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How Far Do Canadians Need to Travel to Access Cash?

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Abstract

This paper develops a travel-based metric to measure Canadians' access to cash from automated banking machines (ABMs) and financial institution branches. Our findings indicate that the average distance Canadians need to travel to reach the nearest ABM is 2.0 km, while the average distance to the nearest branch is 4.5 km. Moreover, more than 90% of Canadians live within 5 km of an ABM, and 84% live within 5 km of a branch. The total number of ABMs in Canada increased by 3.7% between 2019 and 2022, and our results show that, overall, access to cash remained stable in that period. However, the total number of branches decreased by 5.2%. The decline in branch coverage is concentrated in rural areas at 7.2%. This may increase the challenge of accessing cash in these regions. Rural Canadians already have less access to cash: they need to drive an average distance of 4.0 km to the nearest ABM and 9.6 km to the nearest branch, each distance twice the national average.

Topics: Financial services; Regional economic developments
JEL codes: G21, J15, R51

Résumé

Dans cette étude, nous élaborons une mesure fondée sur les déplacements afin d'évaluer l'accessibilité de l'argent comptant par l'accès de la population canadienne à des guichets automatiques bancaires (GAB) et à des succursales d'institutions financières. Nos résultats indiquent que la distance moyenne parcourue par les Canadiens pour atteindre le guichet le plus près est de 2 km; pour atteindre la succursale la plus près, elle est de 4,5 km. Par ailleurs, plus de 90 % de la population canadienne réside à moins de 5 km d'un guichet automatique et 84 %, à moins de 5 km d'une succursale. Selon nos résultats, l'accès à l'argent comptant est resté stable entre 2019 et 2022 dans son ensemble. Le nombre de GAB au Canada s'est accru de 3,7 % durant cette période. Cependant, le nombre de succursales a baissé de 5,2 %. Ce recul est plus marqué en zone rurale où on observe une diminution de 7,2 %. Cela pourrait nuire à l'accessibilité de l'argent comptant dans ces régions, compte tenu du fait qu'elle y est déjà plus limitée : en moyenne, il faut franchir 4 km pour accéder au guichet le plus près de son domicile et parcourir 9,6 km pour se rendre à la succursale la plus près. Ces distances sont deux fois plus grandes que la moyenne nationale.

Sujets : Services financiers; Évolution économique régionale
Codes JEL : G21; J15, R51

1. Introduction

Despite the increasing popularity of cashless payment methods, cash still plays a significant role in the Canadian economy. After declining significantly in the early part of the COVID-19 pandemic, cash usage in Canada started to rebound by 2022 (Chen et al. 2022). More than 20% of all purchases are still paid for with cash (Henry, Shimoda and Zhu 2022). On the merchant side, 97% of small and medium-sized businesses accept cash (Welte and Wu 2023). Naturally, obtaining cash is a prerequisite for individuals to transact in cash. Also, as per the *Bank of Canada Act*, one of the key mandates of the central bank is to ensure that bank notes are adequately distributed to Canadians (Engert and Huynh 2022). Therefore, this paper develops a travel-based metric to quantify Canadians' access to cash. Using this new metric, we generate disaggregated statistics on how far and how long a Canadian on average needs to travel from their dwelling to the nearest cash access point: either an automated banking machine (ABM) or a financial institution (FI) branch.[1] As well, we assess the potential risks that could arise if rural areas were to lose their cash access points.

Overall, we find that cash was accessible for most Canadians in 2022. Canadians on average needed to travel about 2.0 kilometres (km) to reach the nearest ABM and 4.5 km to reach the nearest branch. More than 90% of Canadian households lived within 5.0 km of an ABM, and 84% lived within 5 km of a branch. However, rural Canadians had to travel further: 4.0 km on average to reach the nearest ABM and 9.6 km to reach the nearest branch.

Looking at changes over time from 2019 to 2022, we find that cash access stayed stable. While the total number of ABMs in Canada increased by 3.7% between 2019 and 2022, the total number of FI branches decreased by 5.2%. This decrease in branch access was driven primarily by branch closures in rural areas, where the percentage of branches decreased by 7.2%. Travel metrics provide evidence for the decrease in rural cash access, with the mean travel distance to the nearest branch increasing from 9.0 km in 2019 to 9.6 km in 2022. Since many of these rural closures occurred in census subdivisions (CSDs) that lost their last branch, we perform a risk analysis where we assume that any CSD with only one ABM or branch loses its last ABM or branch. Results show that rural Canadians would suffer the largest negative impacts from losing their last branch: their travel distances would almost double from the current 9.6 km to the counterfactual 17.6 km. Such potential risk requires us to continue monitoring the evolving branch dynamics in rural areas.

In the next section, we discuss the data we use and our methodology for constructing the travel-based metric. Section 3 provides summary results for both driving distance and driving time, with results broken down by urban and rural areas. In section 4, we discuss the possible drivers of the different dynamics between ABMs and branches. We also explore our risk scenario to assess the potential impact on Canadians' access to cash when either the last

[1] We do not consider cashback locations in this paper.

ABM or the last branch leaves town. Conclusions and thoughts on future work are provided in section 5.

