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Staff working paper / Document de travail du personnel—2026-19

Last updated: June 11, 2026

Banking Competition and Access to Cash and Retail Banking Services in Rural Canada

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DOI: https://doi.org/10.34989/swp-2026-19 | ISSN 1701-9397

Banking Competition and Access to Cash and Retail Banking Services in Rural Canada*

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May 12, 2026

Internal Preliminary Paper. Please do not distribute!

Abstract

We study the accessibility and competitive structure of Canadian retail banking and cash services in rural, localized markets using the Bresnahan-Reiss entry threshold framework. We estimate population thresholds required to support a given number of establishments in two segments of the financial industry: retail banking services (financial institution branches) and cash services (branches and ATMs). The first retail banking services branch requires about 500 residents in an average market, whereas the first cash services location requires about 80 residents. Our estimates indicate that retail banking-services markets become effectively competitive once three branches are present, whereas additional cash-service locations may be spatially differentiated for price-insensitive consumers. We also find meaningful regional heterogeneity: public banking is associated with greater access to retail banking services, while stricter regulatory requirements are associated with reduced access to cash services.

JEL Classification: D14; G21; L10; L13.

*We want to thank presentation participants at the 2025 Canadian Economics Association Conference, the Bank of Canada, Innovation, Science and Economic Development Canada, and Lakehead University for comments and suggestions. We also thank Jason Allen, Heng Chen and Youming Liu and other colleagues at the Bank of Canada for their valuable feedback and suggestions. The views expressed in this paper are those of the authors alone and do not necessarily represent the views of the Bank of Canada. This paper was supported by SSHRC-PEG grant #892-2023-3028 and Mitacs grant IT39260.

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1 Introduction

Despite the shift toward online banking and digital payments, consumers continue to value access to retail banking and cash services through 'brick and mortar' outlets. Households rely on branches for services that benefit from face-to-face interaction, such as mortgages and investment advice, and some transactions (e.g., large international transfers) are more difficult to complete fully online.[1] Cash also remains important: the Bank of Canada's 2024 Methods of Payment Survey Report indicates that 20% of in-person point-of-sale purchases by volume used cash (Felt et al., 2025). Accordingly, maintaining a physical presence in a market helps financial institutions (FIs) retain existing customers and attract new ones. Policymakers, particularly in rural and remote areas, are also attentive to the availability of physical access points because access to financial services has public-good characteristics (Lindsay, 2009), and these communities face the greatest access barriers, as captured by travel-based cost metrics (Chen et al., 2023).

In this paper, we analyze entry, competition, and access in retail financial services across isolated Canadian markets using the Bresnahan and Reiss (1991) (BR) entry-threshold framework. We focus on rural and small-urban markets because they are often marginal communities at risk of losing their only physical access point. We examine entry in two segments: retail banking services, measured by FI branches, and cash services, measured by both branches and Automated Teller Machines (ATMs). The BR framework characterizes market structure by estimating entry thresholds—the minimum market size required to sustain an additional branch or cash-service location. Under the assumption of homogeneous firms in long-run equilibrium, these estimates allow us to infer how competitive conduct changes as the number of competitors increases. Overall, the BR framework offers a parsimonious and tractable approach in settings with many small, and often unobserved, potential entrants, such as the cash-services location market.

Our results provide estimates of demand entry thresholds, per-firm entry-threshold ratios, and implied competitive conduct for both retail banking and cash service locations. For retail banking-services locations, we estimate that the first FI branch requires roughly 500 residents in a market with average demographic characteristics, and that entry-threshold ratios converge to one after the third branch entry, indicating that retail banking-service markets become effectively competitive with three branches. By contrast, the entry threshold for the first cash-service location is much lower at about 80 residents, and the entry-threshold ratio remains significantly above one even after the fifth entrant. This pattern suggests that the competitive market structure continues to evolve even after the entry of five cash service locations. One interpretation is that households are less willing to travel long distances to obtain cash, given that households withdraw cash frequently, making travel (shoe-leather) costs a more important consideration for

[1] For Canadians, evidence suggests that about half of Canadians visit a bank branch less than two times a year, while almost 90 percent want the option of visiting a branch - see `https://kpmg.com/ca/en/home/media/press-releases/2024/06/canadian-bank-branches-need-innovation-kpmg-poll-shows.html`.

cash services than broader retail banking services.[2] Another interpretation is that consumers may be more price sensitive for a better mortgage, loan or investment product, therefore willing to pay a higher search cost, than for ATM withdrawals. Both interpretations imply that cash services locations exercise higher market power within given travel distances than retail banking services locations, which explains why additional entry is needed for the latter to reach competitive equilibrium.

We next examine regional heterogeneity, motivated by cultural, competitive, and regulatory differences in Alberta and Quebec. These two provinces have unique features in their banking and cash service markets. Alberta is home to Alberta Treasury Branch (ATB), a publicly owned FI, while Quebec regulates non-FI-owned (white-label) ATMs as money services businesses; no comparable strict reporting and licensing requirements for white-label ATMs are imposed elsewhere in Canada (House of Commons, 2018). Quebec is also culturally distinct as the only province with a majority French-speaking population. Using a modified specification that relaxes the assumption of homogeneous entrants across regions, we find that public banking in Alberta is associated with lower population entry thresholds for both retail banking services and cash services, in contrast to the evidence in Coelho et al. (2013) for Brazil. In Quebec, entry thresholds are significantly higher in both segments, suggesting that restrictive regulation (e.g., anti-money laundering requirements) and unique cultural factors may reduce access to both cash and retail banking services in Quebec.

Our analysis speaks directly to policymakers concerned about the gradual erosion of the physical infrastructure for accessing retail banking and cash services, particularly in rural and small-urban areas where some branch closures have recently occurred (Chen et al., 2023).[3] In rural and remote communities, branches provide essential services for households and local businesses, and the loss of a local banking presence can have negative consequences for some.[4] First, our findings suggest that some interventions—such as introducing a public bank—may improve access to retail banking services, whereas others—such as tighter anti-money laundering requirements—may reduce access to cash services. Second, the estimated population threshold needed to sustain a first FI branch and/or ATM serves as an access indicator, helping to identify marginal communities at risk of losing (or poised to gain) their only branch or ATM. This analysis, in turn, provides a basis for evaluating policies that strengthen incentives for FIs to maintain or expand a physical presence in these communities.

Our paper makes several contributions to the literature. First, we provide the first Canadian

[2]The 2024 Canadian methods-of-payments (MOP) survey finds an average cash withdrawal frequency of 2.6 times per month at ATMs and branches (Felt et al., 2025)

[3]The Financial Consumer Agency of Canada (FCAC) requires a detailed procedure for a federally regulated financial institution to follow when closing a branch. The procedure is more specialized in the case of a closure in a rural market. For details, see `https://www.canada.ca/en/financial-consumer-agency/services/banking/branch-closures.html`.

[4]See `https://www.cbc.ca/news/canada/thunder-bay/last-bank-branch-in-schreiber-to-close-1.7431648`. There are also a series of recent Desjardin and Laurentian branch and ATM closures - see `https://www.ctvnews.ca/montreal/article/desjardins-to-close-service-centres-atms-by-2026/`

estimates of entry thresholds for both retail banking services and cash services. Building on the framework pioneered by Bresnahan and Reiss (1991), De Juan (2008) and Martin-Oliver (2019) estimate entry thresholds in Spanish banking markets, with the latter documenting how spatial financial exclusion evolved after the Great Recession. More recently, Coccorese and Pellecchia (2022) find evidence of competitive conduct in local Italian banking markets. Coelho et al. (2013) uses the BR framework to quantify how the entry of a public bank affects private banks in concentrated Brazilian markets. For the United States, Feinberg (2008) and Cetorelli (2002) estimate entry thresholds separately for credit unions and banks, respectively. We contribute to this literature by analyzing banks and credit unions jointly and by extending the BR model to cash-service locations using ATM data.

A second contribution of our research is to the growing literature on banking competition in Canada. Earlier non-structural studies find little evidence of high markups in Canadian banking despite the sector's high concentration (Nathan and Neave, 1989; Shaffer, 1993; Allen and Engert, 2007). More recently, structural analyses by Allen et al. (2014b) and subsequent work (Allen et al., 2014a, 2019) document sizable search frictions that enable Canadian financial institutions to exercise market power in negotiated-price markets such as mortgage lending. Closest to our approach, Perez-Saiz and Xiao (2022) study isolated Canadian markets and find the expected negative effects of competitor entry on bank and credit union profitability using structural entry models pioneered by Berry (1992) and Cohen and Mazzeo (2007). Relative to this work, we identify heterogeneous effects on competition as markets move from two to three (and more) branches. We also broaden the scope of the analysis by incorporating ATM data alongside branch locations, allowing us to study competition in cash services in addition to retail banking services. Together, these extensions provide a more comprehensive picture of competitive conditions in Canadian retail banking.

Finally, our research contributes to the small empirical literature using structural methods to study the ATM market. Ishii (2004) studies the effects of ATM investment. Ferrari et al. (2010) analyzes the monopolistic ATM market in Belgium and show that coordination between banks results in inefficiently low ATM entry. In contrast, Gowrisankaran and Krainer (2011) study the competitive ATM market in rural United States, where both banks and non-banks can enter, and show that ATM demand is elastic with respect to surcharge fees. Magnac (2017) shows that introducing foreign fees significantly reduces ATM usage in Finland. We contribute to this literature by producing the first structural entry model of cash-service locations in the Canadian context. Canada differs from Europe and even the United States with a very permissive institutional environment, with no regulations on ATM fees and on who can enter (Chen et al., 2023). While the literature focuses on consumer demand, we innovate by also considering cash demand from businesses, who are arguably even more dependent on cash services to retain customers. Therefore, we contribute to the ATM literature by estimating entry thresholds that capture the minimum demand needed to support a given number of cash services locations, in an institutional environment with few regulatory constraints.

The remainder of the paper is organized as follows. Section 2 introduces the Canadian banking industry. Section 3 outlines the BR framework and our empirical strategy. Section 4 describes the data and defines localized markets. Section 5 reports the main results, and Section 6 concludes.

2 The Canadian Banking Industry

The Canadian banking industry consists primarily of a small number of very large banks with nationwide reach (the so-called "Big Six"),[5] a large multi-province credit union (Desjardins), a provincially owned deposit-taking institution (ATB), and a set of much smaller local banks and credit unions. Unlike in the United States, Canadian deposit-taking institutions are generally not specialized and instead offer a broad range of products. These offerings include cash services, provided through both branch tellers and ATMs.

The Canadian banking sector is highly concentrated. In 2024, the "Big Six" banks, Desjardins, and ATB accounted for 92% of industry assets.[6] The industry structure has also been largely stable since the early 2000s, following the federal government's rejection of proposed mergers among large national banks.[7] Further, ownership restrictions limit foreign ownership. Under the "widely held" rule, no shareholder group may own more than 20% of a large bank's voting shares,[8] which prevents 'entry through acquisition' by large foreign banks. Consistent with this overall stability, the number of branches only declined slightly after the Covid-19 pandemic, while the number of ATMs remained roughly constant (Chen et al., 2023).

Within an overall stable industry, market structure varies across regions due to cultural and regulatory factors. With Canada having two official languages (English and French) and a large immigrant population, Canadian financial institutions often trace their founding to a particular cultural origin, which creates substantial cultural entry barriers in markets with different cultural origins (Perez-Saiz and Xiao, 2022). Regulatory entry barriers also play a role in shaping market structure. For example, as a provincial public bank, ATB operates only within Alberta. We consider these factors in our estimation.

In addition to deposit-taking FIs, cash services are also provided by independently operated ATMs (white-label ATMs) that are not owned by FIs. The white-label ATM industry emerged in 1996 following a Consent Order from the Competition Tribunal. The order allowed non-FI providers to connect to Interac, the Canadian interbank network that facilitates electronic

[5]The Big 6 include: Bank of Montreal, Bank of Nova Scotia, Canadian Imperial Bank of Commerce, National Bank, Royal Bank of Canada, and Toronto-Dominion Bank.

[6]Based on authors' calculations and firm financial reports.

[7]In 1998, then-Finance Minister Paul Martin rejected proposed mergers between the Royal Bank of Canada and the Bank of Montreal, and between Canadian Imperial Bank of Commerce and the Toronto-Dominion Bank.

[8]Specifically, the widely-held rule states that no shareholder group can own more than 10% share in banks of any size without Minister of Finance's approval. In addition, for large banks with total assets above $12 billion, no shareholder group may own more than 20% of the issued and outstanding voting shares of the bank.

financial transactions, thereby enabling independent operators to run ATMs. After two decades of rapid growth, the number of white-label ATMs has recently leveled off and now accounts for roughly two thirds of all ATMs operating in Canada (Chen et al., 2023). White-label ATMs are typically located in high-traffic locations (e.g., gas stations, convenience stores, and restaurants) and provide an alternative source of cash when FI branches or FI-owned ATMs are not readily accessible. Although there is little federal regulation of white-label ATMs in Canada, Quebec regulates them as money services businesses. We examine the implications of these regulations in Section 5.3.

The fact that a large majority of ATMs in Canada are independently owned and operated also justifies treating cash services as analytically distinct from broader retail banking services. White-label ATMs highlight the separability of cash revenues and costs from those of other banking services, because these ATMs' profitability is naturally modeled using only cash-related revenues and costs. Service provision trends in other countries also support the separability of cash services from other banking services. For example, many FIs in countries such as Sweden have eliminated teller cash services ("cashless branches") and now provide cash primarily through ATMs, which are often located outside branch premises and are accessible independent of branch hours. (Engert et al., 2019) In addition, the outsourcing of ATM and cash operations by major banks to third-party operators in countries such as France and the Netherlands further underscores the separability of cash operations from broader banking services.

3 Market Structure in Local Canadian Banking Markets

3.1 Bresnahan and Reiss Theoretical Framework

To assess competition and market structure in the provision of retail banking and cash services in localized rural Canadian markets, we employ the seminal empirical framework of Bresnahan and Reiss (1991). Bresnahan and Reiss propose a framework to study competition in local retail and service industries—including doctors, dentists, plumbers, and tire dealers—across 202 U.S. markets. In the highly stylized version, the framework relies on the following assumptions:

- no spatial competition so that there is no differentiation between competitors based on location within a market and location is not choice by which firm compete;
- homogeneous firms with the same cost structures[9];
- long-run equilibrium determining the number of firms in a market;
- complete information; and

[9]This assumption can be relaxed to allow for heterogeneous cost structures across firms.

