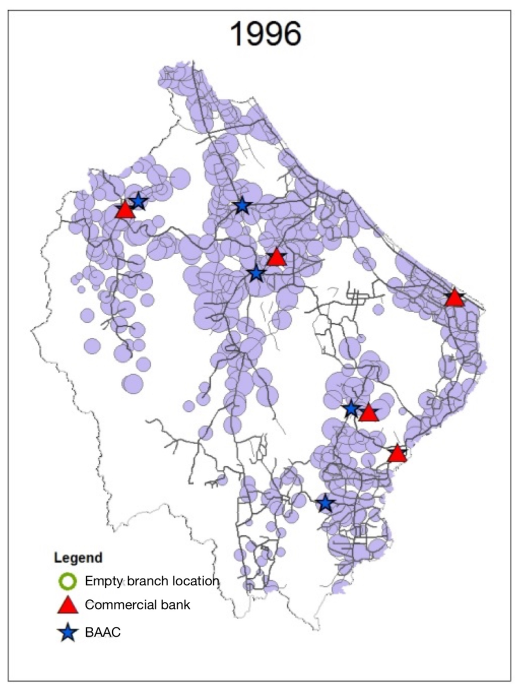
Figure 6: Selected provinces - Branch locations in 1986 and 1996





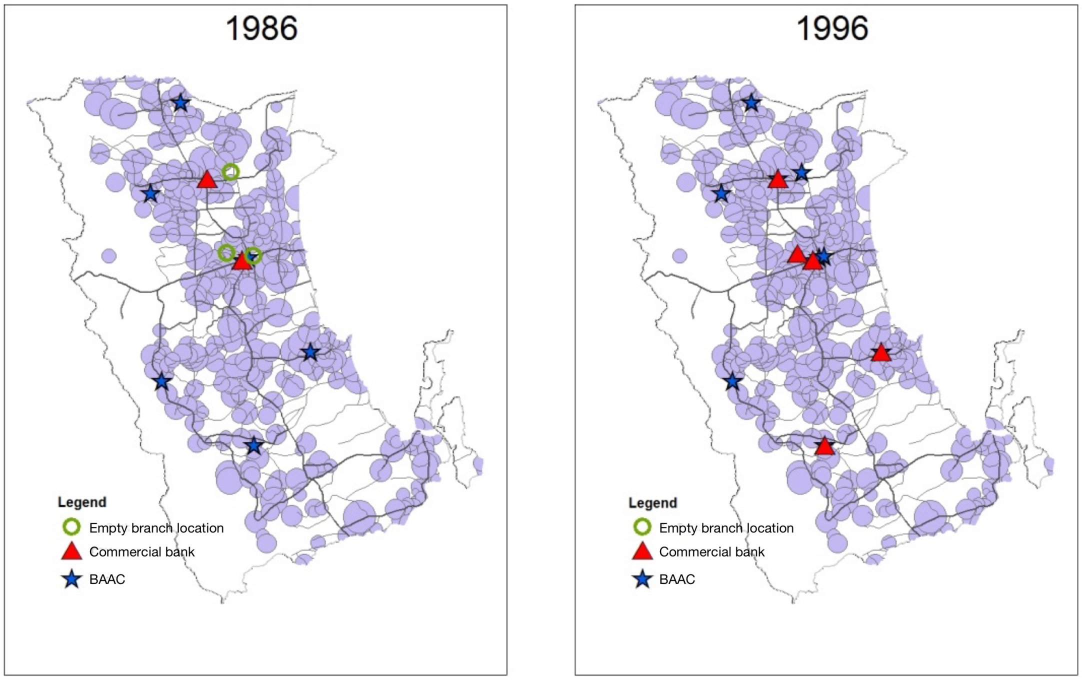
Province NAKHON SAWAN (23)



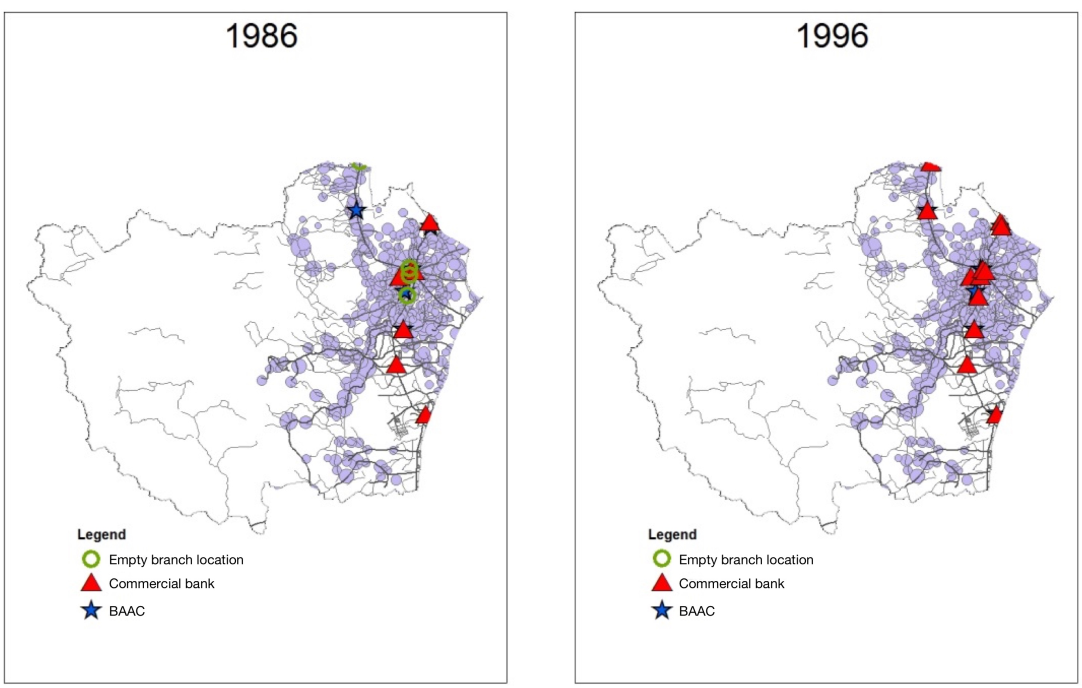


Province NARATHIWAT (25)