2. Data and methodology

We calculate our travel-based metric by measuring the driving distance and driving time between Canadians' home locations and the nearest ABM or FI branch. To identify the origin points for our analysis, we use the Pseudo-Household Demographic Distribution provided by Statistics Canada to proxy for Canadians' home locations. For the destination points, we use Mastercard ABM location data and branch location data we compiled and combined with existing data sources to determine the location of cash access points. Next, we utilize the HERE Routing API to identify the nearest cash access point and compute the smallest driving distance and associated driving time to that point.[2] Similarly, Myers (2021) uses the HERE Routing API to compute travel distances.

The Pseudo-Household Demographic Distribution is a geospatially representative distribution of the population within dissemination blocks along roads and other boundaries.[3] This distribution provides a more accurate home location than using the centroid of an area does. For our paper, we sample 1% of dwellings within each CSD as the origin points. For more details on our sampling and associated weighting, please refer to Appendix A.

As noted, we use two datasets to determine the locations of the two types of cash access points—ABMs and FI branches—that we use as destination points. The first dataset consists of ABM locations, drawn from the Mastercard ABM location data for the fourth quarter of 2019 and the fourth quarter of 2022. We enhance the Mastercard data by geocoding missing geographical coordinates and by adding missing ABMs. We also cross-validate the Mastercard data with information from the branch locator pages on the Canadian Credit Union Association and Desjardins websites. Details are provided in Appendix B. The second dataset concerns branch locations: the 2019 data were provided by the Financial Consumer Agency of Canada, and we update them to 2022 to account for openings and closures of branches from 2019 to 2022. Appendix C explains how we update the 2022 branch locations based on FI public accountability statements (PAS).[4]

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[2] The HERE Routing API is a routing service provided by HERE Technologies. We use the HERE API because it is cost-efficient for large-scale projects, has a flexible data storage policy and provides accurate routing results for both urban and rural areas.

[3] A dissemination block is the smallest geographic unit used by Statistics Canada to disseminate population and dwelling counts. Dissemination blocks cover the entire territory of Canada and have been used to calculate broadband internet service availability.

[4] Annual PAS are required for federally regulated FIs with over $1 billion in equity, and PAS list all branch and ABM openings and closures, including the branch addresses. The following banks with domestic retail branch locations published PAS between 2019 and 2022: Bank of Montreal, Canadian Imperial Bank of Commerce, Canadian Western Bank, Coast Capital Savings, HSBC, Laurentian Bank, National Bank of Canada, Royal Bank of Canada, Scotiabank and TD Bank.

To compute the nearest driving distance and associated driving time from each sampled home location, we implement the following procedure:

1. Determine the five nearest ABMs or FI branches by geodesic distance (as the crow flies).
2. Use the HERE Routing API to calculate the driving distance and driving time for each of the five destination points determined in step 1.[5, 6]
3. Take the shortest of the five driving distances to determine the nearest driving distance and associated driving time.

Compared with the density-based metric developed by Chen and Felt (2022), our travel-based metric provides a clear and easy-to-understand measure of access to cash in either travel distance or driving time.[7] In addition, our metric accounts for a realistic spatial distribution of Canadians' home locations and the actual spatial distribution of cash access points. As well, we extend the analysis to both ABMs and branches, whereas Chen and Felt (2022) examine only ABMs.

3. Results

Travel metrics

In this section, we present our analysis of cash accessibility using our travel-based metrics. The results, presented in tables 1 to 4, indicate that cash appears to be geographically accessible for most Canadians. The mean and median travel distances to an ABM in 2022 were 2.0 km and 0.7 km, respectively, and the mean and median travel distances to a branch were 4.5 km and 1.4 km, respectively. Similarly, the mean and median driving times to an ABM in 2022 were 3.1 minutes and 1.9 minutes, respectively, and the mean and median driving times to a branch were 6.3 minutes and 3.0 minutes, respectively. These metrics are stable between 2019 and 2022 for both ABM and branch access.

[5] Because the HERE Routing API does not directly identify the nearest ABM or branch for a given sampled individual, we need to determine the nearest ABM or branch based on steps 1 and 2. Note that one tuning parameter in the procedure is the number of nearest ABMs or branches by geodesic distance that we consider for calculating driving distances and times. We choose five in the main analysis to balance the trade-off between precision and computational burden. A larger number makes it more likely that the ABM or branch with the true nearest driving distance is included in the consideration set, but the larger number has higher computational and API query costs.

[6] Sometimes the HERE Routing API may adjust the input coordinates, resulting in discrepancies between the coordinates we provide and those automatically assigned by the HERE Routing API. In addition, the HERE Routing API may not find viable routes for all cases. Although both incidences are negligible (i.e., less than 0.1%), we apply additional manual adjustments to address them. The details are available upon request.

[7] Previous studies for Canada have also used a travel distance metric but were limited in scope, focusing on access to cash by First Nations reserves. See Chen et al. (2021, 2022).