- the absence of multi-store firms.[10]

Despite these strong assumptions, we adopt the BR approach because it offers a parsimonious and tractable way to assess market structure and competitive conditions in settings with many small, and often unobserved, potential entrants, such as the cash-services location market. We later discuss the robustness of our results in light of these assumptions.

Consider a market with demand $Q = d(Z, P)S(Y)$, where $d(Z, P)$ is the demand function of a representative consumer, $S(Y)$ denotes the number of consumers, Y and Z denote demographic variables affecting market demand, and P represents price. Profits for each of the N firms operating in a given market are given by:

$$\pi_N = V_N S - F_N \tag{1}$$

where V_N is per-customer variable profit, $S = S(Y)$ is market size (i.e., the number of customers), and F_N is fixed cost. Combining Equation 1 with market demand, the Nth firm to enter the market earns profit

$$\pi_N = [P_N - AVC(q_N, W) - b_N]d(Z, P_N)\frac{S}{N} - f_N - B_N \tag{2}$$

where $V_N \times N = [P_N - AVC(q_N, W) - b_N]d(Z, P_N)$, P_N represents the price after N firms have entered, $AVC(q_N, W)$ is average variable cost (a function of q_N, the quantity of products sold by each firm, and W, exogenous cost shifters). $F_n = f_N + B_N$, and the variables $b_N \geq 0$ and $B_N \geq 0$ capture the fact that later entrants may earn lower variable profits and face higher fixed costs. Note that if the number of consumers doubles, then market demand also doubles. Thus, if we move a consumer to a different-size market while holding Z and P fixed, the consumer behaves the same. This is a reasonable approximation for the demand for banking services.

The Bresnahan and Reiss (1991) framework allows us to estimate entry thresholds, denoted by S_N. We aim to predict how the number of firms, N, varies with market size, S. The entry threshold is the smallest market size necessary for N potential entrants. It is determined by the level of local market demand such that variable profits are just sufficient to cover fixed costs when N firms operate in the market. The theoretical starting point of the Bresnahan and Reiss (1991) model is that market i with characteristics X_i supports exactly N_i firms when profits satisfy:

$$\pi(N_i, X_i) > 0 \quad \text{and} \quad \pi(N_i + 1, X_i) < 0.$$

In other words, the N^{th} firm is the last firm to enter, while the $N^{th} + 1$ firm does not enter because profits would not be large enough to cover fixed costs. Thus, the long-run zero profit condition $\pi = 0$ implies $S_N = F_N/V_N$. Using Equation 2, this condition becomes:

$$S_N = \frac{F_N \times N}{[P_N - AVC(q_N, W) - b_N]d(Z, P_N)} \tag{3}$$

[10] See Section B.1 for an analysis of multi-branch firms in our sample of markets.

The value of S_N gives the threshold market size necessary to support N firms.

Next, we use the entry-threshold estimates to explore competitive conduct. The per-firm entry threshold is obtained by dividing the threshold for the Nth firm, S_N, by the number of firms, N. This value equals the ratio of fixed costs to equilibrium variable profit per customer:

$$s_N = \frac{S_N}{N} = \frac{F_N}{[P_N - AVC(q_N, W) - b_N]d(Z, P_N)} \tag{4}$$

The value of s_N (the population required to support each firm) increases as variable profits fall and fixed costs increase.

Changes in the per-firm entry threshold as N increases provide information about the competitiveness of rural banking in Canada. The ratio of two consecutive per-firm entry thresholds captures how variable profits (which typically fall) change relative to fixed costs (which typically rise) as additional firms enter. Following Bresnahan and Reiss (1991), we compute the $N + 1$ to N per-firm entry-threshold ratio:

$$\frac{s_{N+1}}{s_N} \tag{5}$$

This measure informs how competitive conduct changes with the number of firms. As stated by Bresnahan and Reiss (1991), a constant value of one indicates that the market is fully competitive or fully collusive[11] because additional entry does not change conduct. Bresnahan and Reiss (1991), Coccorese and Pellecchia (2022), and Feinberg and Reynolds (2010) explain that a per-firm entry-threshold ratio significantly greater than one indicates that the market becomes more competitive after the next firm enters: additional firms require a larger per-firm market size, implying lower variable-profit margins and thus stronger competitive conditions.[12] In contrast, a threshold ratio equal to one indicates that additional entry has no impact on the degree of competition in a market, such as under perfect competition or a cartel. A threshold ratio that converges to one as N increases suggests that the market is moving toward perfect competition with additional entry.

A second advantage of the Bresnahan and Reiss (1991) model is its relative ease of implementation. We rewrite and parameterize profits (Equations 1 and 2) as

$$\pi_N = S(Y, \lambda)V_N(X, \alpha, \beta) - F_N(H, \gamma) + \epsilon, \tag{6}$$

where

- S denotes market size, which is related to population Y via

$$S = \lambda Y$$

[11] Cetorelli (2002) find that in concentrated banking markets in the United States there is no evidence consistent with collusive behaviour even in markets with few firms. Instead, even duopolist markets in the sample are sufficiently competitive and competitiveness continues to increase as additional banks enter.

[12] Kesternich et al. (2020) show that in the standard homogeneous goods Cournot oligopoly model with constant marginal cost and downward sloping demand curve that the per-firm entry threshold ratio is non-monotonic in N by rising first then falling with the number of active firms.

- V_N denotes per-capita variable profit, which depends on $X = [W, Z]$ (variables that affect per-capita demand and variable costs). It also depends on the competitive effects captured by α_n, such that

$$V_N = \alpha_1 + \beta X - \sum_{n=2}^{N} \alpha_n$$

- F_N denotes fixed costs, which depend on local land costs H and may increase for later entrants through γ_n, such that

$$F_N = \gamma_1 + \gamma_H H + \sum_{n=2}^{N} \gamma_n$$

- $\epsilon \sim N(0, 1)$ is an unobserved profit shock, assumed to be the same for each firm[13]
- λ, α, β, and γ are parameters to be estimated

The information needed to estimate the Bresnahan and Reiss (1991) structural entry model includes demographic characteristics for each local market and firms' entry decisions.

There are several limitations to the Bresnahan and Reiss (1991) approach. First, markets are assumed to be in long-run equilibrium so that the zero-profit condition holds. Second, firms are assumed to be homogeneous, with identical products and costs.[14] These conditions are largely satisfied in the Canadian banking industry, allowing us to proceed with estimation.[15]

3.2 Estimation Model

The framework above implies the following profit specification for a market with N firms:

$$\pi_N = V_N S - F_N = \lambda Y \times \left(\alpha_1 + \beta X - \sum_{n=2}^{N} \alpha_n \right) - \left(\gamma_1 + \gamma_H H + \sum_{n=2}^{N} \gamma_n \right) + \epsilon, \quad (7)$$

In our context, a market is a census subdivision (CSD), or the equivalent of a municipal division in Canada. We model market size, $S(Y, \lambda)$, as a linear function of population variables:

$$S(Y, \lambda) = \mathbf{POP} + \lambda_1 \mathbf{NGR} + \lambda_2 \mathbf{PGR} + \lambda_3 \mathbf{COM}.$$

[13] See Bresnahan and Reiss (1991) for more discussion of the economic implications of this assumption.

[14] Mazzeo (2002) and Cohen and Mazzeo (2007) modify the Bresnahan and Reiss (1991) framework to allow for product differentiation.

[15] We acknowledge that different institution types, such as credit unions or publicly owned banks, may differ in their entry thresholds from traditional banks due to differences in long-term profit considerations, even if they offer similar products and face similar costs. Under the homogeneous-firm framework, such differences are reflected in the estimated equilibrium structure rather than modeled as distinct strategic decisions or entry costs.

We use the logarithm of CSD population for POP and normalize its coefficient to one because V_N includes a constant term. This normalization expresses market demand in log-population units, which we convert back to population units by exponentiating.[16] The remaining variables are: (i) the negative CSD population growth rate over the past five years (NGR); (ii) the positive CSD population growth rate over the past five years (PGR); and (iii) the share of workers who commute to a usual place of work outside their home CSD (COM). Allowing for separate positive and negative growth measures permits asymmetric effects of population changes on market size. Including COM helps avoid overstating market size when banking activity may occur outside the home CSD for commuters.

We assume that firms' per-capita variable profits are a linear function of N and the covariates X:

$$V_N = \alpha_1 + X\beta - \sum_{n=2}^{N} \alpha_n.$$

The variables $X = [W, Z]$ include:

- demographic variables affecting per-capita demand for in-person retail banking or cash services:
  - **ELD**: proportion of the population over 65
  - **KID**: proportion of the population aged 0–14
  - **IMM**: proportion of the population that are immigrants
  - **MORT**: percentage of owner households in non-farm, non-reserve private dwellings with a mortgage
  - **UE**: unemployment rate
  - **BC**: business count per capita
- variables affecting variable costs:
  - **MTI**: median total income in 2020 among income recipients aged 15 and over in private households

These covariates are motivated as follows. Elderly households may have higher demand for in-person services if they are less familiar with online or mobile banking, and they are more likely to use cash as a payment method than other age groups (Felt et al., 2025). Families with children may have greater financing needs given childcare expenses. Newly arrived immigrants may rely more on in-person services when opening accounts and may come from countries where cash payments are more prevalent. Mortgage lending often involves in-person consultation and review, similar to small-business lending that relies on soft information. Unemployed individuals

[16] In the original Bresnahan and Reiss (1991), units of market demand are translated to units of town population.

may have different needs for in-person services than employed workers. Finally, in the absence of hourly wage data, median total income serves as a proxy for the average annual earnings of workers at FI branches.

The coefficient α_n for $n = 2, 3, \ldots$ captures the difference between V_N and V_{N+1}, that is, the change in per-capita variable profits when an additional firm enters. We expect these coefficients to be positive, reflecting falling variable profits with additional entry. Imposing non-negativity on α_n for $N = 2, 3, \ldots$ ensures that additional entry weakly reduces profits under the assumption of *homogeneous* firms.

We assume that fixed costs depend on real estate values to capture the cost of buildings in a market. We use the median value of housing units in a CSD as our value for H to capture the variation between markets of building a branch:[17]

$$F_N = \gamma_1 + \gamma_H H + \sum_{n=2}^{N} \gamma_n$$

The coefficient γ_n for $n = 2, 3, \ldots$ captures the difference between F_N and F_{N-1}, and γ_H is the coefficient on the median value of housing units variable, H. As part of the BR framework assumptions, the γ_n terms for $N = 2, 3, \ldots$ are jointly non-negative. This implies that later entrants face fixed costs that are at least as high as those faced by earlier entrants.

Given the assumption that $\epsilon \sim N(0, 1)$, an ordered probit model is used to estimate equation 7 using maximum likelihood. We then compute population entry thresholds for different numbers of financial and cash services locations in a market.

4 Data and Sample Selection

4.1 Data Sources

We define markets using census subdivisions (CSDs), geographical areas corresponding to municipalities, Indian reserves, or unorganized territories. Statistics Canada's 2021 Census divides the country into 5,161 CSDs. For each CSD, we retrieve population and other demographic variables from the 2021 Census of Population using the University of Toronto's Canadian Census Analyzer (2024). Business-count information computed from the Business Register is available from Statistics Canada (2023a).[18] Some smaller CSDs have missing values due to privacy restrictions on certain variables, including median total income (MTI) and median

[17] Our use of local house prices is motivated by the need for a geographically detailed proxy for variation in real-estate costs. While an annual rental price index for commercial buildings would be more appropriate, we could not find such an index for Canada at the CSD level. We do understand that housing prices also impact the demand for financial services via products such as mortgages, as shown in Aguirregabiria et al. (2025), so we control for the percentage of households with mortgages as a potential variable profit shifter.

[18] See `https://open.canada.ca/data/en/dataset/3da6caba-d1b6-4053-bce5-5d153a44c602`.

value of dwellings (H). To address this, we replace missing CSD values with those from the corresponding census division (CD).[19]

The second key dataset consists of the locations of branches and ATMs. We obtain the geographic coordinates of all 5,696 FI branches, 2,607 non-bank financial institution branches (ATB and credit unions), and 60,264 ATMs in Canada in 2023 from the Bank of Canada. As noted above, we treat FI branches as retail banking-services locations, and both branches and ATMs as cash-services locations.

4.2 Market Selection and Entry Definition

CSD administrative boundaries do not necessarily coincide with market boundaries because they vary substantially in characteristics such as land area and population. We therefore impose restrictions to select well-defined markets: smaller areas that are unlikely to contain multiple neighbourhoods and that are sufficiently distant from other markets.

First, we compute population-weighted centroids for each CSD for use in subsequent distance calculations.[20] Population weights are based on smaller neighbourhood-level statistical units called dissemination areas (DAs).[21] We then drop CSDs classified as population centres (population greater than 100,000). Next, to reduce confounding from commuting, we retain only CSDs whose centroid is at least 30 kilometres from the centroid of any population-centre CSD and at least 10 kilometres from any other CSD centroid. We also exclude CSDs with land area greater than 300 square kilometres, since geographically large CSDs may contain multiple markets. Finally, we remove CSDs classified as Indian reserves, Indian settlements, or Indian government districts because key demographic variables are not available for many of these areas, and because they follow different legal frameworks that affect the ability of FIs to enter.[22]

After imposing these restrictions, 786[23] CSDs remain in our sample. Figure 1 shows the distribution of CSD populations and highlights the 786 selected CSDs.[24] Most CSDs are small: approximately 83% of CSDs in Canada have populations below 4,000.

[19] A CD is the next-highest geographical unit defined in the Census, and CD information naturally maps down to CSDs.

[20] Boundary shapefiles for 2021 CSDs and other geographical units are obtained from Statistics Canada (2022).

[21] DAs generally contain between 400 and 700 people.

[22] An example of the differences in legal frameworks would be Section 89 of the Indian Act, which does not allow for using on-reserve assets as collateral, making mortgage and other secured lending much more difficult, which would affect entry by FIs.

[23] The restrictions originally select 900 CSDs, but demographic variables used later in our model are available for 786 of the CSDs that pass the restrictions. Those excluded typically have populations under 50.

[24] Using the University of Toronto (2024) census analyzer, 63 of the 5,161 CSDs in Canada have population values that are unavailable or suppressed due to privacy regulations; these CSDs are excluded from Figure 1 and from our model.