Figure 7: Selected provinces - Branch locations in 1986 and 1996

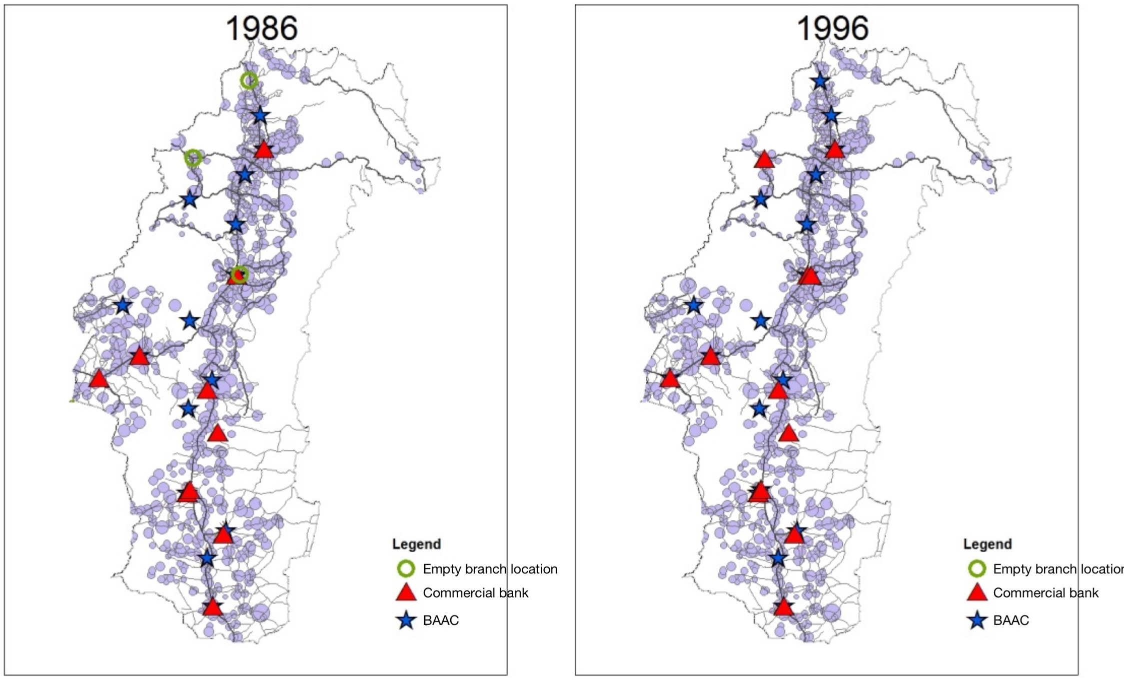


Province PHATTHALUNG (35)

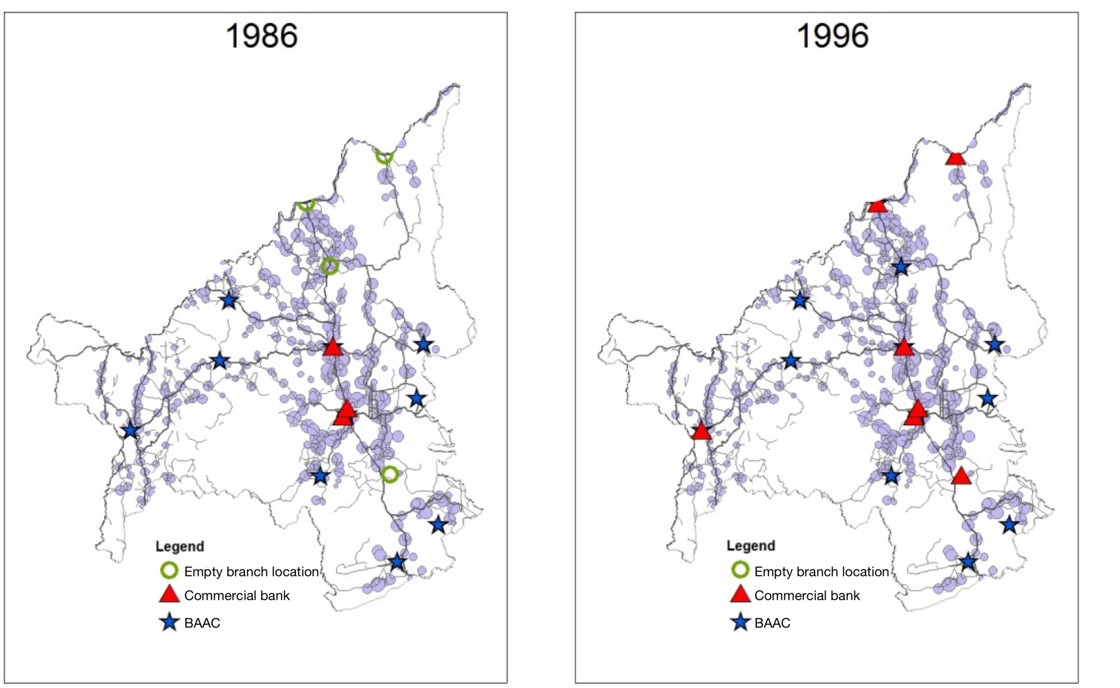


Province PHETCHABURI (38)

Figure 8: Selected provinces - Branch locations in 1986 and 1996



Province PHETCHABUN (39)



Province LOEI (52)

C Flexible functional form for financial outreach technology.

In the main text we considered a particular functional form for the financial outreach technology. The approach is compatible with a latent index model for the propensity of getting financial services and assume that the underlying (village-specific) error term ϵ_{ij}^{k} has an extreme value type 1 distribution which, which is commonly assumed in the industrial organization literature (see e.g. McFadden (1974)). On the estimation procedure, we considered the sample of 10 provinces, comprised of those with the number of new office branch opening being less than 6, which is required for analytical tractability of our two-step estimation procedure. However, one can estimate financial outreach technology using data on financial access from all provinces. This is what we do in the current section. We also investigate whether the functional form with exponential distance discounting represented in equation (5) is too restrictive.