Table 1: Travel distance in kilometres to the nearest ABM and branch—summary

	ABM		Branch	
	Mean	Median	Mean	Median
2019	2.1	0.7	4.3	1.4
2022	2.0	0.7	4.5	1.4

Table 2: Driving time in minutes to the nearest ABM and branch—summary

	ABM		Branch	
	Mean	Median	Mean	Median
2019	3.1	1.8	6.0	3.0
2022	3.1	1.9	6.3	3.0

The share of the Canadian population living within a certain threshold of travel distance and driving time to the nearest cash access point is presented in **Table 3** and **Table 4**. These metrics are also stable between 2019 and 2022, with most Canadians having to travel relatively short distances to a branch or ABM. Specifically, in 2022, 78% of Canadians had access to an ABM within 1.57 km, which is the threshold below which people tend to walk or use public transit for cash withdrawals (Chen, Strathearn and Voia 2021). Similarly, most Canadians, about 54%, had access to a branch within walking or public transit distance.[8] In addition, 91% of the population had access to an ABM within a 5 km driving distance, and 84% had access to a branch within a 5 km driving distance. Further, 95% of the population lived within a 10-minute drive of an ABM, and 89% lived within a 10-minute drive of a branch.

The results from **Table 3** can be compared with the physical accessibility standards set by the service charter established between the Government of Canada and Canada Post, which mandates that 98% of consumers will have a postal outlet within 15 km, 88% within 5 km, and 78% within 2.5 km (Canada Post 2022). Campbell, Beaudoin and Bader (2008) explore how Canada Post can maintain universal service amid technological, competitive and demographic changes.

Table 3: Travel distance to the nearest cash source—cumulative distribution

	ABM		Branch	
Share of population within	2019	2022	2019	2022
1 km	0.64	0.63	0.34	0.33
1.57 km (transit/ walk threshold)	0.78	0.78	0.55	0.54
2.5 km	0.85	0.85	0.71	0.70
5 km	0.91	0.91	0.84	0.84
10 km	0.96	0.96	0.91	0.91
15 km	0.98	0.98	0.95	0.95
20 km	0.99	0.99	0.97	0.97
> 20 km	1	1	1	1

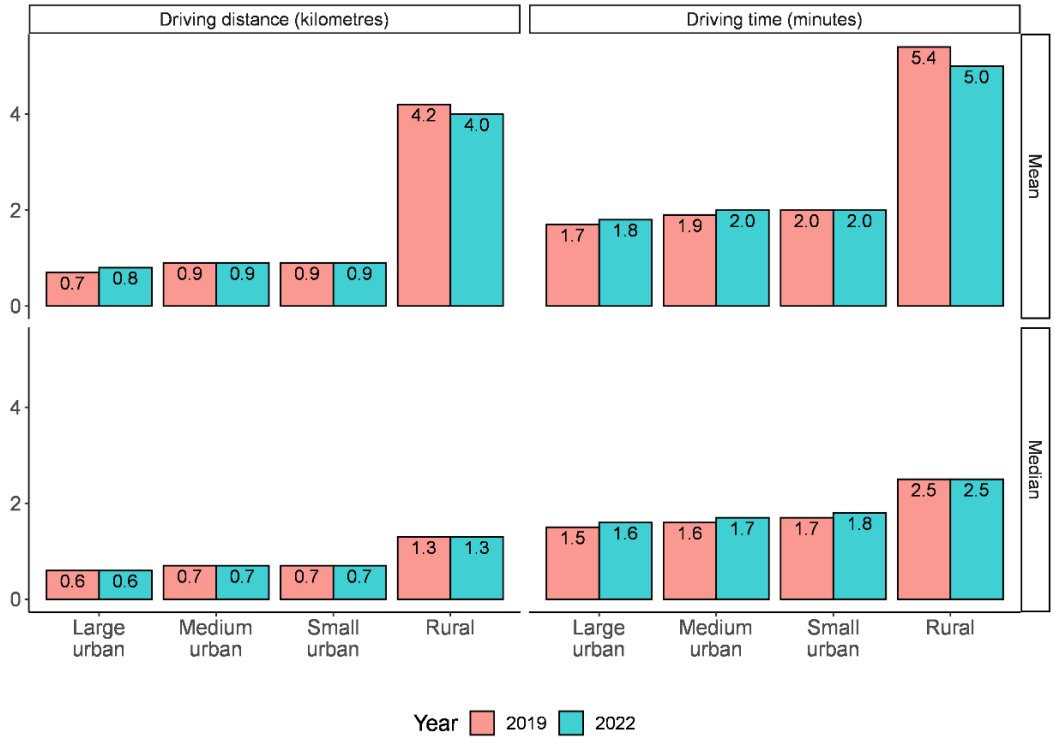
[8] Note that this threshold is computed using driving distance. The actual walking or transit distance between home and an ABM or branch might be slightly different.

Table 4: Driving time to the nearest cash source—cumulative distribution

	ABM		Branch	
Share of population within	2019	2022	2019	2022
5 minutes	0.88	0.88	0.75	0.75
10 minutes	0.95	0.95	0.90	0.89
20 minutes	0.99	0.99	0.97	0.97
> 20 minutes	1	1	1	1

We then break down the travel-based metrics into urban and rural CSDs, shown in **Chart 1** and **Chart 2**.[9] Clearly rural areas have less access to cash than urban areas do. The average travel distance to the nearest ABM for an urban resident is less than 1.0 km (**Chart 1**), while to the nearest branch it is within 2.0 km (**Chart 2**). In rural areas, the corresponding average travel distances are 4.0 km to the nearest ABM and 9.6 km to the nearest branch.