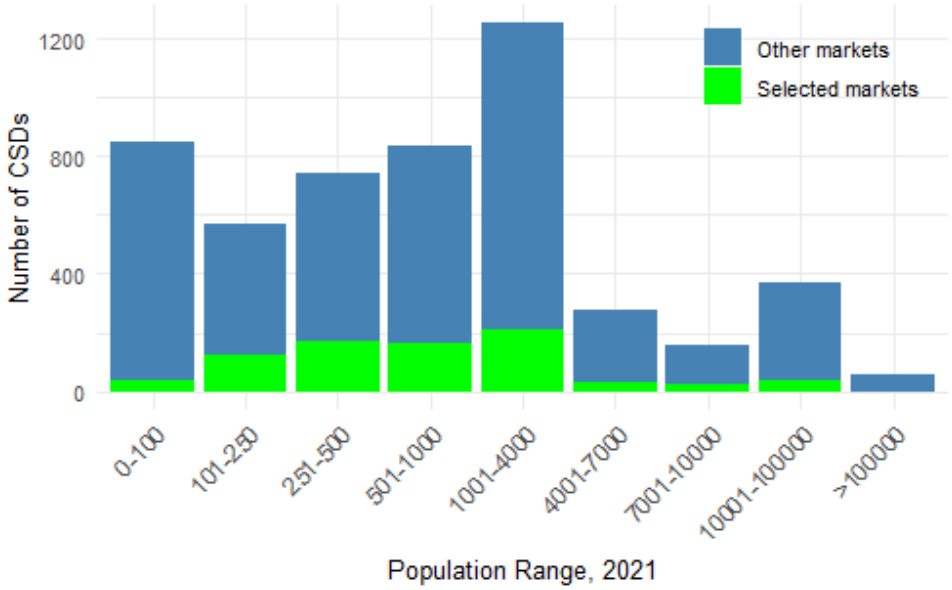

Figure 1: Distribution of CSDs by population range

We define the number of entrants in a market by counting the branches and ATMs located within a 10 km radius of the population-weighted centroid of a given CSD.[25] Entrants are treated as distinct if they are located at different addresses. Accordingly, the number of FI branches equals the number of retail banking-services establishments in a market. For cash services, we count all branches and ATMs located at the same address as a single cash-services location.

To illustrate our market-selection and entry-definition methodology, we present an example selected market: Smooth Rock Falls, Ontario. As shown in Figure 2, the CSD corresponding to this town has a land area of 200 km^2 and a population of 1,200. Thick black lines denote CSD boundaries, and dashed lines denote dissemination-area (DA) boundaries. The market is relatively isolated, with no neighbouring towns nearby. The blue point marks the DA population-weighted centroid of the CSD. Relative to the geometric centroid, the population-weighted centroid better aligns with the town's main residential and business areas. The blue circle indicates the market boundary (a 10 km radius around the population-weighted centroid).

Within this boundary, we identify one Royal Bank of Canada (RBC) branch, one Caisse Alliance branch, and four ATMs as of 2023. One ATM is located inside the RBC branch; therefore, this CSD has two retail banking-services locations and five cash-services locations, with RBC's branch and ATM counted together for cash services. In Figure 2, the two red points denote branch locations and the five green points denote cash-services locations.

[25]Cash-service locations likely serve a smaller geographic area. Appendix B.3 reports results for cash-service locations within a 5 km radius of the population-weighted centroid of a given CSD.

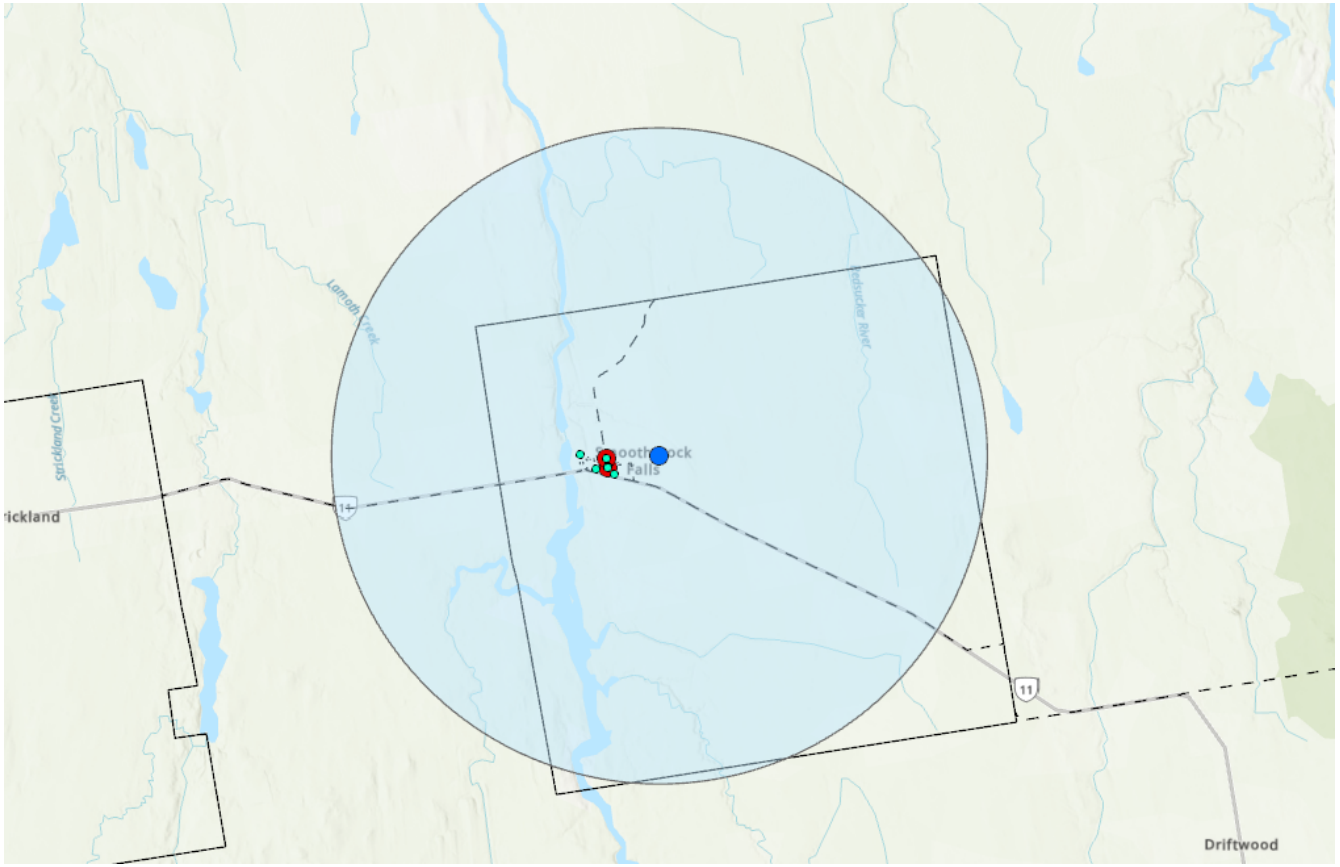

Figure 2: Market definition corresponding to Smooth Rock Falls, ON

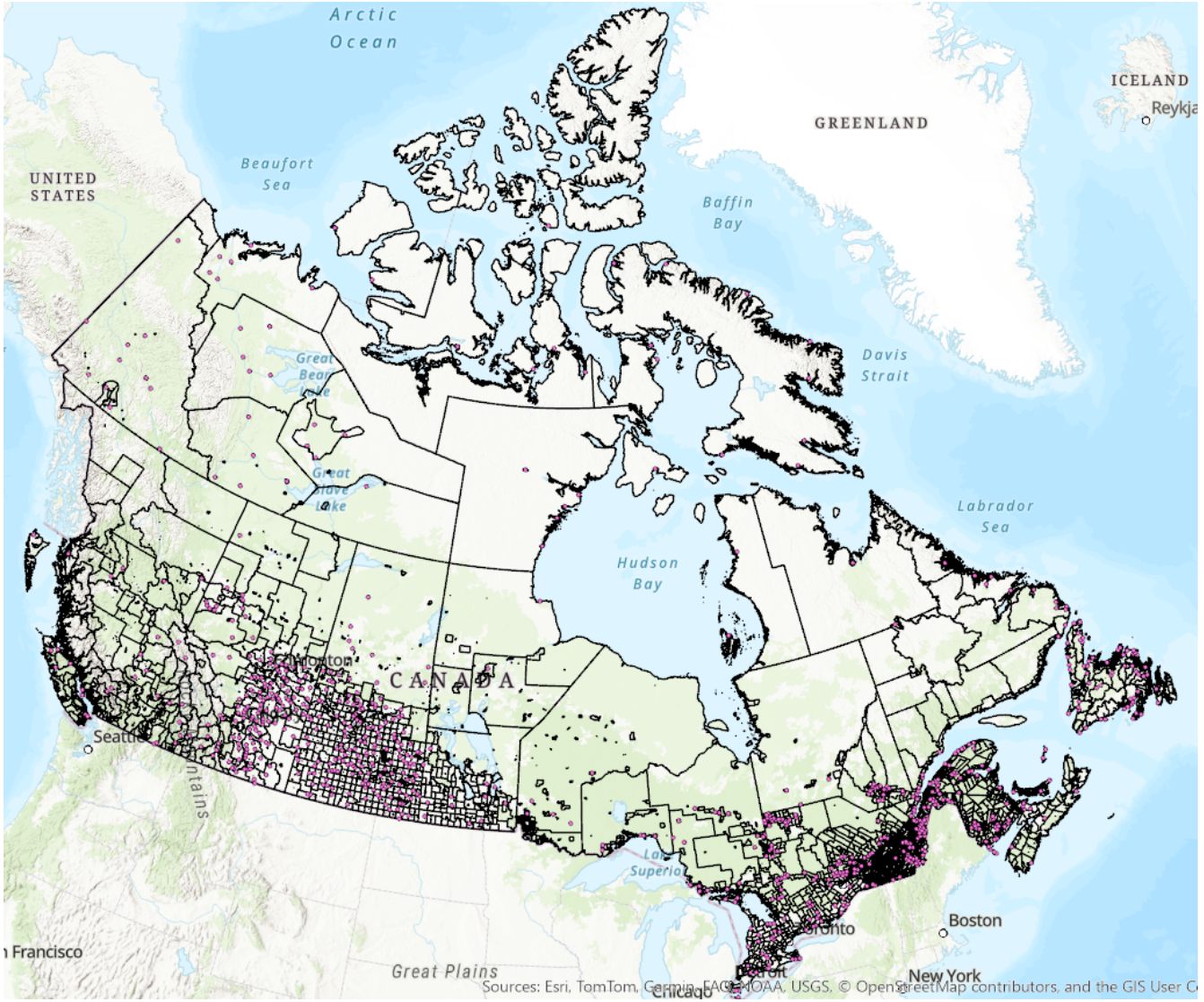

Figure 3: 786 selected markets across Canada

4.3 Summary Statistics

Nationally, Table 46 shows that our sample includes markets from each Canadian region. Figure 3 maps the 786 in-sample markets across Canada (shown in pink), with black lines indicating CSD boundaries. The map makes clear that CSDs vary substantially in size, underscoring the importance of defining market boundaries rather than relying on administrative CSD boundaries when counting cash- and retail banking-service locations. The figure and additional inset maps in Appendix D also show that the selected markets are small, located away from major urban centres, and geographically dispersed across the country.[26]

Table 1 reports the distribution of branches across the selected markets by province and institution type, showing that our sample includes both bank and credit-union locations throughout Canada. In Alberta, ATB has a substantial presence and accounts for the majority of branches in our sampled markets. This pattern reflects ATB's dominant regional role, which we examine further in Section 5.3.2.

Table 2 compares the number of white-label[27] and financial-institution-owned ATMs located within the selected markets across provinces and territories. In most regions, white-label ATMs account for the majority of ATMs; the exception is Quebec, where financial-institution-owned ATMs are more prevalent. Section 5.3.1 explores possible reasons for this pattern and examines its effects on cash services location threshold estimates in Quebec.

Table 1: FI Branch counts by type and province in 786 selected markets

	AB	BC	MB	NL	ON	QC	SK	NB	NS	PEI	Territories	Total
Bank	64	24	12	23	145	27	25	4	5	0	16	345
Credit Union	55	17	12	9	51	60	76	4	3	0	0	287
ATB	107	0	0	0	0	0	0	0	0	0	0	107

Table 2: ATM counts by ownership type and by province in 786 selected markets

	AB	BC	MB	NL	ON	QC	SK	NB	NS	PEI	Territories	Total
FI-owned	254	83	45	68	503	144	108	15	25	0	13	1258
White label	983	289	122	209	1002	140	336	42	39	1	175	3338

Table 3 defines and provides summary statistics for the variables used in the estimation model across the 786 selected CSDs.

[26] Additional detailed maps of our selected markets in Ontario, Quebec, and the Prairie provinces can be found in Appendix D.

[27] White-label ATMs are owned by third-party ATM firms, not by financial institutions.

Table 3: Summary statistics of model variables for the 786 selected CSDs

Description	Abbrev.	Mean	SD	Min	Max
Number of branches, 2023	.	0.97	1.62	0	12
Number of cash services locations, 2023 (10km radius)	.	5.49	11.54	0	151
Number of cash services locations, 2023 (5km radius)	.	4.60	10.30	0	140
Land area in square kilometres	.	80.55	93.03	0.26	300
Population, 2021	POP	2219.08	5497.35	50	64141
Negative population growth (%), 2016-2021	NGR	-3.47	5.90	-59	0
Positive population growth (%), 2016-2021	PGR	5.21	13.23	0	254
% of employed labour force aged 15+ with a usual place of work who commute outside home CSD	COM	56.59	30.78	0	100
% of population: 0-14 years	KID	16.05	6.29	0	41
% of population: 65 years and over	ELD	24.65	9.55	0	55
% of population: immigrants	IMM	4.85	5.95	0	40
% of owner households in non-farm, non-reserve private dwellings with a mortgage	MORT	44.70	18.73	0	100
Median total income in 2020 among income recipients aged 15 years and over in private households ($)	MTI	38325.70	6455.82	23400	86000
Count of businesses per capita in a given CSD in all industries	BC	0.22	0.25	0	2.53
Unemployment rate (%)	UE	11.25	8.96	0	57
Median value of dwellings (owner households in non-farm, non-reserve private dwellings) ($)	H	211769.97	137896.42	20000	1200000

5 Results

In this section, we begin with a descriptive analysis of access to cash and retail banking services by relating the number of location entries to population in our market sample. We then present baseline model estimates and entry-threshold results for both service types. Next, we extend the model to account for regional heterogeneity and quantify the effects of public banking, tighter regulation, and cultural factors on entry thresholds. Finally, we assess the plausibility of our estimates using alternative data sources.