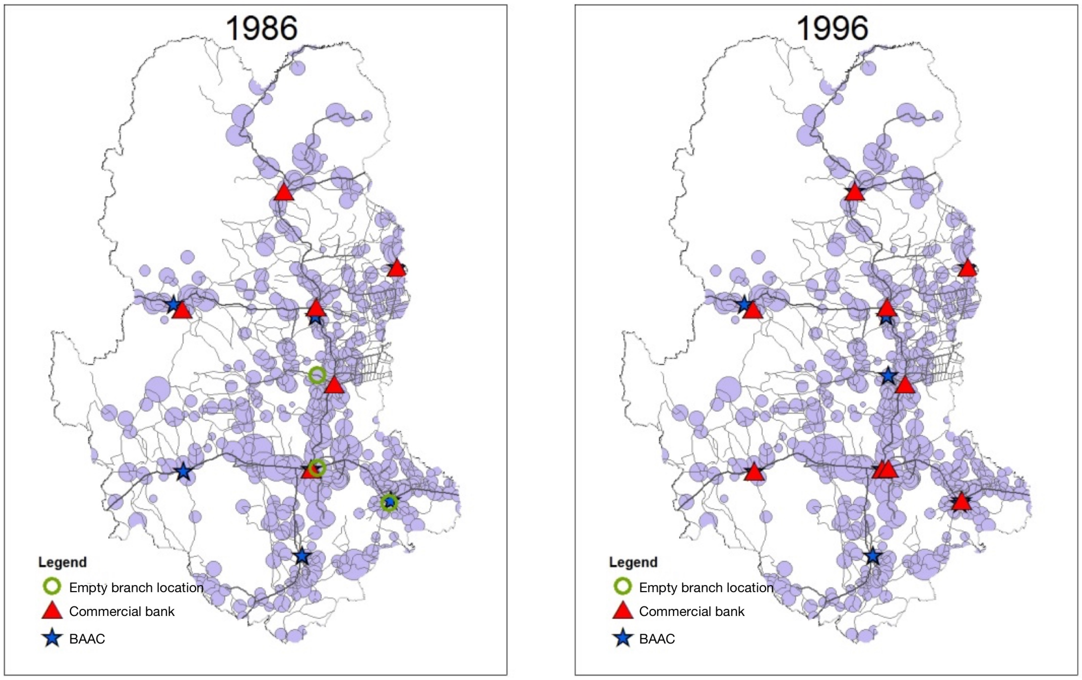
Table A6 and Figure 10 present parametric and non-parametric estimation of equation (5). Figure 10 shows that equation (5) is a good approximation for the relationship between financial access and the distance to the branches.

The outreach technology of the BAAC and commercial banks differs in two ways. First, the baseline probability of being served by the BAAC is higher - 94% instead of 53%. Second, while the probability of getting services of commercial banks decreases in the distance from the commercial bank branch, it is pretty flat for the BAAC, if anything it increases slightly with distance. It seems that conditionally on being present in the area the BAAC perceives travel time/distance as less of a hurdle in providing its services to customers in remote locations. Thus, outreach is an important dimension through which the behavior of the BAAC and commercial banks might differ, with implications for the spatial distribution of financial access.

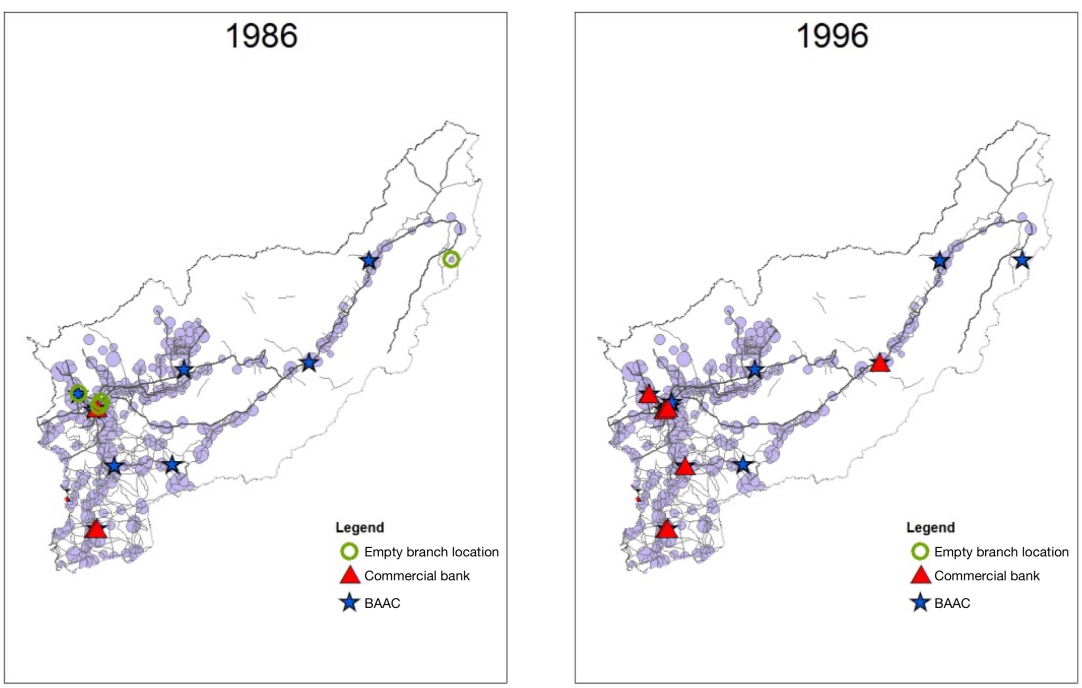
In the last column of Table A6 we also estimate the outreach technology under the assumption of homogeneity across financial providers. In this case, we pooled all of the observations and estimate equation (5) assuming all the information on access is associated with a single bank. In this case, the estimated technology is closer to that of a commercial bank.