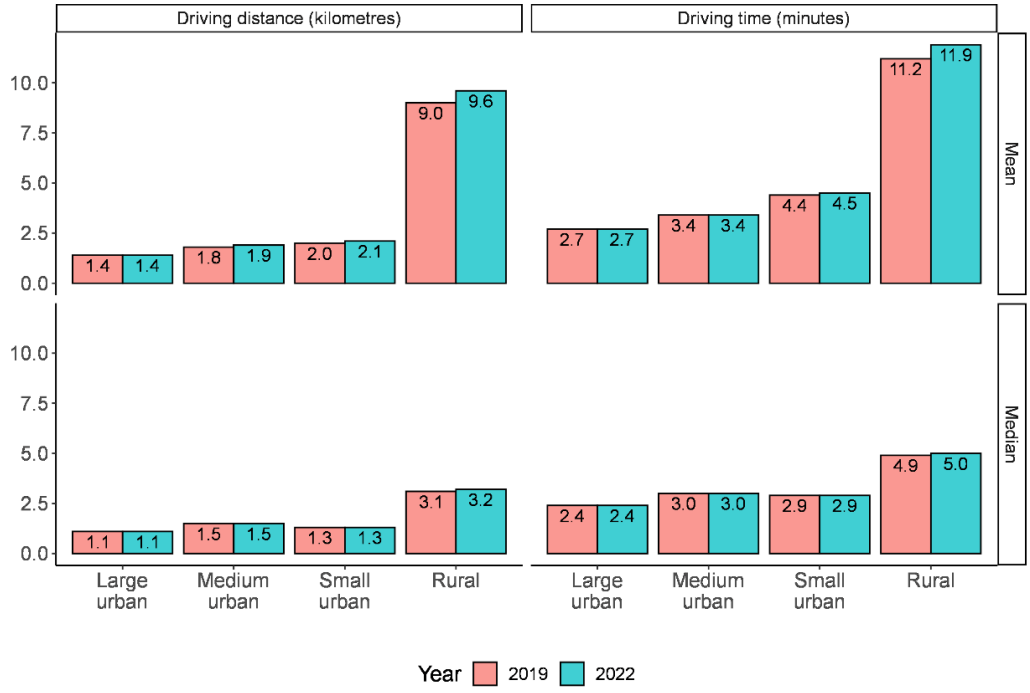
Chart 1: Mean and median driving distance and time to the nearest automated banking machine, by census subdivision type



[9] We classify CSD locations into urban and rural following Statistics Canada. In this regard, an urban centre has a population of at least 1,000 people and a population density of 400 people or more per square kilometre, based on the Census. All areas outside of such population centres are classified as rural. Taken together, urban and rural areas cover all of Canada. Urban centres are further classified into three groups, according to their populations: small population centres with a population of between 1,000 and 29,999; medium-sized population centres with a population of between 30,000 and 99,999; and large urban population centres with a population of 100,000 or more. In 2021, Canada had a total of 42 large urban CSDs, 52 medium-sized urban CSDs, 267 small urban CSDs and 4,801 rural CSDs.

Chart 1 and **Chart 2** also show that ABM access is stable in both urban and rural areas over time, with little difference in mean and median travel time and distance between 2019 and 2022 for these geographies. Branches in rural areas, however, became slightly less accessible over this period. That is, the mean driving distance to a branch for rural households increased from 9.0 km to 9.6 km between 2019 and 2022, and the median driving distance increased from 3.1 km to 3.2 km in 2022.

Chart 2: Mean and median driving distance and time to the nearest financial institution branch, by census subdivision type



In summary, while cash access has been stable for most of the population, individuals in rural areas have experienced a small decline in access to branches since 2019 as measured by distance and travel time to branches. Next, we look more closely at the opening and closing of ABMs and branches across Canada to gain more insight into these developments.

Chart 3 shows that the total number of ABMs in Canada increased from 2019 to 2022, specifically by 3.7%, with 69.2% of the increase accounted for by white-label (WL) ABMs.[10] in contrast, the total number of FI branches decreased by 5.2% in the same period.

[10] White-label ABMs are ABMs not affiliated with any FI brand.

Chart 3: Number of automated banking machines and financial institution branches in Canada before and after the start of the COVID-19 pandemic, by type