5.1 Predicting Thresholds: A Descriptive Analysis

We begin with a descriptive analysis of cash and retail banking services entry in our selected markets. Figures 4 and 5 show, respectively, the share of the 786 selected markets with different numbers of branches and cash-services locations across population ranges. As expected, larger populations are associated with more branches and cash-services locations. Although

these histograms provide only a partial view—they rely solely on population and omit other determinants of demand and market size—they offer a useful benchmark for the plausible range of entry thresholds.

In Figure 4, the share of markets with one branch rises sharply for populations in the 100–750 range, suggesting that the entry threshold for the first branch likely falls within this interval. Similarly, the threshold for a second branch appears to lie in the 750–3,000 range. Figure 5 suggests that the entry threshold for the first cash-services location is around 100 residents. The figure also shows a discrete increase in the share of markets with 5–10 cash-services locations once population exceeds 1,000, suggesting that the first five thresholds may all be below 1,000. Because population is only one determinant of profits, we next estimate the baseline model described in Section 3.

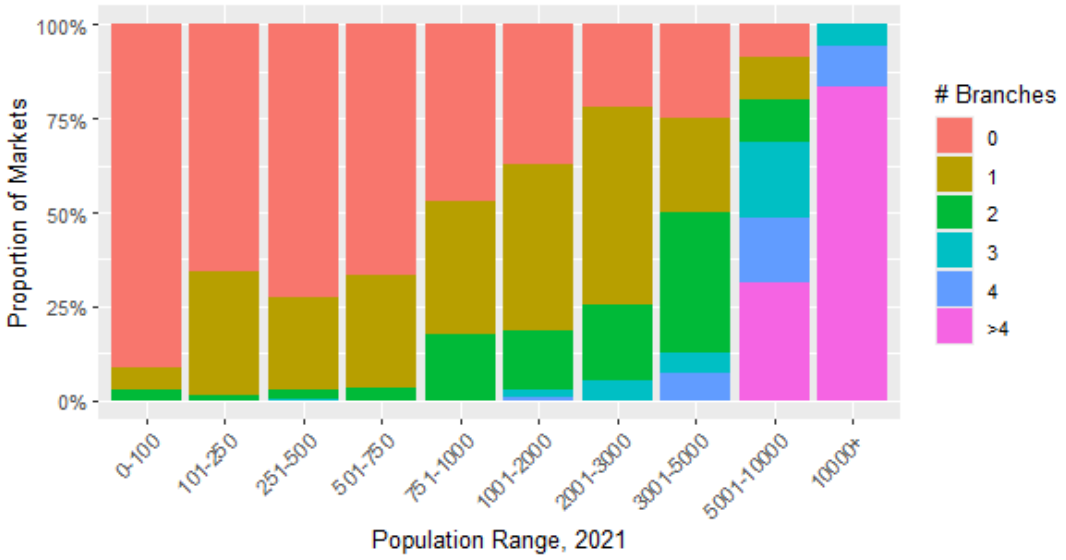

Figure 4: Fraction of markets by number of branches in 2023 and population range for 786 select markets

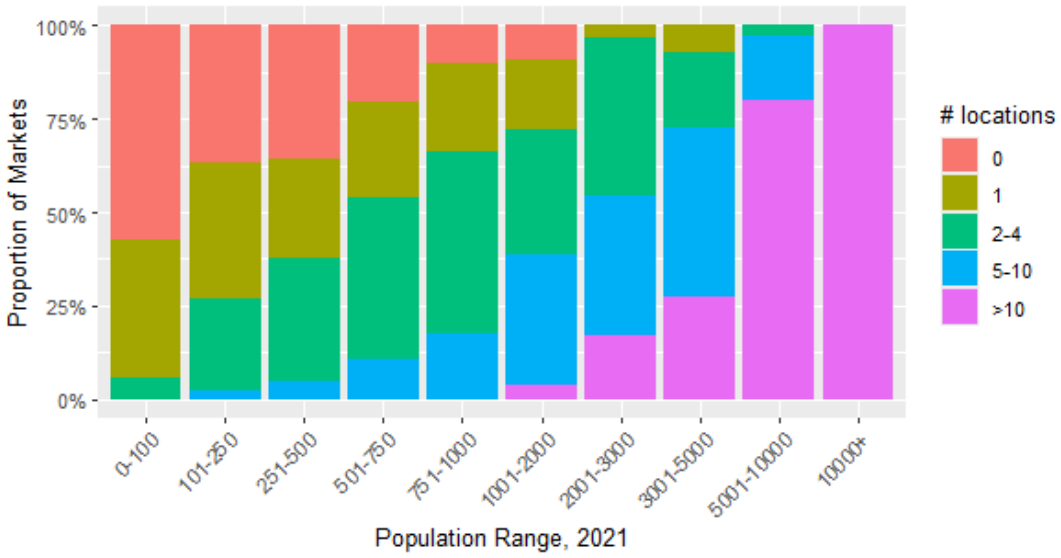

Figure 5: Fraction of markets by number of cash services locations in 2023 and population range for 786 select markets

5.2 Baseline Estimates

5.2.1 Retail Banking Services Locations

Table 4 reports maximum likelihood estimates from the ordered probit regression for FI branches in the 786 sampled markets. Most coefficients have the expected signs. All three market-size shifters—negative and positive population growth rates and the share of commuters—have negative effects on market size. Negative coefficients on **NGR** are consistent with expectations that population decline may persist. The negative effect of **PGR** likely reflects a lagged adjustment to population growth. A higher share of workers commuting to other markets reduces the demand for banking services within the CSD and, thus, effective market size.

Next, we turn to variable profits. The coefficients α_n for $n = 2, \ldots, 5$ are constrained to be non-negative.[28] The positive coefficient on the share of elderly residents (β_{eld}) indicates that expected bank profitability increases with a higher elderly share, consistent with older consumers valuing in-person banking relative to online alternatives. We also find that business counts per capita and median total income have the expected positive effects on per-capita variable profits, reflecting higher demand for banking services among businesses and higher-income households. The remaining variable-profit coefficients are statistically insignificant.

For fixed costs, a higher median value of dwellings (**H**) is associated with higher fixed costs, as expected. The coefficients γ_1 through γ_5 indicate that entry costs increase with the order of

[28] We also estimate the model without imposing these constraints, which yields negative coefficient estimates. Entry-threshold estimates are similar across the constrained and unconstrained specifications.

entry, consistent with the assumptions of the BR framework. Finally, the coefficients α_n for $n = 2, \ldots, 5$ are constrained to zero under the non-negativity restriction.

Table 4: Ordered Probit Regression Results: Number of Branches

Market Size		Variable Profits		Fixed Costs	
λ_{com}	-.007***	β_{eld}	.003**	γ_H	.217*
	(.002)		(.002)		(.122)
λ_{ngr}	-.018**	β_{mti}	.134**	γ_1	4.159***
	(.008)		(.058)		(1.363)
λ_{pgr}	-.010*	β_{kid}	.001	$\gamma_2 (F_2 - F_1)$	1.559***
	(.005)		(.002)		(.090)
		β_{imm}	.002	$\gamma_3 (F_3 - F_2)$	0.910***
			(.001)		(.096)
		β_{mort}	.0009	$\gamma_4 (F_4 - F_3)$	0.378***
			(.0007)		(.084)
		β_{bc}	.519***	$\gamma_5 (F_5 - F_4)$	0.375***
			(.047)		(0.094)
		β_{ue}	-.0007		
			(.001)		
		$\alpha_1 (V_1)$	-.563		
			(.644)		
		$\alpha_2 (V_1 - V_2)$	.		
		$\alpha_3 (V_2 - V_3)$	.		
		$\alpha_4 (V_3 - V_4)$	.		
		$\alpha_5 (V_4 - V_5)$	.		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

Table 5 reports the estimated demand entry thresholds for FI branches in the selected markets, along with their associated standard errors.[29] The first FI requires approximately 480 residents to enter a market with average demographic characteristics,[30] the second branch requires approximately 2,000 residents, and five branches require more than 9,000 residents.

[29]The Delta method is used to compute standard errors.

[30]All market-size shifters other than population are set to zero when computing entry thresholds. Thus, the reported thresholds correspond to markets with stable long-run population and no out-commuting.

Table 6 reports the corresponding per-firm entry-threshold ratios. For example, the ratio s_5/s_4 implies that, in a market with four branches, each firm serves about 12.5% fewer customers than each firm in a market with five branches.

For retail banking services, the per-firm entry-threshold ratio converges quickly to one after roughly the third branch enters a market: both s_4/s_3 and s_5/s_4 are not statistically different from one. This suggests that the financial services market is competitive once three or more branches are present. Because the coefficients α_n for $n = 2, \ldots, 5$ are constrained to be non-negative, the estimated entry thresholds in Table 5 and the corresponding ratios in Table 6 vary with the number of branches primarily through rising fixed costs as N increases. De Juan (2008) finds a similar result for Spanish banks and suggests that "instruments other than price, such as advertising, location choice and promotion," also drive banking competition.

Table 5: Entry thresholds: FI Branches

S_1	S_2	S_3	S_4	S_5
480	1982	4537	6401	9001
(60.82)	(211.73)	(573.36)	(889.52)	(1776.69)

Note: Standard errors are in parentheses.

Table 6: Per firm entry threshold ratios: FI Branches

s_2/s_1	s_3/s_2	s_4/s_3	s_5/s_4
2.064***	1.526***	1.058	1.125
(0.21)	(0.14)	(0.08)	(0.16)

Note: Standard errors are in parentheses. For the hypothesis test $s_{n+1}/s_n = 1$, the significance levels are * (0.1), ** (0.05), *** (0.01).

5.2.2 Cash Services Locations

Table 7 reports the maximum-likelihood estimates from the ordered probit model for cash service locations (ATMs and bank branches) in the selected markets.[31] Overall, the estimated coefficients in Table 7 align with those from the financial services model (Table 4) in both sign and statistical significance. This pattern is intuitive: demand for cash services is higher in markets with more elderly residents, wealthier households holding more assets, and businesses that require cash for transactions. The main difference concerns the property-value coefficient (γ_H), which is positive and statistically significant for FI branches but becomes statistically insignificant in the cash services specification. A plausible explanation is that standalone (white-label) ATMs are

[31] Appendix B.3 provides results for cash service locations within a 5km radius of the population-weighted centroid of a given CSD.

often placed inside consumer-facing businesses (e.g., restaurants, malls, or convenience stores) and therefore do not incur the same fixed building costs.

Table 7: Ordered Probit Estimates: Number of Cash Locations

Market Size		Variable Profits		Fixed Costs	
λ_{com}	-.013***	β_{eld}	.003*	γ_H	-.123
	(.002)		(.002)		(.104)
λ_{ngr}	-.014**	β_{mti}	.228***	$\gamma_1 (F_1)$	5.770***
	(.007)		(.057)		(1.225)
λ_{pgr}	-.009*	β_{kid}	-.00004	$\gamma_2 (F_2 - F_1)$	1.019***
	(.005)		(.002)		(.068)
		β_{imm}	.001	$\gamma_3 (F_3 - F_2)$	.578***
			(.001)		(.052)
		β_{mort}	.0007	$\gamma_4 (F_4 - F_3)$	.503***
			(.0006)		(.052)
		β_{bc}	.398***	$\gamma_5 (F_5 - F_4)$	.409***
			(.045)		(.052)
		β_{ue}	.001		
			(.001)		
		$\alpha_1 (V_1)$	-1.620***		
			(.638)		
		$\alpha_2 (V_1 - V_2)$	.		
		$\alpha_3 (V_2 - V_3)$	.		
		$\alpha_4 (V_3 - V_4)$	.		
		$\alpha_5 (V_4 - V_5)$	.		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

Next, we turn to entry thresholds and threshold ratios for cash access locations. As before, we impose the restriction that the coefficients α_n for $n = 2, \ldots, 5$ are non-negative, since they are negative in the unconstrained estimates. Imposing this non-negativity constraint has little effect on the estimated thresholds or ratios. For cash services, fixed costs continue to play the main role in determining these values.

Table 8 reports the entry thresholds and Table 9 reports the corresponding threshold ratios

for cash access locations. The estimated demand thresholds imply that substantially smaller populations are needed to support cash service locations than to support financial-services branches. In fact, the thresholds for the first through fifth cash location are each more than 80% lower than their financial-services counterparts. The first cash location requires roughly 76 residents in a market with average demographic characteristics, compared with 480 residents for the first FI branch, suggesting that the first cash location is almost certainly a standalone ATM. This low threshold is expected because standalone ATMs do not incur the fixed costs associated with an entire building and therefore face much lower fixed costs compared to branches. Demand for cash services generates fee revenue for ATMs, especially white-label ATMs,[32] and, as discussed below, these revenues do not need to be large for an ATM to break even given the much lower fixed cost. Comparing thresholds across the two location types also suggests that roughly three cash locations enter a market before the first FI branch: $S_1 = 480$ for branches versus $S_3 = 382$ for cash locations. Overall, these patterns point to demand for cash services that is distinct from demand for other banking services.

Table 9 reports the resulting per-firm entry-threshold ratios. As in the financial services model, the ratio declines from s_2/s_1 to s_3/s_2, falling from 1.4 to 1.2. After this initial drop, the ratio appears to stabilize around 1.2, which remains significantly greater than one. Although an additional location makes a market more competitive, this pattern suggests that the competitive market structure continues to evolve even after the entry of five cash service locations. One interpretation is that households exhibit relatively low price sensitivity to each additional spatially differentiated cash access point. This is intuitive given that households withdraw cash frequently, making travel (shoe-leather) costs a more important consideration for cash services than for broader financial services.

Table 8: Entry thresholds: Cash Locations

S_1	S_2	S_3	S_4	S_5
76	213	382	635	960
(14.84)	(32.18)	(50.16)	(76.05)	(139.05)

Note: Standard errors are in parentheses.

Table 9: Per firm entry threshold ratio: Cash Locations

s_2/s_1	s_3/s_2	s_4/s_3	s_5/s_4
1.400^{***}	1.196^{***}	1.247^{***}	1.210^{*}
(0.12)	(0.072)	(0.072)	(0.12)

Note: Standard errors are in parentheses. For the hypothesis test $s_{n+1}/s_n = 1$, the significance levels are * (0.1), ** (0.05), *** (0.01).