When we compare the estimates presented in Table A6 to the ones presented in Table 4 obtained

Figure 9: Selected provinces - Branch locations in 1986 and 1996



Province SUKHOTHAI (62)



Province UTTARADIT (69)

Table A6: Estimation of the outreach technology function (all provinces) $\Upsilon_k exp(-\tau_k D_{ij})$

	heterogeneous outreach technologies		homogeneous outreach technologies
	access to BAAC (B)	access to commercial bank (C)	access to BAAC or commercial bank
Υ_k	0.940***	0.534***	0.763***
	(0.0021)	(0.0060)	(0.00360)
τ_k	-0.00073***	0.00665***	0.00297***
	(0.000081)	(0.00043)	(0.000175)
Observations	35686	34365	70051
R-squared	0.96	0.45	0.71

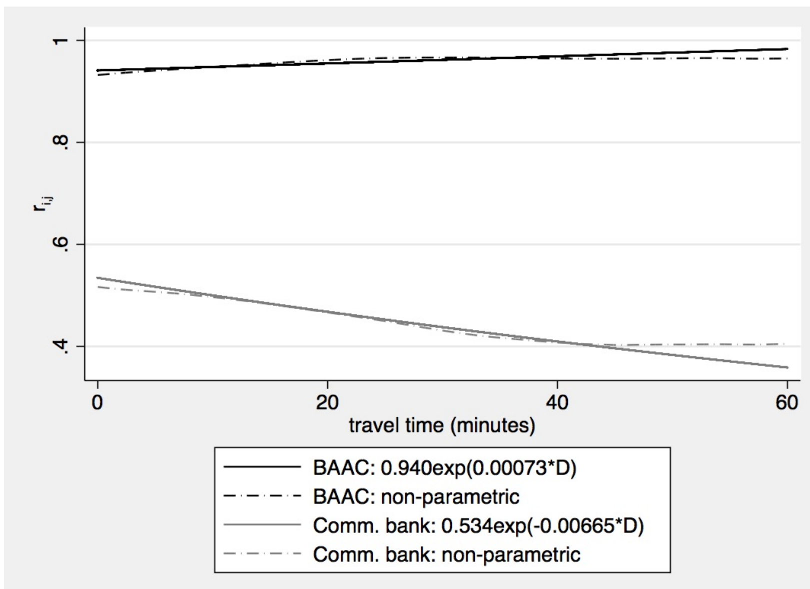
Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The equation $r^k_{i,j} = \Upsilon_k exp(-\tau_k D_{ij})$ is estimated through non-linear least squares, considering the 1996 data.

Table A7: Estimation of the outreach technology function depending on intensity of service of other provider: $\Upsilon_k exp(-\tau_k D_{ij})$

	access to BAAC (1)	access to BAAC (2)	access to BAAC (3)	access to commercial bank (4)	access to commercial bank (5)	access to commercial bank (6)
Υ_k	0.934***	0.949***	0.949***	0.486***	0.561***	0.561***
	(0.00993)	(0.00689)	(0.00688)	(0.0279)	(0.0188)	(0.0188)
τ_k	-0.000742**	-0.000720***	-0.000720***	0.00674***	0.00710***	0.00710***
	(0.000318)	(0.000196)	(0.000196)	(0.00211)	(0.00105)	(0.00105)
Υ'_k			-0.0150			-0.0749**
(low presence of other FSP)			(0.0121)			(0.0336)
τ'_k			-2.17e-05			-0.000359
(low presence of other FSP)			(0.000373)			(0.00235)
Presence of other FSP	Low	High	Any	Low	High	Any
Observations	18,649	17,037	35,686	10,057	24,308	34,365
R-squared	0.950	0.965	0.958	0.421	0.474	0.460

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Specifications (1), (2), (4),(5) contain estimation for the equation $r^k_{i,j} = \Upsilon_k exp(-\tau_k D_{ij})$, which is estimated through non-linear least squares, considering the 1996 data. "Low"("High") presence of other FSP indicate subsamples of villages in amphoes below(above) the mean level of presence of the other provider, where amphoe-level presence of an FSP provider is calculated as the mean number of villages in the amphoe with access to services of that provider. Specifications (3) and (6) show estimates of the equation $r^k_{i,j} = (\Upsilon_k + \Upsilon'_k * 1(Low\ other\ presence))exp(-(\tau_k + \tau'_k 1(Low\ other\ presence))D_{ij})$ for the whole sample of villages, considering 1996 data, where 1(Low other presence) is a dummy variable which for a given FSP indicates that presence of another FSP in the area(amphoe) is below the mean presence.

Figure 10: Estimated Outreach Technology



Notes: The figure plots the non-parametric and the parametric estimations of the outreach equation. The parametric version considers the model specification $r^k_{i,j} = \Upsilon_k exp(-\tau_k D_{ij})$, as presented in Table A6. The non-parametric estimation is based on the Nadaraya-Watson regression with Epanechnikov kernel and bandwidth 15.

using bootstrap for the 10 selected provinces, then for the most part estimated parameters τ's and Υ's are quite close across specifications qualitatively and quantitatively.

One could also be concerned that financial outreach parameters might be not constant and depend on the presence of a competing FSP in the area. For example, there could be a "selection" issue, with BAAC serving the primarily agricultural areas where it could be hypothesized it might have a competitive advantage and losing ground to commercial banks in more lucrative markets where it has to compete head-to-head with them. This could then potentially bias our structural parameter estimates (Υ and τ) and antipreemption patterns, which we find and explain with our model, might be affected by such selection.[26]

As we mentioned in at the beginning of Section 2 the BAAC and commercial banks are likely to be competing for the same customers. While BAAC indeed started as agricultural bank with lending mission to farmers and farmer cooperative, over time its mission has changed to be a rural bank competing not only in the loan market but also for deposits with commercial banks. Still, to alleviate such "non-common support" concerns we reestimate financial outreach technology separately for villages in amphoes with high vs low presence of the other service provider. To measure the presence of an FSP in an amphoe we calculate the average number of villages in an amphoe with reported services from a given FSP[27]) and for each financial services provider divide our village-level sample into two depending on whether villages are located in amphoes with below or above the mean amphoe-level presence of the other FSP.

Table A7 contains estimation results. We find that, a given FSP outreach technology parameters remain surprisingly stable in terms of economic magnitudes[28] (particularly for the BAAC) regardless of whether the presence of the other FSP is high or low (above below the mean) in the amphoe. The BAAC seems to be able to extend its financial outreach in the same way in areas which have both high and low presence of the commercial banks. In this regard, we argue that financial outreach technology parameters are unlikely to be affected by the potential selection issues and assuming that those parameters are common for different amphoes is likely to be a sensible approximation.

[26] We would like to thank an anonymous referee to raising this issue.

[27] We use 1996 year data to measure FSP presence, but the results are similar if we use 1986 data.

[28] We also performed statistical test of equality coefficients and for the most part coefficients are not statistically distinguishable from each other. Both level and distance discounting (Υ and τ) are similar for the BAAC and only level (Υ) might be different in the case of commercial banks.