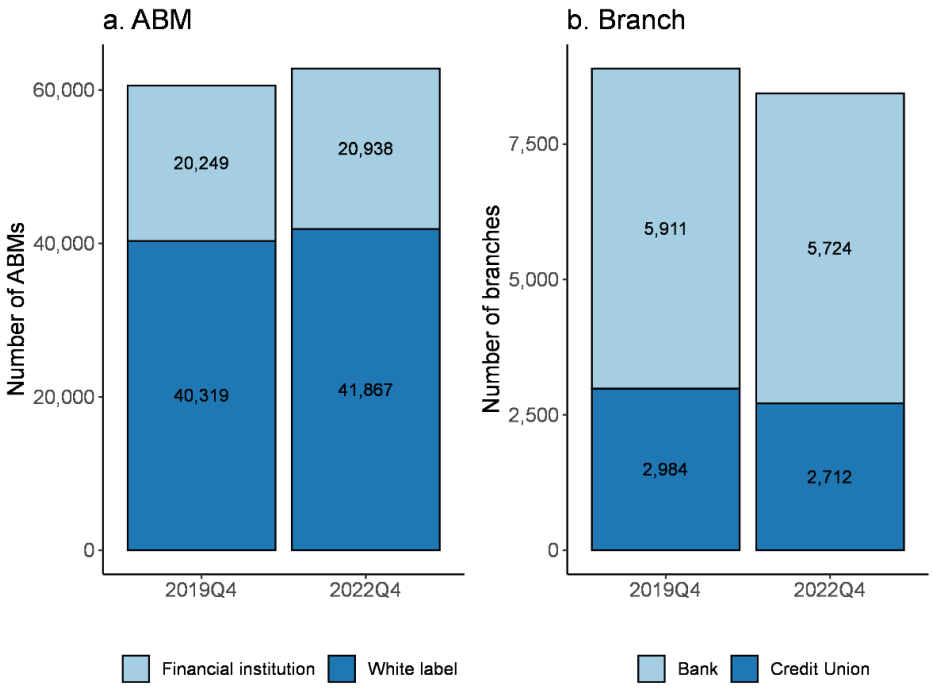
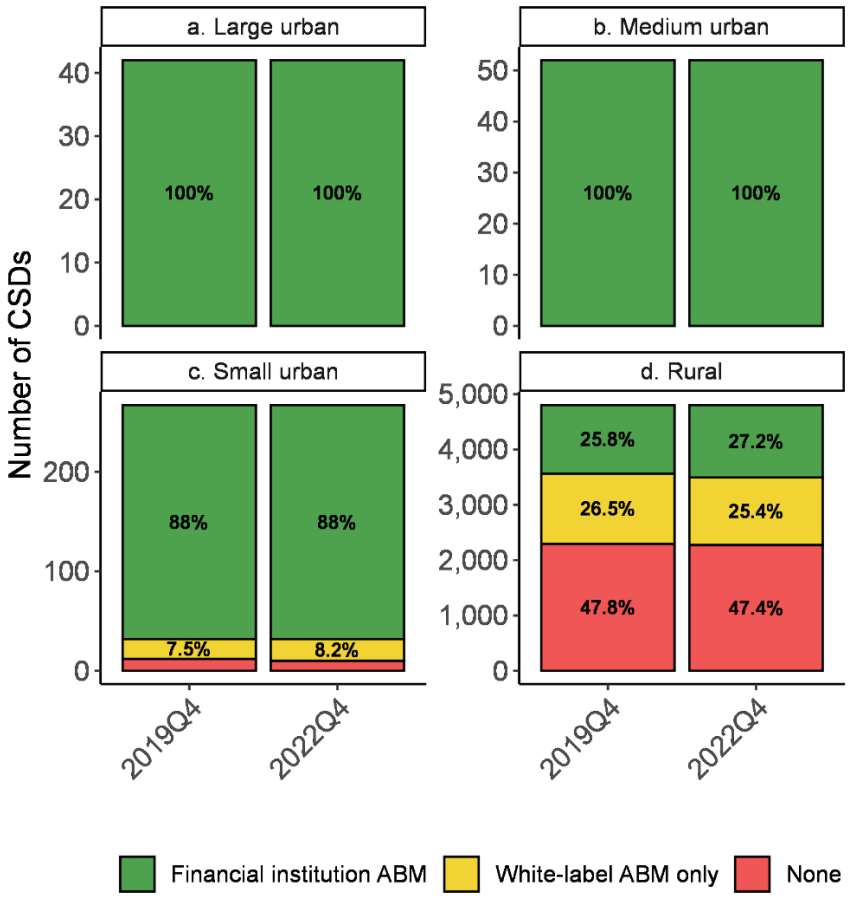


Chart 4 shows the availability of ABMs in large, medium-sized and small urban CSDs, as well as rural CSDs, according to three categories: CSDs with FI-owned ABMs,[11] CSDs with only WL ABMs and CSDs without any ABMs. We see that 100% of large and medium-sized urban CSDs have FI ABM access (i.e., at least one ABM), and this did not change between 2019 and 2022. As regards small urban CSDs, 88% of them have FI ABM access, which also did not change over this period. The percentage of small urban CSDs with only white-label ABM access (at least one WL ABM) increased from 7.5% in 2019 to 8.2% in 2022, while the percentage of CSDs with no ABMs at all decreased from 4.5% in 2019 to 3.7%. Among rural CSDs, 27.2% had FI ABM access in 2022, up from 25.8% in 2019. The percentage of rural CSDs with no ABMs was stable across both periods at around 47%. Overall, these results are consistent with the travel metric results discussed above, showing stable access to ABMs between 2019 and 2022.

[11] More than 80% of the CSDs with FI ABMs also have WL ABMs. We do not focus on WL ABMs when FI ABMs are present because the latter tend to offer more services (Engert and Fung 2019).