[32] White-label ATMs are ATMs that are not owned by FIs.

5.3 Regional Differences

Quebec and Alberta present distinct institutional environments that may affect the provision of banking and cash services. To relax the assumption of homogeneous potential entrants across regions, we modify equation 7 as follows:

$$\pi_N = \lambda Y \times (\alpha_1 + \beta X + \beta_D D - \sum_{n=2}^{N} \alpha_n - \sum_{n=2}^{N} \alpha_n^D) - (\gamma_1 + \gamma_D D + \gamma_H H + \sum_{n=2}^{N} \gamma_n + \sum_{n=2}^{N} \gamma_n^D) + \epsilon. \quad (8)$$

where D is a dummy variable indicating the province of interest. Relative to equation 7, equation 8 introduces three extensions: (i) D allows variable profits and fixed costs to differ in the province of interest; (ii) the interaction terms α_n^D allow the effect of additional competitors on variable profits to differ by province; and (iii) the interaction terms γ_n^D allow the effect of additional competitors on fixed costs to differ by province. We estimate the Quebec and Alberta specifications separately. The next subsection reports *entry thresholds* for Quebec, while Section 5.3.2 reports the corresponding results for Alberta. Appendix A presents the full set of regression estimates for the models including Quebec or Alberta controls.

5.3.1 Quebec

As shown in Table 2, Quebec is the only province in which a majority of ATMs in the selected markets are owned by financial institutions rather than operated by white-label providers. This pattern raises the question of why white-label ATMs are less prevalent in Quebec than in the rest of Canada.

One potential explanation is Quebec's distinct regulatory framework for non-bank ("white-label") ATMs under the Money-Services Businesses Act (*Loi sur les entreprises de services monétaires*), adopted in 2010 and enforced beginning in 2012. Enacted in response to concerns about money laundering and tax evasion, the legislation requires operators of ATMs not affiliated with chartered FIs to register with the Autorité des marchés financiers (AMF), the provincial financial regulator. White-label ATM operators must also disclose sources of funds and comply with ongoing licensing, reporting, and inspection requirements, and employees handling cash are subject to criminal background checks (Stikeman Elliott, 2010). The AMF may levy fines of up to $15,000 per unlicensed ATM, and enforcement actions in the late 2010s may have increased compliance with these rules (AMF, 2017).

In contrast, other provinces rely primarily on federal anti–money laundering oversight administered by FINTRAC (the Financial Transactions and Reports Analysis Centre of Canada), which focuses on financial institutions and does not impose a comparable licensing regime on independent ATM operators (House of Commons, 2018). Consequently, Quebec remains the only Canadian jurisdiction in which white-label ATM providers are directly supervised by a provincial financial regulator.[33] This more stringent compliance environment may have

[33] In the Canadian setting, there are major differences in the stringency of federal versus provincial regulations,

contributed to consolidation and the exit of smaller ATM operators following implementation, as suggested by industry observers (Bergeron, 2022). However, there is not yet quantitative evidence on this point, and it remains possible that FI-owned ATMs expanded to offset any reduction in white-label provision.

In this section, we test whether entry thresholds for cash service locations (including white-label ATMs) are higher in Quebec than in the rest of Canada. We begin with descriptive evidence for Quebec markets, mirroring the analysis in Section 5.1. Figure 6 shows the share of markets with different numbers of cash service locations for each population bin, while Figure 7 presents the analogous distribution for retail banking service locations. Relative to the corresponding national distributions (Figure 5 for cash services and Figure 4 for retail banking services), the implied population thresholds appear higher in Quebec. For instance, nearly 50% of CSDs in Canada with populations below 100 have at least one ATM, whereas the corresponding share in Quebec is 0%. This gap is much smaller for FI branch locations than for cash service locations.

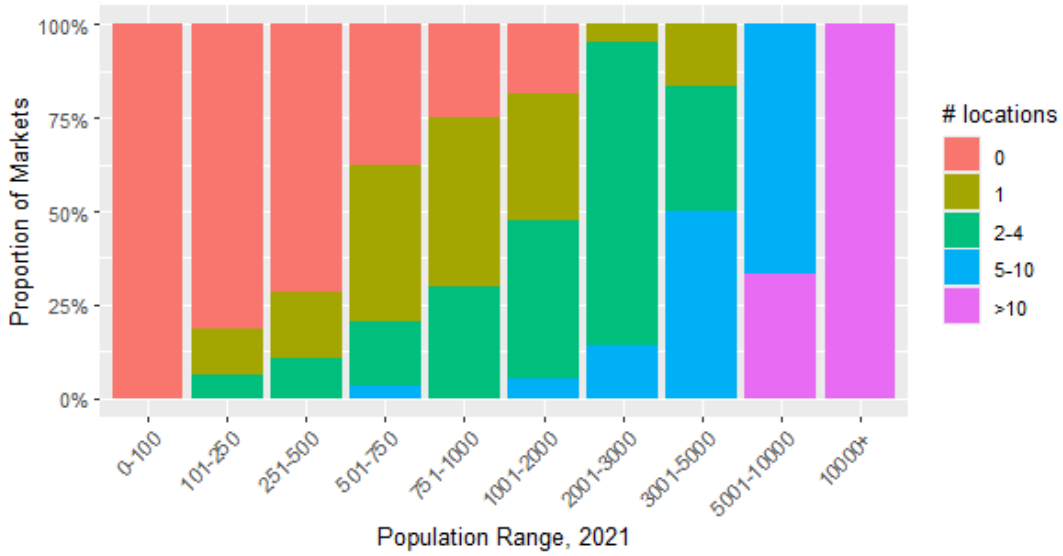

Figure 6: Fraction of markets by number of cash services locations in 2023 and population range for Quebec markets

which contrasts with the analysis by Agarwal et al. (2014) in the United States, where the text of the regulation is the same, with rotating federal or state enforcement agencies.

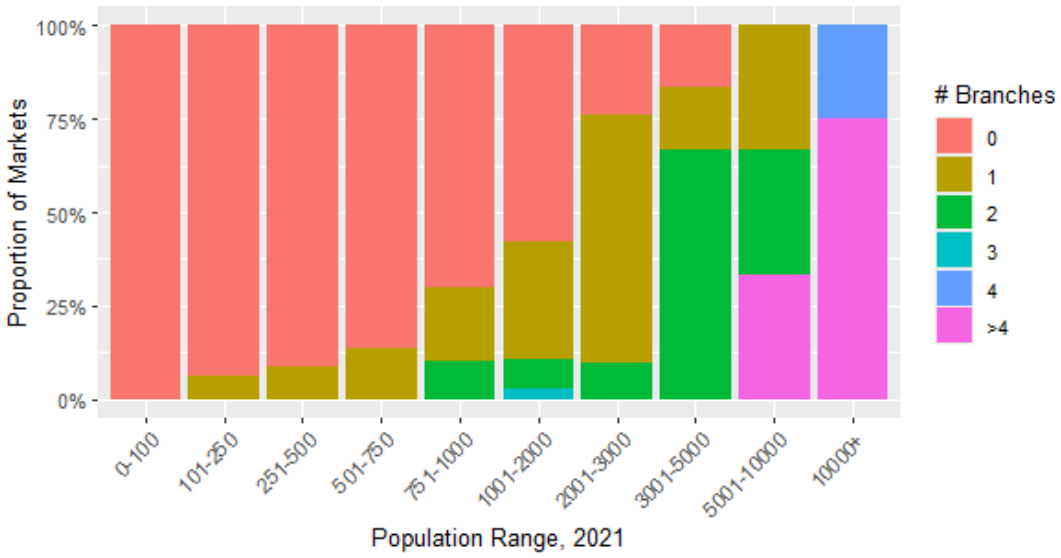

Figure 7: Fraction of markets by number of branches in 2023 and population range for Quebec markets

We next examine how Quebec's *Money Services Businesses Act* affects cash-services location entry thresholds using the estimation model in equation 8. Table 10 compares Quebec's entry thresholds (third row) with those for Canada as a whole (second row) and reports the test of equality, $H_0 : S_n^C = S_n^Q$ (fourth row). Across specifications, Quebec's thresholds are higher than Canada's, and the differences are statistically significant. This finding is consistent with higher entry and operating costs induced by the Act for white-label ATM operators. Because other provinces and territories do not require ATM operators to be licensed, excluding Quebec markets from the national model should reduce the estimated cash-services location thresholds, as the results indicate.

Table 10: Cash services location entry thresholds

	S_1	S_2	S_3	S_4	S_5
Canada - S_n^C	63	177	304	526	798
Quebec - S_n^Q	208	509	1014	1489	2324
$H_0 : S_n^C = S_n^Q$	5.14^{***}	5.15^{***}	4.58^{***}	3.68^{***}	3.13^{***}

Note: For the hypothesis test $S_n^C = S_n^Q$, the significance level is *** (0.01).

In addition, Table 11 reports the Canada–Quebec comparison of branch entry thresholds from the retail banking-services locations model in equation 8. Branch entry thresholds are also higher in Quebec than in Canada as a whole, although the proportional gap is smaller than for cash-services locations. Moreover, the Quebec–Canada difference is statistically significant only

for the first entry threshold ($H_0 : S_1^C = S_1^Q$). One possible explanation is Quebec's distinctive cultural and linguistic context as Canada's only majority French-speaking region. As shown in Perez-Saiz and Xiao (2022), English-origin financial institutions (FIs) face larger entry barriers in French-speaking local markets than in English-speaking ones. Because most large Canadian FIs are English-origin,[34] they may face higher entry costs in Quebec than elsewhere, raising the population threshold for branch entry in the province.[35]

Table 11: Branch entry thresholds

	S_1	S_2	S_3	S_4	S_5
Canada - S_n^C	425	1921	4378	6303	8968
Quebec - S_n^Q	730	2289	5963	7549	20479
$H_0 : S_n^C = S_n^Q$	3.24***	0.80	0.83	0.46	0.51

Note: For the hypothesis test $S_n^C = S_n^Q$, the significance level is *** (0.01).

5.3.2 Alberta

ATB Financial (formerly Alberta Treasury Branches) is a provincially owned financial institution that was established in 1938 and operates exclusively in Alberta. It is the largest financial institution headquartered in Western Canada, with more than $100 billion in assets under management.

Alberta is the only province with a government-owned bank (Hodgson, 2022), which gives ATB a governance structure and mandate that differ from those of Canada's major banks and credit unions. Anielski and Ascah (2018) note that, as a Crown corporation, ATB is not subject to the same corporate income tax regime as other Canadian banks; instead, its profits accrue to the Government of Alberta. As a result, ATB may face lower profitability incentives than private commercial banks or even credit unions, which could encourage greater risk-taking (given the implicit taxpayer backstop) or a stronger focus on public-policy objectives. One example is ATB's extensive rural branch network, which has been politically popular in isolated communities, but which might be reduced under a privatized, profit-maximizing model. Table 1 highlights ATB's importance in Alberta's banking sector—especially in rural areas: in 2023, ATB accounts for 25.52% (271/1062) of all Alberta branches and 47.35% (107/226) of branches in the isolated CSDs included in our sample.

Given the presence of a large public bank, we expect branch entry thresholds to be lower in Alberta's isolated markets. Figures 8 and 9 report the shares of Alberta markets with different

[34] Out of the 10 largest deposit-taking financial institutions in Canada, 7 are English-origin and 3 are French-origin (Desjardins, National Bank, Laurentian Bank).

[35] French-origin FIs face higher entry costs in English-speaking markets. However, there are fewer such institutions, and Desjardins cannot be a potential entrant in most provinces because it is a Quebec-regulated credit union, so the reverse effect is likely smaller.

numbers of retail banking-services and cash-services locations by population bin. Relative to the national patterns (Figures 4 and 5), FI branches appear at lower population thresholds in Alberta. For example, more than 25% of CSDs with fewer than 100 residents have an FI branch in Alberta, compared with about 10% of similarly sized CSDs in Canada overall. This Alberta–Canada gap in FI-branch presence persists across larger population categories. Cash-services locations also appear at lower population thresholds in Alberta, although the difference relative to Canada is smaller than for retail banking-services locations.

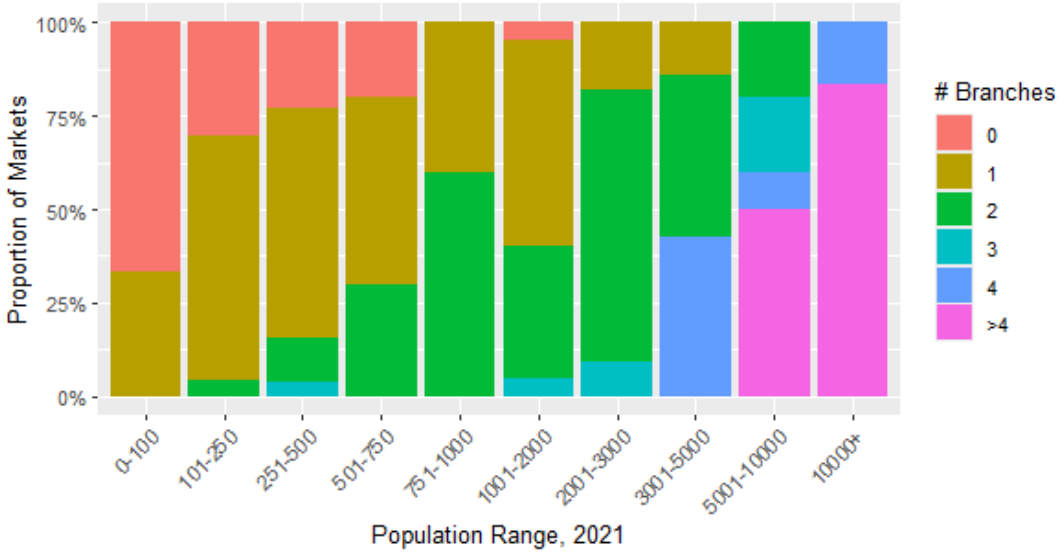

Figure 8: Fraction of markets by number of branches in 2023 and population range for Alberta markets