D The role of product quality differences

In the main-text model simulations above, we have abstracted from explicitly modeling individual choices in the random utility framework and instead condensed them in financial outreach technology (see equation (5) above). Note that in that equation we do allow for differential distance discounting (in τ_K) and also allow for differential baseline level of financial access (Υ_K) between the two providers k: $k \in \{BAAC, COMM\}$. However, that specification differs from logit specification, which arises from a random utility model, which is commonly used in IO literature. This modelling choice is dictated by the CDD data limitation that we observe only indicator function for the financial access at the village level without information about relative shares of different FSPs in the village. We also observe only the type of the FSP (BAAC, commercial) without knowing the exact location of the branch that provides the service. A natural question in this regard: to what extent such limitations in our baseline model are likely to affect the main message of our paper. Namely, could the anti-preemptive motive (represented by $\lambda = 1$) come from a richer model in terms of demand for financial services but with purely competitive BAAC and commercial banks (λ=0.)

To probe this, in this section we consider the same example economy as in Section 3.4 above, but here in this appendix we model demand for financial services on the basis of a random utility model rather than financial outreach technology shortcut (as in equation 5).

Namely, we assume that two FSPs offer (potentially) different financial services contracts. The choice set for an individual/household h located in a given village i consists of financial services from a bank branch located in the village i as well as a bank branch in any other villages that is linked connected by a road to this village.

Denote $j = 1, .., , J$ the options from which this household/individual could get financial services. The utility of this household/individual from a particular option j is given by:

$$U_{hj} = \Delta_j - \tau_{ij} + \epsilon_{hj} \tag{18}$$

Here Δ_j measures the attractiveness of the contract offered by the particular FSP in location j: $\Delta_j \in \{\delta_C, \delta_B\}$, where δ_B and δ_C represent the contracts offered by the BAAC and commercial bank, respectively.[29] τ_{ij} represents travel cost that individual h has to incur if traveling outside of own village i to provider in location j . We assume that $\tau_{ii} = 0$ and $\tau_{ij} = \tau$ when $i \neq j$. ϵ_{hj} is random component of utility. Without loss of generality we set utility of outside option (of not getting financial services) to zero.

Under the standard distributional assumptions (that ϵ_{hj} are iid and have Gumbel distribution) the probability for a given individual h to pick option j would be:

$$P_{ij} = \frac{e^{\Delta_j - \tau_{ij}}}{1 + \sum_{k=1}^{J} e^{\Delta_k - \tau_{ik}}} \tag{19}$$

Thus, if the village i has population N_i then $N_i P_{ij}$ people from that location would get financial services from FSP located in location j.

We then proceed in the similar way as in the model in the main text. Namely, we assume that the commercial bank maximizes the number of customers it serves. While for the BAAC we consider two scenarios: maximization of number of customers served by the BAAC: ($\lambda = 0$, "self-interested" BAAC) as well as maximization of number serves regardless of the provider, total financial access: ($\lambda = 1$, "benevolent" BAAC).[30] As before, we start with the example economy having no bank branches and then allow for the two FSPs to move sequentially placing branches. Only one bank branch per village is allowed and the game ends when all nodes are filled, from which point the payoff of FSP is set to the value of infinite discounted stream of one period payments under the final configuration of financial access.

We calibrate time-travel discounting τ in line with the estimated distance discounting in financial outreach technology assuming that the travel time between two adjacent villages on our graph is one hour.[31] To calibrate the proper range for δs, we consider the following heuristic argument. We posit that a representative consumer has access to single BAAC office and single commercial bank office offering the same utility δ. Under those assumptions, out of all people eligible to get finance

[29] Since contract terms are set at the national level by each FSP (See section 2.1.1 above) we assume that each FSP sets the same contractual terms in all areas it services.

[30] As we discussed above, we cannot disentangle the benevolent motive of caring about welfare of customer vs political economy motive when the BAAC cares about payoff of the commercial banks.

[31] Particularly, we set $\tau = 0.18 \equiv 0.003 * 60$

the following fraction *would* choose either FSP over the autarky (getting no financing) option:

$$\frac{2exp(\delta)}{2exp(\delta)+1}. \tag{20}$$

As was mentioned in Section 2.1.2 above, from the urban data, 6 percent of people get loans from commercial banks and 12 percent from the BAAC (these two sets are not mutually exclusive). This implies that approximately 18 percent of population gets access to loans from either FSPs. Setting $\delta = -3$ in the equation above results in this fraction being equal to 10 percent.[32] So, if we make an assumption that roughly 100 percent of all population in Thailand *is* eligible to get finance (i.e., won't be rejected by the FSPs when applying) $\delta = -3$ seems like a reasonable *lower* bound.

If we set $\delta = 0$ then half of all eligible population would get access to finance, which, together with observed financial access around 20 percent, would imply that an eligible fraction of approximately 40 percent. We, again, consider a wider bound in our simulations and, thus, consider the range $\delta \in (-3, 1)$ as reasonable in the sense that those bounds are sufficiently wide to contain all potential values of δs offered by the BAAC and commercial bank, respectively. The above is using market shares for credit.

We then estimate this model for different values of δ_B and δ_C, which represent both the different financial products offered by the BAAC and commercial banks and the welfare gain of customers using those product, as in Section 2.1.2 . In the end, for every set of values for δ_B and δ_C we have the sequence of pictures similar to Figures 1. Since it is difficult to draw inference inspecting each such individual set of pictures we need a way to summarize the outcomes of each game to obtain insights about differences in the expansion patterns by the BAAC and the commercial banks. Particularly, we consider the following summary statistic.

In our example economy we have a cluster of rich villages located in the top center position (at coordinates $(2,2)$, (2.3), and $(2,3)$). Therefore, as our summary statistic we use the indicator function for each set of δ_B and δ_C: whether BAAC when making its first move chooses to open a branch in this rich cluster of villages. Note that as the game progresses all locations *have* to be occupied. Therefore, we are using the first move of the BAAC, rather than whether BAAC

[32] In fact the implied financial access would be even smaller, if travel costs are included in consideration, which is the case in the observed data.

eventually places a branch in the cluster of rich villages.