Chart 4: Proportion of census subdivisions having at least one automated banking machine, by census subdivision type and automated banking machine type



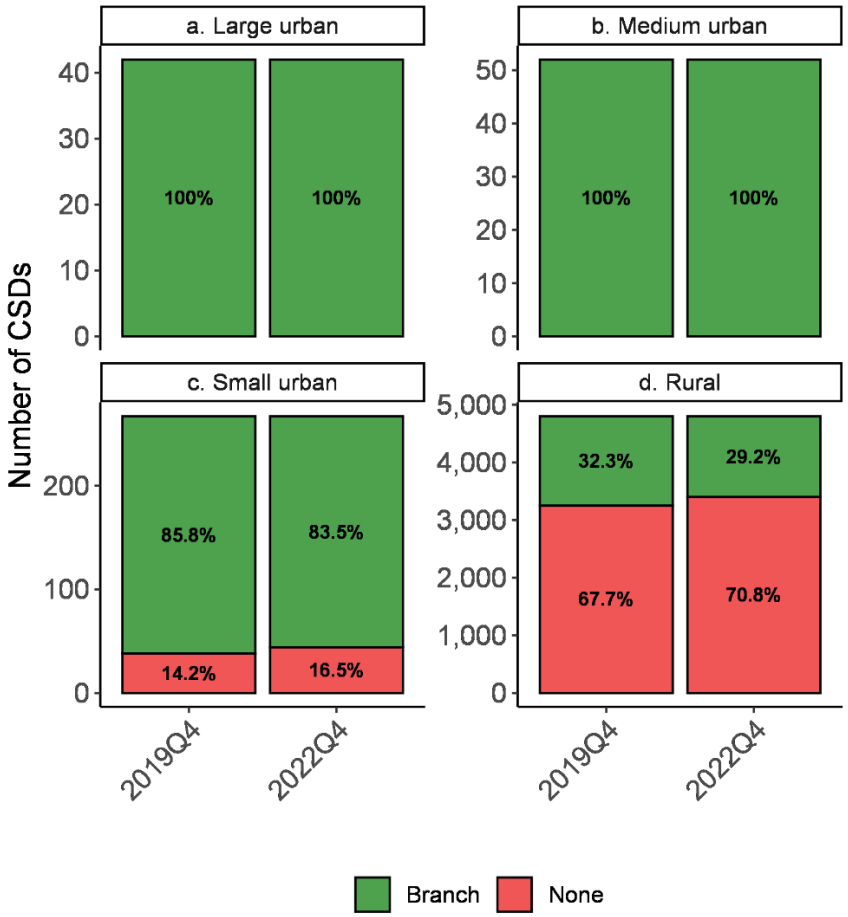
Note: In panel c, values for "None" are 4.5% in 2019Q4 and 3.7% in 2022Q4.

Chart 5 examines FI branch availability at the CSD level and looks at whether branch availability is different across urban and rural areas. It shows that all large and medium-sized urban CSDs have access to branches, which has been consistent over time. However, access to branches in small urban CSDs and in rural areas is poorer and has deteriorated. More specifically, in 2019 14.2% of small urban CSDs did not have a branch, and this share increased to 16.5% in 2022. Notably, 67.7% of rural CSDs had no FI branch in 2019, and this increased to 70.8% in 2022.[12] This suggests that the decrease in the total number of FI branches from 2019 to 2022 was driven partly by branch closures in rural areas. These closures also led to increased driving distance and time to the nearest branch in rural areas,

[12] Rural CSDs have a mean population of 2,750 and a median population of 595, covering an average area of 1,864 square kilometers, or a median area of 67 square kilometers. The rural CSDs with [at least one/an] ABM are on average much more populated than the CSDs without an ABM, with the former having an average population of 4,864, and the latter having an average population of 405. Similarly, rural CSDs with a branch presence have 7,345 residents on average, while those without have 851 residents on average. Hence, only 22% of rural Canadians had no access to a branch within their CSD in 2022, and only 7% of rural Canadians had no access to an ABM within their CSD. More details on population-weighted metrics are given in Appendix D.

as discussed above. Appendix D shows identical trends using population-weighted density metrics.

Chart 5: Proportion of census subdivisions having at least one financial institution branch, by census subdivision type



4. Discussion

Access to ABMs stayed stable in Canada between 2019 and 2022. In particular, the number of ABMs overall—including both FI-owned ABMs and WL ABMs—increased between 2019 and 2022. This experience contrasts with that of many other developed economies, where the number of ABMs has decreased in recent years (Banque de France 2021; Caddy and Zhang 2021). At the same time, the cash share of transactions in Canada (by volume) has decreased in recent years, from 33% in 2017 to 22% in 2021. Further, while overall cash demand has been resilient due to strong demand for non-transactional (large denomination) bank notes, the number of ABM visits has been declining over time (Henry, Shimoda and Zhu 2022). What

can explain the fact that the number of ABMs in Canada has been increasing while the cash share of transactions has been decreasing and the number of ABM visits has been declining?