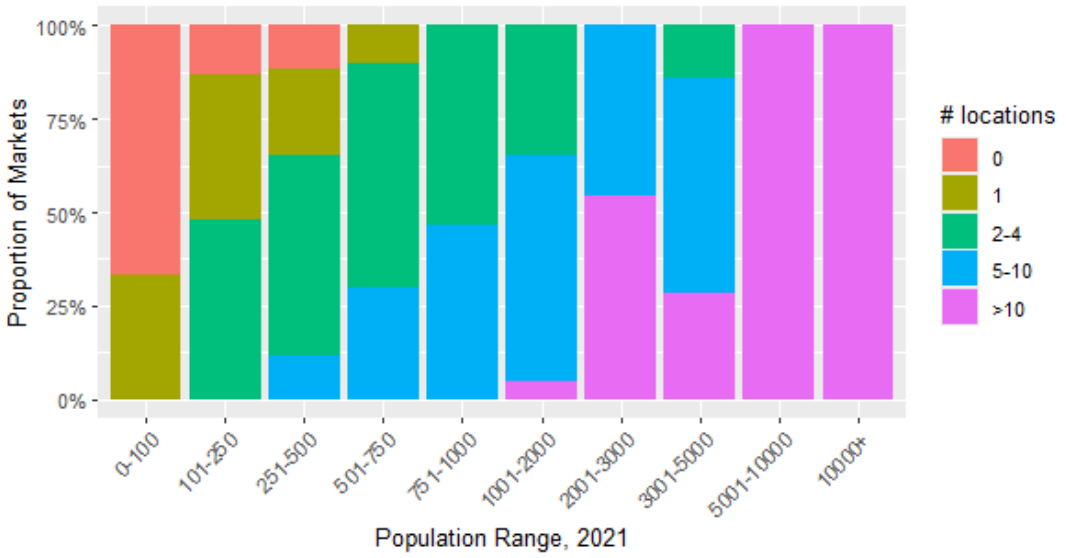

Figure 9: Fraction of markets by number of cash services locations in 2023 and population range for Alberta markets

We further assess ATB's effect on location thresholds by estimating equation 8 with Alberta dummy variables. Based on the resulting coefficient estimates, Table 12 compares estimated branch population thresholds in Alberta with those for Canada overall. The results indicate lower branch entry thresholds in Alberta markets. For the two smallest thresholds, the Alberta–Canada differences are statistically significant, and Alberta's threshold levels are about 40% of those in the rest of Canada. For the three largest thresholds, the differences are not statistically significant; Alberta's thresholds are approximately 80% $(3403/4199)$, 78% $(4672/5978)$, and 86% $(7051/8136)$ of the corresponding thresholds for the rest of Canada, respectively. Overall, these findings suggest that a public bank can increase access to retail banking services in small and isolated markets.

Table 12: Branch entry thresholds

	S_1	S_2	S_3	S_4	S_5
Canada - S_n^C	536	2245	4199	5978	8136
Alberta - S_n^A	202	998	3403	4673	7051
$H_0 : S_n^C = S_n^A$	6.36^{***}	4.91^{***}	1.12	1.18	0.60

Note: For the hypothesis test $S_n^C = S_n^A$, the significance level is *** (0.01).

Turning to cash-services locations, Table 13 shows that entry thresholds are lower in Alberta markets, with statistically significant differences for two locations and above. Notably, Alberta's estimated entry threshold for the first FI branch is 202 people, which is close to the entry threshold

for the second cash-services location in the province. This alignment suggests that the second cash-services entrant in Alberta is often the first FI branch. Because FI branch entry occurs at significantly lower population levels in Alberta than in the rest of Canada, this mechanism helps explain both (i) why the first cash-services threshold difference is not statistically significant and (ii) why differences become statistically significant for $n > 1$. Overall, this heterogeneity result suggests that public banks primarily affect FI branch entry, with spillovers to cash-services locations through branches' role as cash-access points.

Table 13: Cash services location entry thresholds

	S_1	S_2	S_3	S_4	S_5
Canada - S_n^C	88	247	452	731	1069
Alberta - S_n^A	72	170	258	448	693
$H_0 : S_n^C = S_n^A$	1.06	2.64***	4.02***	3.49***	2.73***

Note: For the hypothesis test $S_n^C = S_n^A$, the significance level is *** (0.01).

5.4 Robustness Checks

Appendix B reports a set of robustness checks that relax several strong assumptions in the baseline model. We first relax the homogeneous-entrants assumption in the BR framework, which may be violated when an institution opens a second branch in the same market (i.e., multi-store firms). In such cases, resource sharing could lower costs relative to entry by a new owner. This issue is unlikely to materially affect our baseline estimates: across all sampled markets, only 3% involve the same FI operating two or more branches, and this share falls to about 1% among markets with fewer than six total branches. Nonetheless, to gauge the impact of multi-branch institutions, Appendix B.1 re-estimates the retail banking-services locations model using the number of distinct FI competitors in a market rather than the number of FI branches. The main conclusions regarding entry-threshold ratios and competition are unchanged. Estimated thresholds for one to three locations are similar under both measures, whereas thresholds for four and five-or-more locations are larger when entry is measured by competitors rather than branches.

For cash-services locations, one concern is that branches without on-site ATMs may offer a somewhat different service than stand-alone ATMs. We therefore relax the assumption that branches and ATMs provide comparable cash access by re-estimating the cash-services model using only ATM locations (i.e., excluding branches without a co-located ATM). The resulting thresholds in Appendix B.2 are slightly higher than those in Table 8, especially for S_4 and S_5, which is expected because branches typically begin to enter at those population levels.

The next robustness check examines how sensitive our results are to the geographic size of the market definition. Recall that the baseline definition counts branches and ATMs within a

10 km radius of the population-weighted centroid of each CSD. Cash-access points may serve smaller areas than branches, while branches may draw customers from a broader region. In Appendix B.3, we re-estimate the cash-services model using a 5 km radius (instead of 10 km) for the selected markets. Appendix B.4 reports results using a 15 km radius for both FI branches and cash-services locations. The estimated entry thresholds and threshold ratios are very similar across these alternatives, indicating that the baseline radius choice is not a major driver of the results.

Two final robustness checks relax the non-negativity restrictions on α_n for $n = 2, 3, 4, 5$ and exclude the commuting variable from the set of market-size shifters. In Appendix B.5, the estimated α_n values for $n = 2, 3, 4, 5$ are always negative in both the branch and cash-locations models. For branches, this implies lower estimated entry thresholds for $n = 3, 4, 5+$, with only minor changes in the estimated entry-threshold ratios; consequently, the implied competitive pattern is essentially unchanged. For cash locations, estimated thresholds and threshold ratios are very similar whether or not the $\alpha_n \geq 0$ constraints are imposed. Finally, Appendix B.6 shows that removing the commuting variable increases the estimated entry thresholds for both branches and cash locations, validating its inclusion in the baseline model as a market-size shifter.

5.5 Discussion

In this section, we use alternative data sources to assess whether the estimated population entry thresholds—480 for the first retail banking-services location and 76 for the first cash-services location—are plausible. We argue that these magnitudes are reasonable because FI branches in small towns often serve as financing hubs for surrounding rural areas, while the only ATM in a small village is typically co-located within an existing business establishment and therefore entails low (or zero) fixed costs.

Unlike the United States, branch-level financial data are generally not available in Canada. As a proxy for branch-level loan portfolios in small-town FI branches, we therefore examine the financial statements of small credit unions that operate in only one or two rural markets in our sample. In particular, we focus on two credit unions that serve very small rural towns.

Rockglen-Killdeer Credit Union and Raymore Credit Union are two credit unions in the province of Saskatchewan. Rockglen-Killdeer CU operates a single branch in Rockglen, SK, while Raymore CU operates two branches in Raymore, SK and Dysart, SK. These communities are small—with 2021 Census populations of 399, 507, and 155, respectively. Based on their 2024 annual reports, consumer loans and mortgages account for only 16% of Rockglen-Killdeer CU's total loan portfolio and 27% of Raymore CU's. By contrast, agriculture lending represents 75% and 55% of their portfolios, respectively, with the remainder in commercial and other loans. Taken together, these figures suggest that a stand-alone branch can be viable in a community of only a few hundred residents because it functions as a financing hub for surrounding rural areas,

including local farms.

We next examine cash-services locations in our selected markets with fewer than 300 residents. Table 14 shows that under 5% of ATMs in these markets are owned by financial institutions. Instead, ATMs are typically installed in retail establishments—such as stores, gas stations, hotels, bars, and restaurants—under contractual arrangements between business owners and third-party independent ATM deployers (IADs). Because these communities generally do not support a bank or credit union branch, ATMs serve as households' primary source of obtaining cash.

Table 14: ATM location distribution for in-sample markets with fewer than 300 people

Location Type	Frequency	Percent
Bar or Tavern	27	18.12
Exhibition Center	1	0.67
Financial Institution	7	4.7
Gas Station	18	12.08
Hotel	17	11.41
Mobile ATM	3	2.01
Other	7	4.7
Restaurant	2	1.34
Retail Store	34	22.82
Sports Complex	1	0.67
Super Market	5	3.36
Unknown White-Label	27	18.12
Total	149	100

Because cash-services locations in small towns are almost exclusively white-label ATMs, we manually collected a sample of white-label ATM placement contracts and sales terms. These documents suggest that the establishment owner typically does not pay a fixed rental fee for hosting the machine. Instead, the owner often outsources cash handling and servicing to the IAD, which retains most (or all) of the surcharge revenue to cover operating and maintenance costs. The establishment benefits primarily through increased foot traffic from cash-withdrawal visits. As a result, the fixed cost of placing an ATM is likely negligible for the host business, consistent with the statistically insignificant fixed-cost term in our cash-services location estimates.

While we do not have access to individual ATM-level cost data, we can benchmark orders of magnitude using information on machine prices and surcharge revenue. A typical second-hand ATM machine may cost as little as $2,500,[36] implying annual depreciation costs of only a few hundred dollars. According to the Bank of Canada's MOP survey (Felt et al., 2025), the

[36]Example listing: `https://cashintime.ca/product/nh-1800se/`.

average cash-withdrawal frequency at ATMs has remained around two withdrawals per person per month for many years. With an average surcharge fee of approximately $3 per transaction, 80 people withdrawing twice per month would generate about $5,000 per year in surcharge revenue. Taken together, these back-of-the-envelope calculations suggest that this revenue could be sufficient to cover an IAD's variable operating and maintenance costs in a small community, particularly given the relatively low fixed costs (mostly equipment depreciation) and shared-service arrangements typical of white-label ATMs.

6 Conclusion

In this paper, we examine competitive conditions in isolated Canadian markets for retail banking and cash services. We use the Bresnahan and Reiss (1991) model to estimate the population entry thresholds required to support a given number of FI branches or cash-services locations, without requiring direct measures of firms' costs and revenues.

We find that a population of approximately 480 is sufficient to support a single FI branch in a market with average demographic characteristics, whereas roughly 9,000 residents are needed to support five or more branches. Cash-services locations require far smaller market sizes: about 76 residents are sufficient to support one location, and about 960 are sufficient to support five or more locations. The estimated per-firm entry-threshold ratios further indicate that a competitive situation starts to occur in local retail banking-services markets once three branches have entered, whereas competitive conditions for cash services continue to evolve even after five cash-services locations enter. This pattern is consistent with consumers being less price sensitive for slightly spatially differentiated cash-services locations. Moreover, white-label ATMs are relatively inexpensive to own and operate. Their low costs, together with spatial differentiation, allow them to serve consumers with lower price sensitivity because time and shoe-leather costs constitute a larger share of total costs for cash access. These time and shoe-leather costs are less salient for consumers when accessing retail banking services.

We also document meaningful regional variation in entry thresholds. Quebec exhibits higher thresholds for both branches and cash-services locations, consistent with higher entry and operating costs associated with its distinct cultural origin and more restrictive regulations. By contrast, Alberta exhibits lower branch entry thresholds, consistent with the presence of Canada's only government-owned financial institution.

In conclusion, our results contribute to the literature on structural models of banking in Canada by applying the Bresnahan and Reiss (1991) framework to estimate population thresholds and infer competitive conduct. The estimated entry thresholds can serve as an indicator of access to retail banking and cash services, helping policymakers identify under-served markets where demand could plausibly support a physical branch and to diagnose barriers to entry (e.g., unusually high fixed costs). Our findings may also help policymakers assess which communities are at risk of losing access to banking and/or cash services and inform targeted

policy interventions. From an external-validity perspective, the thresholds provide a benchmark for cross-country comparisons of access conditions in marginal communities. Ensuring access to financial services is particularly important because such services are a public good with positive externalities for households (Lindsay, 2009).

Our work could be extended in two ways. First, our model could be extended to include demand for financial services by farms. Indeed, there are almost 200,000 farms in Canada, 97% of which are family-owned. The average Canadian farm has over $1 million in liabilities in 2023, (Statistics Canada, 2023b) making them very important customers for banks and credit unions in rural Canada. Second, with a potentially changing payment landscape (Henry et al., 2023), entry thresholds can be computed in different years to see whether the minimum population needed to support a cash or retail banking services location is evolving over time.