Since there are two options for which FSP moves first, we calculate the average for this statistic between these two possible scenarios ("BAAC moves first", "commercial bank moves first"). Therefore, the resulting statistics could take on three distinct values: (i) 1 - when BAAC when making *its* first move goes to a rich cluster in both scenarios; (ii) 0.5 - when BAAC when making *its* first move goes to a rich cluster only when the commercial bank moves second;[33] (iii) - the BAAC never goes to a rich cluster at its first move (and instead expands into poorer areas first) regardless of which FSP moves first.

We then plot these statistics as a function of δ_B and δ_C separately for the case of pure competitive BAAC ($\lambda = 0$) and for the case of benevolent BAAC ($\lambda = 1$) and present them in Figures 12 and 14, respectively. Particularly, in Figure 12 we consider the plots for the BAAC decision to expand first into the "rich" cluster under the assumption of "self-interested" ($\lambda = 0$) and "benevolent" BAAC ($\lambda = 1$), respectively. (Figure 13 shows corresponding contour plots).

Panel (a) in Figures 12 and 13 shows that the self-interested BAAC ($\lambda = 0$) almost always expands into the "rich" cluster of villages when making its first move (regardless whether BAAC moves first or second after the commercial bank). Panel (b) in Figures 12 and 13 indicates that "Benevolent" BAAC ($\lambda = 1$) does sometimes expand into the "rich" cluster but only when the value of BAAC's contract is much better than that of commercial banks ($\delta_B >> \delta_C$) and even then this is more likely to happen when BAAC has a first-mover advantage in the game, i.e., commercial banks are arriving later into the area. When the commercial bank is moving first (in which case, it is more likely to occupy a village in the "rich" cluster) the BAAC tend avoid the "rich" cluster, provided the contracts offered by the BAAC and commercial banks do not differ drastically in the eyes of the consumers ($\delta_B \sim \delta_C$) or BAAC's contract on average is perceived to be worse ($\delta_B < \delta_C$).

It is worth noting that such contract difference plays a modest role in the model with "self-interested" BAAC ($\lambda = 0$). The BAAC predominantly tends to open a branch in the rich cluster regardless of the contracts being offered (Panel (a) in Figures 12 and 13). For some parameter configurations self-interested BAAC does abstain from the "rich" cluster (especially when it moves

[33] In principle, there is also a theoretical possibility that BAAC could move to a rich cluster *only* when it moves second. But this scenario never realizes in our setup.

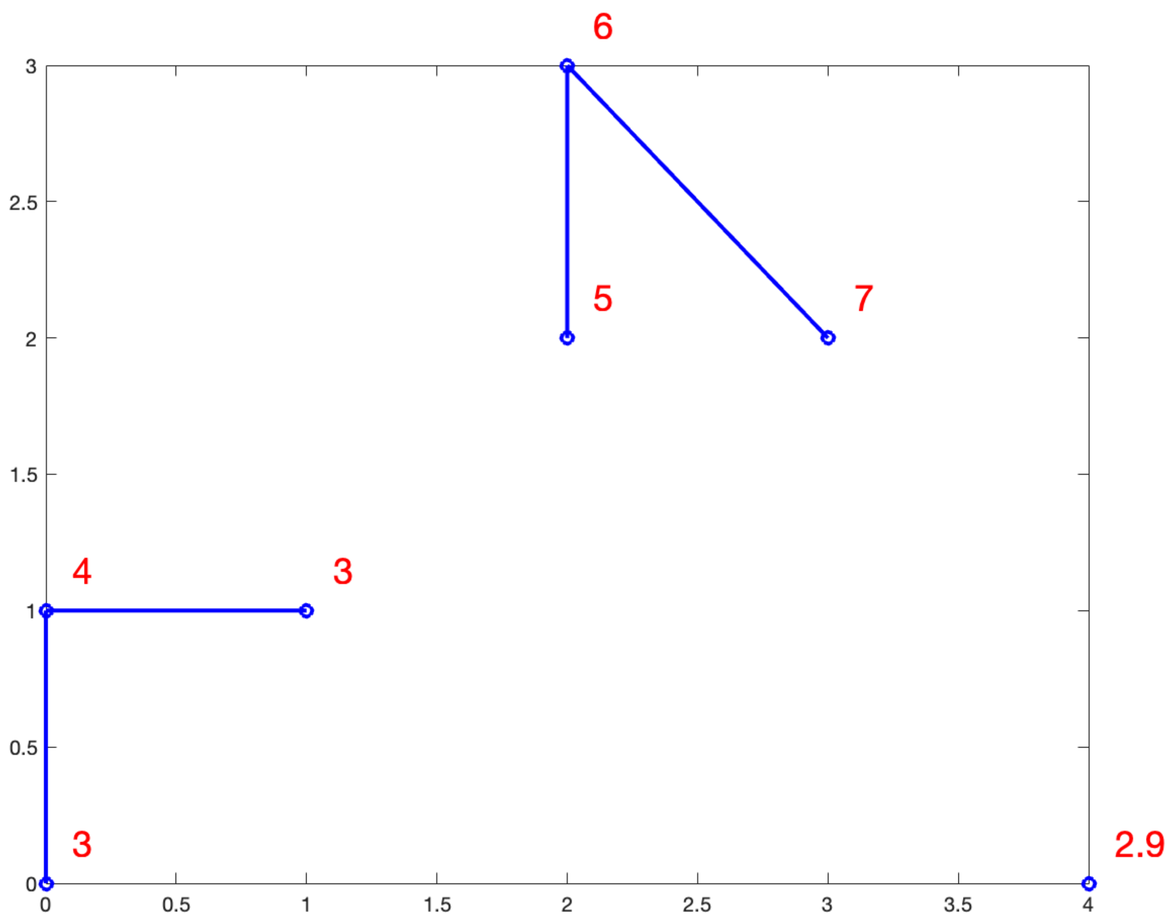
second, i.e., after the commercial bank). Notably, those cases are predominantly observed when BAAC offers a *drastically* worse contract than commercial banks. So, theoretically it *is* possible for the BAAC not to go to "rich" cluster due to contractual differences. However, we would argue that the implied difference in $\delta_C - \delta_B = 3$ makes it unlikely that those differences are relevant empirically. As we have discussed in Section 2 above, the contracts offered by the commercial banks and BAAC are not that dissimilar. Additionally, we would also argue that such difference in δs does not pass the "smell" test of calibrated financial access shares in the hypothetical example behind equation (20) as it would imply a 20 times higher share for commercial banks compared to the BAAC: $exp(\delta_C - \delta_B) = exp(3)$. Thus, the assumption of "benevolent" BAAC ($\lambda = 1$) is crucial to generate the part of the "anti-preemptive" pattern that BAAC avoids "rich" locations when directly competing with commercial banks.