One possible explanation comes from the fee structure of the ABM industry in Canada. Three types of fees can result when a consumer withdraws cash from an ABM:

- Consumers might pay a direct fee to the ABM owner for using the ABM. This is known as the *surcharge fee*.
- A bank may pay the ABM owner if one of the bank's customers uses an ABM that the bank does not own, known as the *interchange fee*.
- Finally, consumers might pay a *foreign fee* to their own bank if they withdraw cash from an ABM that their bank does not own.

So, for an ABM transaction, a consumer could pay both the surcharge fee and a foreign fee. An ABM owner could receive revenue from both the consumer and the consumer's bank—that is, from the surcharge fee and the interchange fee (Markkula and Takalo 2021). Many countries limit these fee amounts or even ban some fees completely. Canada, however, allows all three fees when a consumer makes a withdrawal at an ABM not owned by that consumer's FI (Donze and Dubec 2009).

While these fees might, at first glance, appear to be detrimental to the consumer, they could help explain why the number of ABMs in Canada has increased over the past three years even though both the use of cash for transactions and ABM visits have declined. With a surcharge fee, both FIs and other ABM-owning companies (the independent ABM deployers) are incentivized to deploy more ABMs because they can recover more of the ABM's operating cost (Ferrari, Verboven and Degryse 2010). Allowing foreign fees also prompts an FI to install more ABMs, for two reasons. First, a significant ABM fleet supports acquisition and retention of customers, who benefit from a larger ABM network and avoid paying foreign fees (Ardizzi and Cologgi 2022). Second, with a larger ABM fleet, an FI can generate more interchange fee revenue from the customers of other FIs, who benefit from that larger ABM fleet (Magnac 2017). This makes investment in ABM networks a means to attract potential customers (Engert, Fung and Segendorf 2019). Further, competition between FIs drives the installation of multi-functional ABMs that provide a range of services (Engert and Fung 2019).

So, despite the fees associated with using ABMs, consumers could benefit because the larger number of more sophisticated ABMs incentivized by the fee structure improves convenience and reduces the cost of travelling to access cash (Donze and Dubec 2009). Overall, this can improve and help sustain access to cash.

While access to ABMs in Canada increased between 2019 and 2022, our results show that access to FI branches decreased during the same period, driven by a decline in the number of branches in rural areas. Along with greater reliance on ABMs instead of branches for cash distribution, there has also been a continuous shift toward digital banking, which was

accelerated by the pandemic (Canadian Bankers Association 2022). Consumers can pay their bills, deposit cheques and send money globally, online or via mobile apps, and even meet with their financial advisor online by video conference. Branches can become less profitable as in-person visits decline, leading FIs to close them (Allen, Clark and Houde 2008). At the same time, it appears branch space and staff are being reallocated to more valuable services such as financial advice, sales and investment services (Engert and Fung 2019).[13]

Note that even though the number of FI branches has declined in Canada in the past few years, the decrease is smaller than in similar countries, such as Australia, where the number of branches dropped by almost 30% in five years, from 2017 to 2022 (Stone 2022). This difference might be related to the fact that in some countries post offices play a role in providing basic banking services. But unlike in Australia (Caddy and Zhang 2021) and the United Kingdom (Tischer and Evans 2022), post offices in Canada do not provide cash or basic banking services; households that desire basic in-person financial services are served at their FI branch, and this can help sustain branches.

Risk-based scenario

While access to cash is broadly stable in Canada, there is a risk that more ABMs and branches might close in the future. Experience in other countries suggests that rural areas with sparse access to cash infrastructure might be particularly vulnerable to ABM and branch closures (Caddy and Zhang 2021). We therefore assess a risk scenario to evaluate how our travel metrics would change if cash access points in CSDs with only one ABM or branch, which tend to be rural areas, were to shut down.

To do this, we count the number of CSDs that have only one ABM or one branch. Of the 5,162 CSDs in Canada:

628 had only one remaining ABM in 2022, with 623 of these in rural areas

931 had only one branch, with 877 of these in rural areas

Table 5: Number of CSDs with only one ABM or branch, by CSD type

CSD type	Number of CSDs with 1 ABM	Number if CSDs with 1 branch
Rural	623	877
Small urban	5	54

We then simulate the closure of all such single ABMs and branches and recompute our travel-based metrics. All these branches and ABM closures are in rural and small urban CSDs, so we present results only for these CSDs.

[13] As an example, the FI closing the most branches is Desjardins, whose number of branches in Quebec decreased from 890 in 2019 to 706 in 2022. According to a news article, a primary driver of this decrease is the shift to online transactions (Genois Gagnon 2022).

Chart 6 illustrates the impact of closing ABMs on both driving time and distance. Closing ABMs in all rural CSDs with only one ABM would increase the mean driving distance for residents in those CSDs from 4.0 km to 4.7 km, while their mean driving time would increase from 5.0 minutes to 5.6 minutes.