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A Coefficients for Regional Models

A.1 Quebec

Table 15: Ordered Probit Estimates: Bank Branches - Quebec

Market Size		Variable Profits		Fixed Costs	
λ_{com}	-.006 (.002)***	β_{eld}	.004 (.002)**	γ_H	.271 (.126)**
λ_{ngr}	-.016 (.008)**	β_{mti}	.102 (.058)	γ^D	1.716 (1.140)
λ_{pgr}	-.010 (.005)**	β_{kid}	-.0002 (.002)	γ_1	3.236 (1.397)**
		β_{imm}	.0008 (.001)	γ_2	1.625 (.102)***
		β_{mort}	.001 (.0007)**	γ_3	.887 (.102)***
		β_{bc}	.469 (.049)***	γ_4	.392 (.090)***
		β_{ue}	-.002 (.001)	γ_5	.380 (.099)***
		β_D	.172 (.177)	γ_2^D	-.386 (1.681)
		α_1	-.232 (.653)	γ_3^D	.285 (.339)
		α_2	.	γ_4^D	-.104 (.294)
		α_3	.	γ_5^D	-18.83 (14.25)
		α_4	.		
		α_5	.		
		α_2^D	.024 (.241)		
		α_3^D	.		
		α_4^D	.		
		α_5^D	1.982 (1.500)		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

Table 16: Ordered Probit Estimates: Cash Locations - Quebec

Market Size		Variable Profits		Fixed Costs	
λ_{com}	-.012 (.002)***	β_{eld}	.003 (.002)**	γ_H	.049 (.107)
λ_{ngr}	-.008 (.007)	β_{mti}	.170 (.058)***	γ^D	2.128 (.707)***
λ_{pgr}	-.009 (.004)**	β_{kid}	-.002 (.002)	γ_1	3.807 (1.264)***
		β_{imm}	.003 (.002)*	γ_2	1.096 (.073)***
		β_{mort}	.002 (.0006)***	γ_3	.573 (.062)***
		β_{bc}	.300 (.046)***	γ_4	.583 (.065)***
		β_{ue}	-.001 (.001)	γ_5	.442 (.061)***
		β_D	.162 (.122)	γ_2^D	.
		α_1	-.920 (.641)	γ_3^D	.
		α_2	.	γ_4^D	-.128 (.135)
		α_3	.	γ_5^D	.085 (.174)
		α_4	.		
		α_5	.		
		α_2^D	.		
		α_3^D	.039 (.023)*		
		α_4^D	.		
		α_5^D	.		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

A.2 Alberta

Table 17: Ordered Probit Estimates: Bank Branches - Alberta

Market Size		Variable Profits		Fixed Costs	
λ_{com}	-.007 (.002)***	β_{eld}	.003 (.002)	γ_H	.188 (.121)
λ_{ngr}	-.015 (.007)**	β_{mti}	.131 (.058)**	γ^D	1.227 (.766)
λ_{pgr}	-.008 (.005)	β_{kid}	-.0003 (.002)	γ_1	4.332 (1.373)***
		β_{imm}	.0003 (.001)	γ_2	1.506 (.100)***
		β_{mort}	-.0001 (.0007)	γ_3	.658 (.100)***
		β_{bc}	.452 (.051)***	γ_4	.371 (.097)***
		β_{ue}	-.002 (.001)	γ_5	.324 (.102)***
		β_D	.425 (.131)***	γ_2^D	.854 (.279)***
		α_1	-.480 (.657)	γ_3^D	1.153 (.284)***
		α_2	.	γ_4^D	.097 (.218)
		α_3	.	γ_5^D	.283 (.263)
		α_4	.		
		α_5	.		
		α_2^D	.		
		α_3^D	.		
		α_4^D	.		
		α_5^D	.		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

Table 18: Ordered Probit Estimates: Cash Locations - Alberta

Market Size		Variable Profits		Fixed Costs	
λ_{com}	-.012 (.002)***	β_{eld}	.002 (.002)	γ_H	-.103 (.103)
λ_{ngr}	-.011 (.007)*	β_{mti}	.223 (.057)***	γ^D	2.005 (.855)**
λ_{pgr}	-.006 (.004)	β_{kid}	-.0007 (.002)	γ_1	5.564 (1.217)***
		β_{imm}	.0007 (.001)	γ_2	.998 (.070)***
		β_{mort}	.0002 (.0006)	γ_3	.585 (.056)***
		β_{bc}	.366 (.048)***	γ_4	.464 (.055)***
		β_{ue}	.001 (.001)	γ_5	.367 (.055)***
		β_D	.515 (.163)***	γ_2^D	.287 (.282)
		α_1	-1.536 (.631)**	γ_3^D	.027 (.171)
		α_2	.	γ_4^D	.355 (.180)**
		α_3	.	γ_5^D	.279 (.159)*
		α_4	.		
		α_5	.		
		α_2^D	.		
		α_3^D	.		
		α_4^D	.		
		α_5^D	.		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

B Robustness

B.1 Multibranches

Recall from Section 3 that the BR framework relies on the strong assumption of homogeneous firms. This assumption may be violated when a financial institution opens a second branch in the same market (i.e., multi-store firms), because resource sharing can reduce costs relative to entry by a new owner. In our selected markets, only 18.6% have two or more branches. Moreover, the share of markets in which the same FI operates at least two branches is approximately 3%, falling to about 1% when restricting attention to markets with fewer than six total branches.

To assess the impact of multi-branch institutions, we re-estimate the financial-services model using the number of distinct FI competitors in a CSD, rather than the number of FI branches. The overall message is unchanged in terms of entry-threshold ratios and inferred competitive conduct. Estimated thresholds for one to three locations are similar under both measures, whereas thresholds for four and five-or-more locations are larger when entry is measured by competitors rather than branches.

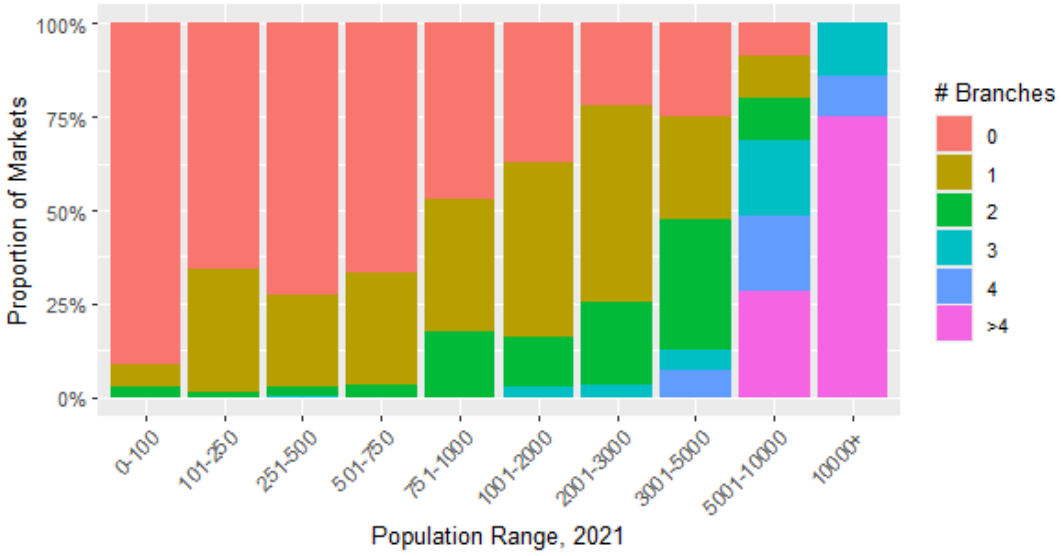

Figure 10: Fraction of markets by number of competitors in 2023 and population range for 786 select markets

Table 19: Ordered Probit Estimates: Number of Financial Institutions

Market Size		Variable Profits		Fixed Costs	
λ_{com}	-.007***	β_{eld}	.003**	γ_H	.241**
	(.002)		(.002)		(.122)
λ_{ngr}	-.018**	β_{mti}	.120**	$\gamma_1(F_1)$	3.867***
	(.008)		(.057)		(1.363)
λ_{pgr}	-.010*	β_{kid}	.0008	$\gamma_2(F_2 - F_1)$	1.601***
	(.005)		(.002)		(.091)
		β_{imm}	.002*	$\gamma_3(F_3 - F_2)$	.898***
			(.001)		(.097)
		β_{mort}	-.0009	$\gamma_4(F_4 - F_3)$	.462***
			(.0007)		(.094)
		β_{bc}	.525***	$\gamma_5(F_5 - F_4)$	.392***
			(.047)		(.098)
		β_{ue}	-.0008		
			(.001)		
		$\alpha_1(V_1)$	-.415		
			(.643)		
		$\alpha_2(V_1 - V_2)$	.		
		$\alpha_3(V_2 - V_3)$	.		
		$\alpha_4(V_3 - V_4)$	.		
		$\alpha_5(V_4 - V_5)$	.		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

Table 20: Entry thresholds: Number of Financial Institutions

S_1	S_2	S_3	S_4	S_5
476	2037	4604	7005	10005
(60.28)	(217.95)	(582.15)	(995.13)	(2021.15)

Note: Standard errors are in parentheses.

Table 21: Per firm entry threshold ratios: Number of Financial Institutions

s_2/s_1	s_3/s_2	s_4/s_3	s_5/s_4
2.140***	1.507***	1.141***	1.143
(0.23)	(0.14)	(0.10)	(0.13)

Note: Standard errors are in parentheses. For the hypothesis test $s_{n+1}/s_n = 1$, the significance levels are * (0.1), ** (0.05), *** (0.01).

B.2 ATM Locations Only

Table 22: Ordered Probit Estimates: ATM Locations

Market Size		Variable Profits		Fixed Costs	
λ_{com}	-.014 (.002)***	β_{eld}	.001 (.002)	γ_H	-.180 (.104)
λ_{ngr}	-.007 (.008)	β_{mti}	.209 (.058)***	$\gamma_1 (F_1)$	6.127 (1.232)***
λ_{pgr}	-.009 (.005)	β_{kid}	-.002 (.002)	$\gamma_2 (F_2 - F_1)$	1.105 (.068)***
		β_{imm}	.003 (.001)	$\gamma_3 (F_3 - F_2)$	.658 (.055)***
		β_{mort}	.0005 (.0006)	$\gamma_4 (F_4 - F_3)$	.429 (.051)***
		β_{bc}	.263 (.046)***	$\gamma_5 (F_5 - F_4)$	.350 (.052)***
		β_{ue}	.002 (.001)		
		$\alpha_1 (V_1)$	-1.620*** (.638)		
		$\alpha_2 (V_1 - V_2)$	.		
		$\alpha_3 (V_2 - V_3)$	.		
		$\alpha_4 (V_3 - V_4)$	.		
		$\alpha_5 (V_4 - V_5)$	.		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

Table 23: Entry thresholds: ATM Locations

S_1	S_2	S_3	S_4	S_5
80	270	559	899	1324
(17.11)	(42.64)	(75.23)	(114.04)	(215.13)

Note: Standard errors are in parentheses.

Table 24: Per firm entry threshold ratios: ATM Locations

s_2/s_1	s_3/s_2	s_4/s_3	s_5/s_4
1.698***	1.381***	1.206***	1.179
(0.17)	(0.10)	(0.08)	(0.13)

Note: Standard errors are in parentheses. For the hypothesis test $s_{n+1}/s_n = 1$, the significance levels are * (0.1), ** (0.05), *** (0.01).

B.3 Cash Services Locations within 5km

Cash-services locations may serve smaller markets in geographic terms. This section therefore reports results in which the number of cash locations in a CSD is defined as the number of bank branches and ATMs within a 5 km radius of the population-weighted centroid of the CSD.

Table 25: Ordered Probit Estimates: Cash Locations (5km markets)

Market Size		Variable Profits		Fixed Costs	
λ_{com}	-.019 (.003)***	β_{eld}	.002 (.002)	γ_H	.198 (.103)
λ_{ngr}	-.017 (.009)	β_{mti}	.146 (.058)*	$\gamma_1(F_1)$	1.224 (1.196)
λ_{pgr}	-.009 (.006)	β_{kid}	.002 (.002)	$\gamma_2(F_2 - F_1)$	.789 (.057)***
		β_{imm}	.003 (.001)	$\gamma_3(F_3 - F_2)$	.583 (.053)***
		β_{mort}	.001 (.001)*	$\gamma_4(F_4 - F_3)$	.441 (.050)***
		β_{bc}	.435 (.049)***	$\gamma_5(F_5 - F_4)$	.353 (.049)***
		β_{ue}	.001 (.001)		
		$\alpha_1(V_1)$	-.991 (.651)		
		$\alpha_2(V_1 - V_2)$	.		
		$\alpha_3(V_2 - V_3)$	.		
		$\alpha_4(V_3 - V_4)$	.		
		$\alpha_5(V_4 - V_5)$	.		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

Table 26: Entry thresholds: Cash Locations (5km markets)

S_1	S_2	S_3	S_4	S_5
82	216	439	751	1156
(18.42)	(38.44)	(66.52)	(103.75)	(204.57)

Note: Standard errors are in parentheses.

Table 27: Per firm entry threshold ratios: Cash Locations (5km markets)

s_2/s_1	s_3/s_2	s_4/s_3	s_5/s_4
1.308***	1.357***	1.284***	1.231
(0.12)	(0.10)	(0.09)	(0.15)

Note: Standard errors are in parentheses. For the hypothesis test $s_{n+1}/s_n = 1$, the significance levels are * (0.1), ** (0.05), *** (0.01).

B.4 Market Definition: Markets 15km away from Another Market (Instead of 10km)

When we increase the minimum distance between markets to 15 km, the sample size falls from 786 selected markets to 272. The results below correspond to this revised set of markets.

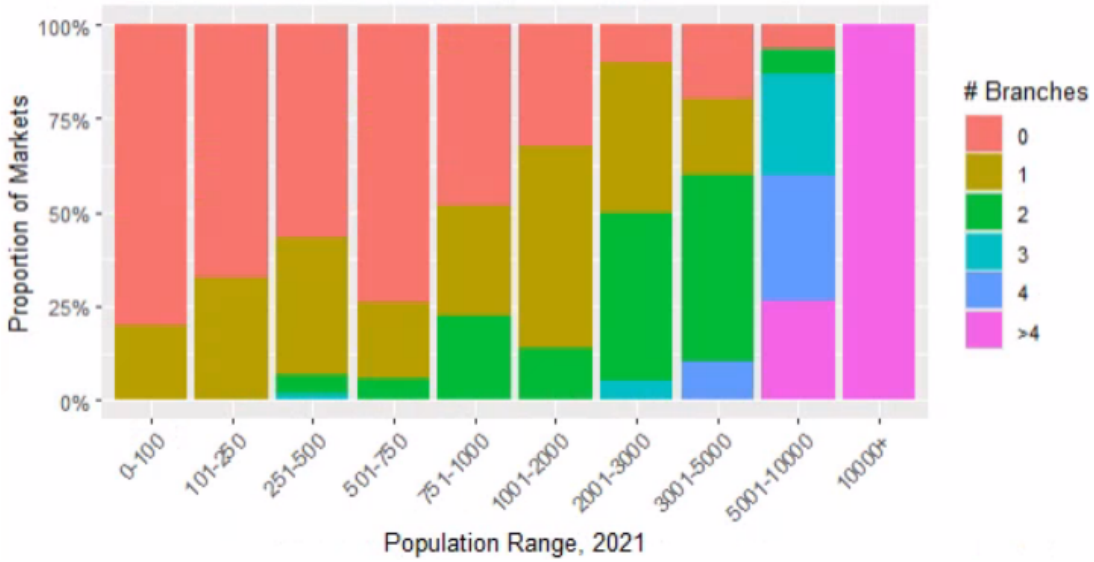

Figure 11: Fraction of markets by number of branches in 2023 and population range for 272 select markets, using 15km market definition