We also probed further the second part of the "anti-preemption" story: that BAAC expands into richer villages when commercial banks are absent from the area. In the context of this example, we model this situation by allowing the BAAC to make the first three moves, which effectively postpones commercial banks' arrival into the area. In Figure 14 we see that in this case the behavior of self-interested and benevolent BAAC tend to become closer to each other. Self-interested BAAC (in Panel (a)) always expands into the rich cluster when making the first move, while benevolent BAAC (in Panel (b)) does so for "majotiry" combinations in the contract space (δ_B, δ_C). Only when commercial bank's contract is drastically better than the of the BAAC, the "benevolent" BAAC refrains from expanding into the rich cluster first.

Overall, we conclude that even if we were to allow for a more general demand system by the consumers, and assume that there is a difference in the quality of financial products offered by the BAAC and the commercial banks in the eyes of the consumers, we won't be able to generate the anti-preemptive patterns that we observe in the data if we maintain the assumption that the BAAC is self-interested ($\lambda = 0$). The assumption of "benevolent" BAAC ($\lambda = 1$) is essential to guarantee for the BAAC to actually cede ground to commercial banks when those are (will be soon) present in the area. At the same time, under this assumption we also get the second part of the anti-preemption story: that BAAC behaves more likely self-interested bank when it acts alone in the local market. Therefore, in the main text, to make full-scale model estimation feasible, we dispense with those demand-side heterogeneity considerations and focus on the salient aspects of BAAC vs commercial banks' interaction: role of $\lambda > 0$, while assuming a simplified version of the demand system.

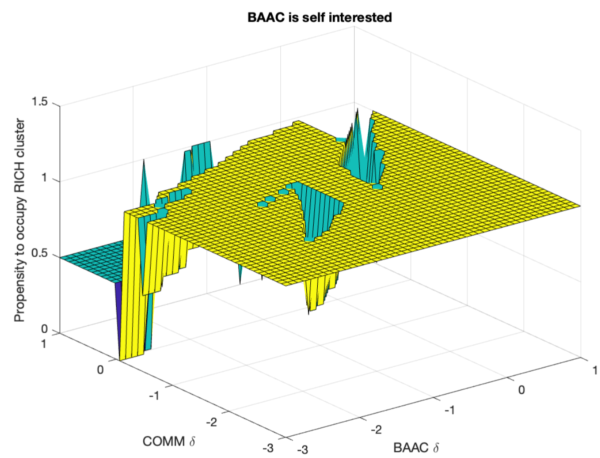
Again, we would like to stress, that "benevolence" of the BAAC is a placeholder for several motives that could result in positive weight being put on the number of customers being served by the commercial banks' in the BAAC's objective: i) genuine care about overall consumer welfare, ii) caring about profits of commercial banks - which in part could be due to political pressure from the commercial banks' owners on the government, iii) combination of i) and ii).

Figure 11: Example economy

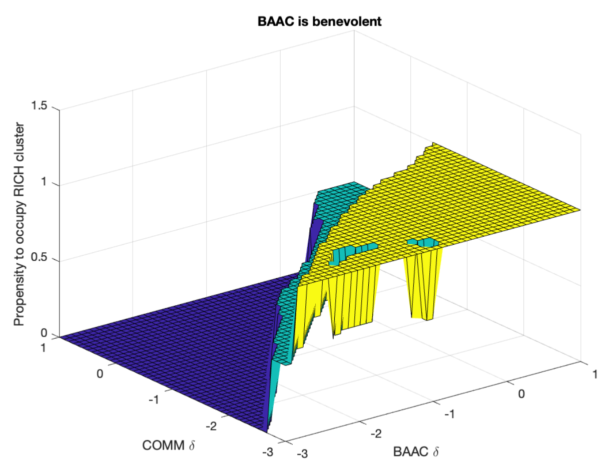


Notes: This figure shows example economy graph. Nodes of the graph represent villages with populations/payoffs indicated. Graph links represent roads connecting nodes (villages). We assume that a person in a given village can obtain financial services from the provider (if any) located in his/her own village or providers located in villages immediately adjacent to his/her own village (connected by a road).

Figure 12: Propensity to expand first into the "Rich" cluster. Average of the two scenarios.



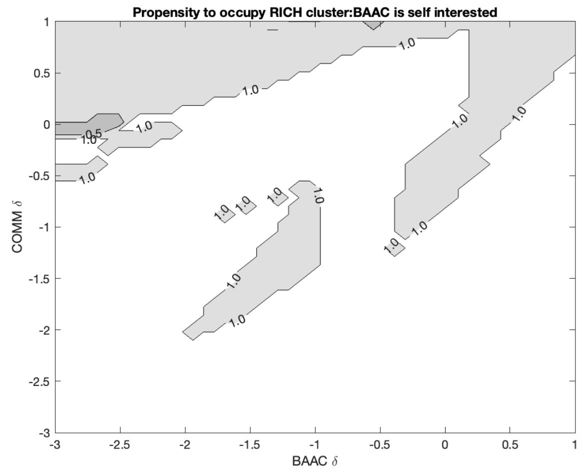
(a) Self-interested BAAC: $\lambda = 0$



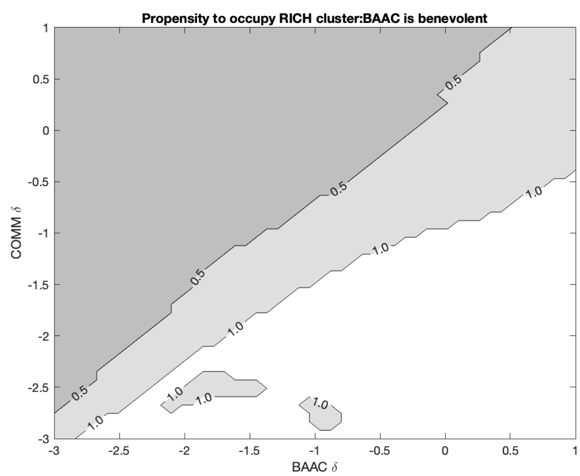
(b) "Benevolent" BAAC: $\lambda = 1$

Notes: Figure shows the (averaged) propensity of BAAC to expand into the "rich" cluster on the map in Figure 11 when making its first move. Subplot (a) shows the case when BAAC is self-interested ($\lambda = 0$), while subplot (b) shows the case when BAAC is benevolent ($\lambda = 1$). We assume that a person in a given village can obtain financial services from the provider (if any) located in his/her own village or providers located in villages immediately adjacent to his/her own village which results in the net utility of δ_B for the BAAC contract and δ_C for the commercial bank's contract. If the person chooses the provider located in another village, travel cost τ are additionally subtracted from random utility. Individual-level random utility disturbance terms are distributed according to Gumbel distribution. Providers move sequentially. Average is taken over the two scenarios when BAAC is the first/second to move. Commercial bank and the BAAC are assumed to move interchangeably.

Figure 13: Countour Plots for the Propensity to expand first into the "Rich" cluster. Average of the two scenarios.



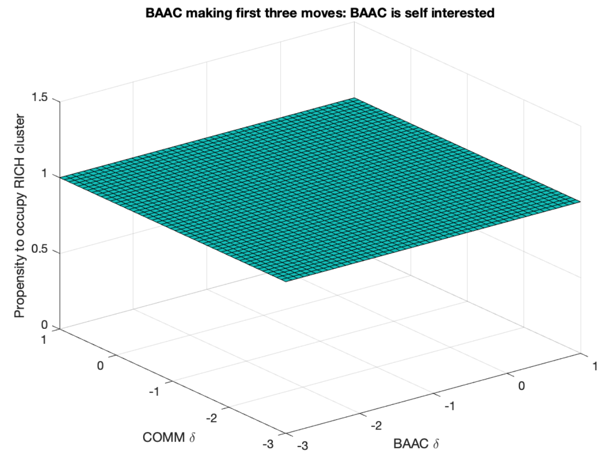
(a) Self-interested BAAC: $\lambda = 0$



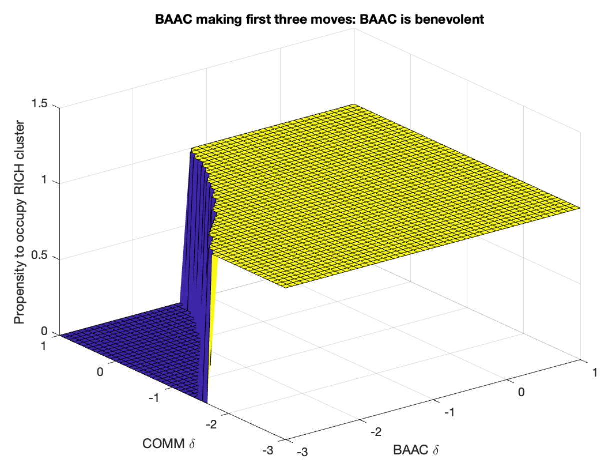
(b) "Benevolent" BAAC: $\lambda = 1$

Notes: Figure shows the contour plots for the (averaged) propensity of BAAC to expand into the "rich" cluster on the map in Figure 11 when making its first move. White areas comprise the highest values, while dark gray refer to the lowest values. Subplot (a) shows the case when BAAC is self-interested ($\lambda = 0$), while subplot (b) shows the case when BAAC is benevolent ($\lambda = 1$). We assume that a person in a given village can obtain financial services from the provider (if any) located in his/her own village or providers located in villages immediately adjacent to his/her own village which results in the net utility of δ_B for the BAAC contract and δ_C for the commercial bank's contract. If the person chooses the provider located in another village, travel cost τ are additionally subtracted from random utility. Individual-level random utility disturbance terms are distributed according to Gumbel distribution. Providers move sequentially. Average is taken over the two scenarios when BAAC is the first/second to move. Commercial bank and the BAAC are assumed to move interchangeably.

Figure 14: Propensity to expand first into the "Rich" cluster. Average of the two scenarios.



(a) Self-interested BAAC: $\lambda = 0$



(b) "Benevolent" BAAC: $\lambda = 1$

Notes: Figure shows the propensity of BAAC to expand into the "rich" cluster on the map in Figure 11 when making its first move. Subplot (a) shows the case when BAAC is self-interested ($\lambda = 0$), while subplot (b) shows the case when BAAC is benevolent ($\lambda = 1$). We assume that a person in a given village can obtain financial services from the provider (if any) located in his/her own village or providers located in villages immediately adjacent to his/her own village which results in the net utility of δ_B for the BAAC contract and δ_C for the commercial bank's contract. If the person chooses the provider located in another village, travel cost τ are additionally subtracted from random utility. Individual-level random utility disturbance terms are distributed according to Gumbel distribution. Providers move sequentially. BAAC is assumed to make first three moves after which commercial bank and the BAAC move interchangeably.

E Error Terms Structure

In the main text we have assumed exponentially declining in distance financial outreach technology. In this Appendix we discuss what distributional assumptions we need to make to obtain this functional form. Namely, we posit that probability r of financial access at the village-level to a particular FSP is given by the following function:[34]

$$r = \Upsilon e^{-\tau d} \tag{21}$$

Here, $\Upsilon > 0$ is the baseline probability of financial access at villages with zero distance to the FSP, while $d > 0$ is distance from a given village to an FSP branch while τ is distance discounting. Setting $\upsilon \equiv \log(\Upsilon)$ this formula can alternatively be written as:

$$r = e^{\upsilon - \tau d} \tag{22}$$

which is related to the CDF of exponential distribution CDF if we define:

Assume that access to finance at the individual level is governed by a latent index model. Namely, household h located in a village decides to obtain financial services from a FSP located at the distance $d > 0$ from the village if:

$$\upsilon - \tau d + \epsilon_h > 0 \tag{23}$$

Here we can think of $\upsilon - \tau d$ is the utility household obtains from getting financial services. ϵ_h is unobserved shock to utility of household h.

We assume that ϵ_h has exponential distribution $E(1)$. Then probability to get financial service for household h would be:

$$Prob(\upsilon - \tau d + \epsilon_h > 0) = e^{\upsilon - \tau d} \tag{24}$$

Then by law of large numbers this probability would also be the share of households in a given village receiving financial services.

[34]For simplicity, we omit all village- and FSP-specific subscripts from equation (5).