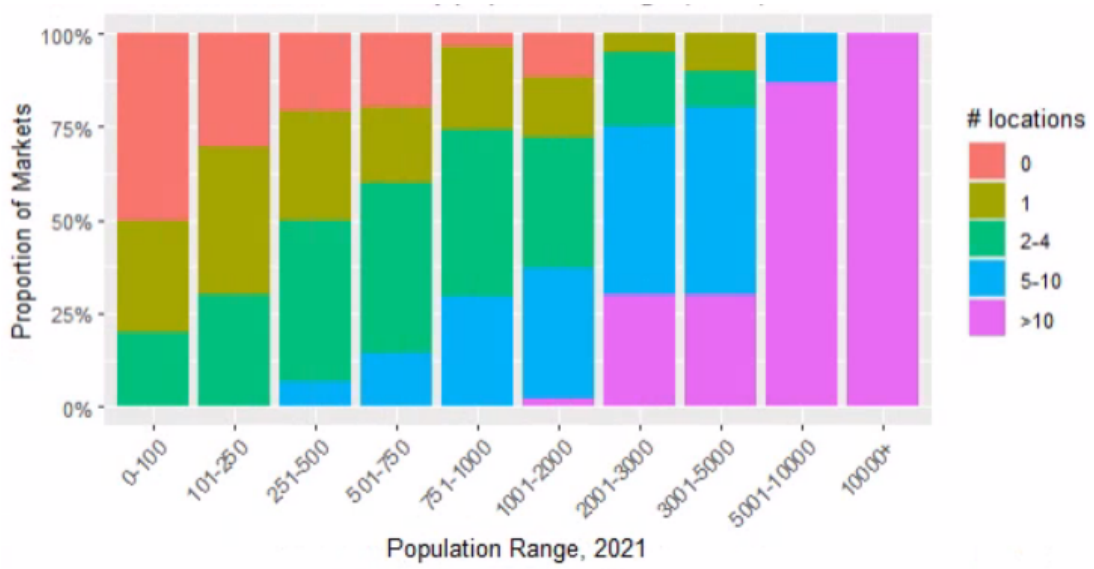

Figure 12: Fraction of markets by number of cash services locations in 2023 and population range for 272 select markets, using 15km market definition

Table 28: Ordered Probit Estimates: Bank Branches (15km)

Market Size		Variable Profits		Fixed Costs	
λ_{com}	.00001	β_{eld}	.0003	γ_H	.238
	(.002)		(.003)		(.204)
λ_{ngr}	-.017*	β_{mti}	.102	$\gamma_1 (F_1)$	6.466***
	(.010)		(.086)		(2.329)
λ_{pgr}	-.001	β_{kid}	-.004	$\gamma_2 (F_2 - F_1)$	1.776***
	(.006)		(.003)		(.168)
		β_{imm}	.002	$\gamma_3 (F_3 - F_2)$	1.250***
			(.002)		(.198)
		β_{mort}	.0003	$\gamma_4 (F_4 - F_3)$	.423***
			(.001)		(.162)
		β_{bc}	.605***	$\gamma_5 (F_5 - F_4)$	.510***
			(.077)		(.190)
		β_{ue}	-.002		
			(.002)		
		$\alpha_1 (V_1)$	-.296		
			(.975)		
		$\alpha_2 (V_1 - V_2)$	.		
		$\alpha_3 (V_2 - V_3)$	.		
		$\alpha_4 (V_3 - V_4)$	.		
		$\alpha_5 (V_4 - V_5)$	.		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

Table 29: Entry thresholds: Bank Branches (15km)

S_1	S_2	S_3	S_4	S_5
654	2239	5326	7143	10171
(95.25)	(307.38)	(929.78)	(1379.06)	(2839.91)

Note: Standard errors are in parentheses.

Table 30: Per firm entry threshold ratios: Bank Branches (15km)

s_2/s_1	s_3/s_2	s_4/s_3	s_5/s_4
1.712***	1.586***	1.006	1.139
(0.24)	(0.22)	(0.11)	(0.24)

Note: Standard errors are in parentheses. For the hypothesis test $s_{n+1}/s_n = 1$, the significance levels are * (0.1), ** (0.05), *** (0.01).

Table 31: Ordered Probit Estimates: Cash Locations (15km)

Market Size		Variable Profits		Fixed Costs	
λ_{com}	-.008***	β_{eld}	.003	γ_H	-.068
	(.003)		(.003)		(.171)
λ_{ngr}	-.009	β_{mti}	.212**	$\gamma_1(F_1)$	5.707***
	(.011)		(.085)		(2.116)
λ_{pgr}	-.021***	β_{kid}	-.002	$\gamma_2(F_2 - F_1)$	1.077***
	(.007)		(.003)		(.123)
		β_{imm}	.004	$\gamma_3(F_3 - F_2)$	.671***
			(.003)		(.098)
		β_{mort}	.001	$\gamma_4(F_4 - F_3)$	.617***
			(.001)		(.101)
		β_{bc}	.334***	$\gamma_5(F_5 - F_4)$	.414***
			(.071)		(.092)
		β_{ue}	.001		
			(.002)		
		$\alpha_1(V_1)$	-1.338		
			(.959)		
		$\alpha_2(V_1 - V_2)$	.		
		$\alpha_3(V_2 - V_3)$	.		
		$\alpha_4(V_3 - V_4)$	.		
		$\alpha_5(V_4 - V_5)$	.		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

Table 32: Entry thresholds: Cash Locations (15km)

S_1	S_2	S_3	S_4	S_5
88	237	439	774	1132
(23.41)	(47.28)	(76.35)	(126.53)	(241.46)

Note: Standard errors are in parentheses.

Table 33: Per firm entry threshold ratios: Cash Locations (15km)

s_2/s_1	s_3/s_2	s_4/s_3	s_5/s_4
1.344*	1.235*	1.322**	1.170
(0.18)	(0.12)	(0.13)	(0.18)

Note: Standard errors are in parentheses. For the hypothesis test $s_{n+1}/s_n = 1$, the significance levels are * (0.1), ** (0.05), *** (0.01).

B.5 No Restrictions for $\alpha_n \geq 0$

B.5.1 Bank Branches

Table 34: Ordered Probit Estimates: Bank Branches

Market Size		Variable Profits		Fixed Costs	
λ_{com}	-.007***	β_{eld}	.004**	γ_H	-.186
	(.002)		(.002)		(.120)
λ_{ngr}	-.015*	β_{mti}	.105*	$\gamma_1(F_1)$	3.074**
	(.008)		(.058)		(1.372)
λ_{pgr}	-.012**	β_{kid}	.003	$\gamma_2(F_2 - F_1)$	3.717***
	(.006)		(.002)		(.598)
		β_{imm}	.001	$\gamma_3(F_3 - F_2)$	4.612***
			(.001)		(1.118)
		β_{mort}	.001	$\gamma_4(F_4 - F_3)$	1.505
			(.0007)		(1.343)
		β_{bc}	.522***	$\gamma_5(F_5 - F_4)$	4.265*
			(.048)		(2.567)
		β_{ue}	-.0004		
			(.001)		
		$\alpha_1(V_1)$	-.543		
			(.644)		
		$\alpha_2(V_1 - V_2)$	-.331***		
			(.086)		
		$\alpha_3(V_2 - V_3)$	-.472***		
			(.142)		
		$\alpha_4(V_3 - V_4)$	-.113		
			(.159)		
		$\alpha_5(V_4 - V_5)$	-.414		
			(.283)		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

Table 35: Entry thresholds: Bank Branches

S_1	S_2	S_3	S_4	S_5
488	1980	3672	5071	7089
(63.98)	(216.07)	(374.85)	(533.74)	(812.15)

Note: Standard errors are in parentheses.

Table 36: Per firm entry threshold ratios: Bank Branches

s_2/s_1	s_3/s_2	s_4/s_3	s_5/s_4
2.028***	1.236**	1.036	1.118
(0.22)	(0.10)	(0.07)	(0.10)

Note: Standard errors are in parentheses. For the hypothesis test $s_{n+1}/s_n = 1$, the significance levels are * (0.1), ** (0.05), *** (0.01).

B.5.2 Cash Locations

Table 37: Ordered Probit Estimates: Cash Locations

Market Size		Variable Profits		Fixed Costs	
λ_{com}	-.013***	β_{eld}	.003*	γ_H	-.101
	(.002)		(.002)		(.104)
λ_{ngr}	-.013*	β_{mti}	.214***	$\gamma_1(F_1)$	4.979***
	(.007)		(.058)		(1.265)
λ_{pgr}	-.007	β_{kid}	.0002	$\gamma_2(F_2 - F_1)$	1.472***
	(.005)		(.002)		(.370)
		β_{imm}	.0012	$\gamma_3(F_3 - F_2)$	.610**
			(.002)		(.306)
		β_{mort}	.0007	$\gamma_4(F_4 - F_3)$	1.441***
			(.0006)		(.393)
		β_{bc}	.402***	$\gamma_5(F_5 - F_4)$	.322
			(.045)		(.365)
		β_{ue}	.002		
			(.001)		
		$\alpha_1(V_1)$	-1.586**		
			(.637)		
		$\alpha_2(V_1 - V_2)$	-.089		
			(.068)		
		$\alpha_3(V_2 - V_3)$	-.006		
			(.053)		
		$\alpha_4(V_3 - V_4)$	-.156**		
			(.063)		
		$\alpha_5(V_4 - V_5)$	.016		
			(.058)		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

Table 38: Entry thresholds: Cash Locations

S_1	S_2	S_3	S_4	S_5
72	221	401	629	921
(14.57)	(33.25)	(52.25)	(73.35)	(125.25)

Note: Standard errors are in parentheses.

Table 39: Per firm entry threshold ratios: Cash Locations

s_2/s_1	s_3/s_2	s_4/s_3	s_5/s_4
1.541***	1.208***	1.177***	1.172
(0.16)	(0.08)	(0.06)	(0.10)

Note: Standard errors are in parentheses. For the hypothesis test $s_{n+1}/s_n = 1$, the significance levels are * (0.1), ** (0.05), *** (0.01).

B.6 Models without Commuting Variable

B.6.1 Bank Branches and No Commuting Variable

Table 40: Ordered Probit Estimates: Bank Branches (COM removed)

Market Size		Variable Profits		Fixed Costs	
λ_{com}	.	β_{eld}	.003**	γ_H	.321***
			(.002)		(.120)
λ_{ngr}	-.018	β_{mti}	.148***	$\gamma_1(F_1)$	3.912***
	(.007)**		(.056)		(1.365)
λ_{pgr}	-.010	β_{kid}	.002	$\gamma_2(F_2 - F_1)$	1.514***
	(.005)**		(.002)		(.086)
		β_{imm}	.003	$\gamma_3(F_3 - F_2)$	.900***
			(.001)		(.096)
		β_{mort}	.0002	$\gamma_4(F_4 - F_3)$	.378***
			(.0006)		(.084)
		β_{bc}	.496***	$\gamma_5(F_5 - F_4)$	.377***
			(.044)		(.094)
		β_{ue}	-.0003		
			(.001)		
		$\alpha_1(V_1)$	-.619		
			(.616)		
		$\alpha_2(V_1 - V_2)$	.		
		$\alpha_3(V_2 - V_3)$	.		
		$\alpha_4(V_3 - V_4)$	.		
		$\alpha_5(V_4 - V_5)$	.		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

Table 41: Entry thresholds: Bank Branches (COM removed)

S_1	S_2	S_3	S_4	S_5
709	2536	5412	7437	10212
(43.96)	(212.06)	(613.05)	(943.94)	(1813.01)

Note: Standard errors are in parentheses.

Table 42: Per firm entry threshold ratios: Bank Branches (COM removed)

s_2/s_1	s_3/s_2	s_4/s_3	s_5/s_4
1.788***	1.422***	1.031	1.099
(0.15)	(0.12)	(0.07)	(0.14)

Note: Standard errors are in parentheses. For the hypothesis test $s_{n+1}/s_n = 1$, the significance levels are * (0.1), ** (0.05), *** (0.01).

B.6.2 Cash Locations and No Commuting Variable

Table 43: Ordered Probit Estimates: Cash Locations (COM removed)

Market Size		Variable Profits		Fixed Costs	
λ_{com}	.	β_{eld}	.002*	γ_H	-.013
			(.001)		(.103)
λ_{ngr}	-.017**	β_{mti}	.210***	$\gamma_1(F_1)$	6.031***
	(.007)		(.051)		(1.225)
λ_{pgr}	-.009**	β_{kid}	.002	$\gamma_2(F_2 - F_1)$	.967***
	(.004)		(.002)		(.065)
		β_{imm}	.004***	$\gamma_3(F_3 - F_2)$	.548***
			(.001)		(.050)
		β_{mort}	-.0005	$\gamma_4(F_4 - F_3)$	.478***
			(.0005)		(.050)
		β_{bc}	.347***	$\gamma_5(F_5 - F_4)$	.386***
			(.038)		(.049)
		β_{ue}	.002**		
			(.0009)		
		$\alpha_1(V_1)$	-1.293**		
			(.559)		
		$\alpha_2(V_1 - V_2)$	.		
		$\alpha_3(V_2 - V_3)$	.		
		$\alpha_4(V_3 - V_4)$	.		
		$\alpha_5(V_4 - V_5)$	.		

Note: Standard errors are in parentheses. Significance levels are denoted as follows: * (0.1), ** (0.05), *** (0.01).

Table 44: Entry thresholds: Cash Locations (COM removed)

S_1	S_2	S_3	S_4	S_5
203	487	799	1231	1746
(16.93)	(30.80)	(49.31)	(82.94)	(179.37)

Note: Standard errors are in parentheses.

Table 45: Per firm entry threshold ratios: Cash Locations (COM removed)

s_2/s_1	s_3/s_2	s_4/s_3	s_5/s_4
1.199***	1.094***	1.156***	1.134
(0.08)	(0.05)	(0.05)	(0.09)

Note: Standard errors are in parentheses. For the hypothesis test $s_{n+1}/s_n = 1$, the significance levels are * (0.1), ** (0.05), *** (0.01).

C Additional Tables

Table 46: Frequency and proportion of selected markets and all markets in Canada by province

	AB	BC	MB	NL	ON	QC
Selected	131	37	13	68	89	184
	16.67%	4.71%	1.65%	8.65%	11.32%	23.41%
Total	423	751	239	372	577	1282
	8.20%	14.55%	4.63%	7.21%	11.18%	24.84%

	SK	NB	NS	PEI	Territories	Total
Selected	165	34	6	3	56	**786**
	20.99%	4.33%	0.76%	0.38%	7.12%	
Total	951	266	95	98	107	**5161**
	18.43%	5.15%	1.84%	1.90%	2.07%	

D Additional Maps