Chart 6: Impact of automated banking machine closures on travel metrics, by census subdivision type

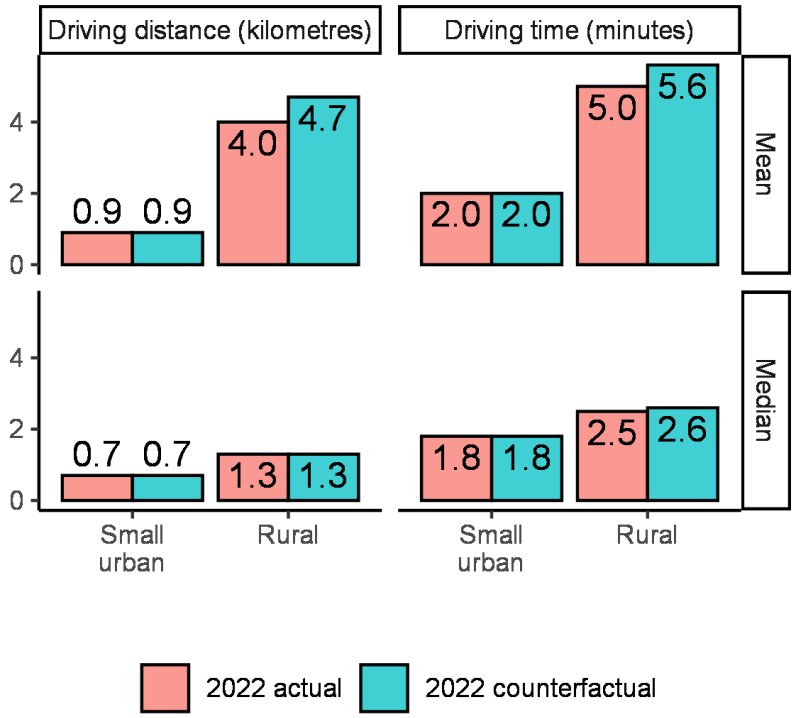
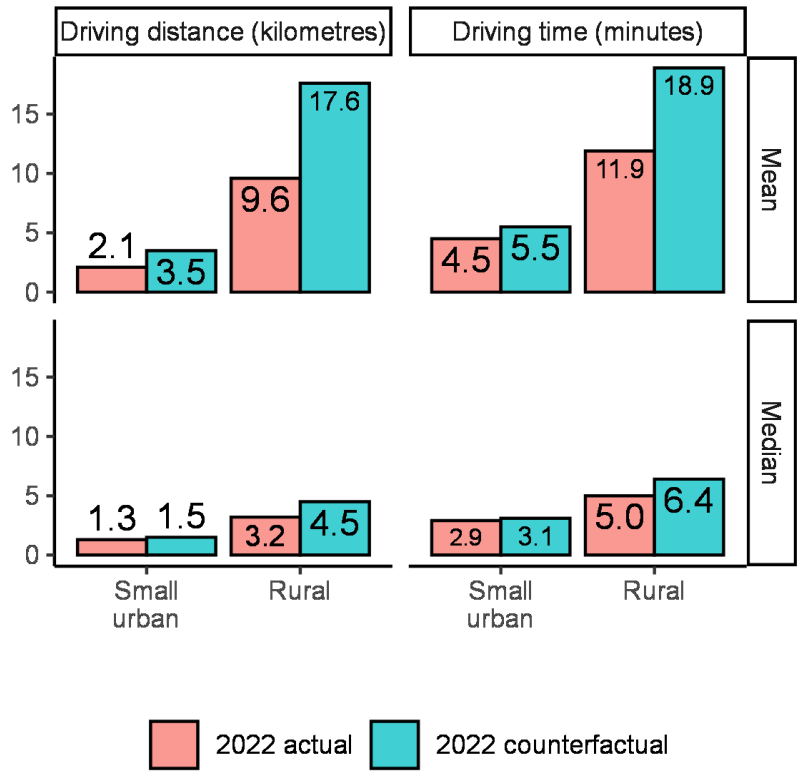


Chart 7 illustrates the impact of branch closures on driving distance and time. In small urban CSDs, closing branches would increase the mean driving distance from 2.1 km to 3.5 km and the mean driving time from 4.5 minutes to 5.5 minutes. Rural CSDs would see a larger increase in both mean driving distance and mean driving time, from 9.6 km to 17.6 km and from 11.9 to 18.9 minutes, respectively.

Chart 7: Impact of branch closures on travel metrics, by census subdivision type



We find that the closure of the last or only ABM in a rural or small urban CSD would have a relatively small impact on travel-based metrics for access to ABMs, whereas the closure of the last or only FI branch in a CSD can significantly increase both driving distance and driving time to the nearest branch. These findings are particularly relevant because of the increasing risk of branch closures in rural areas that already have limited access to cash infrastructure. This analysis highlights the need to continue monitoring access to cash infrastructure.

Concluding remarks

This paper provides a comprehensive travel-based analysis of cash accessibility in Canada before and after the start of the COVID-19 pandemic. Specifically, we look at data from 2019 and 2022. Nevertheless, we recognize that our methodology could be improved in future work. One key area of focus is to incorporate consumer mobility into our cash accessibility measurement by using mobility data. Our current approach assumes that consumers travel to branches and ABMs from their home location. But some people could take advantage of a less costly trip by accessing cash near their workplace or close to a store they shop at or a restaurant they frequent (Chen, Strathearn and Voia 2021; Miyauchi, Nakajima and Redding 2021; Relihan 2022). This suggests that placing the origin point at consumers' home locations would result in overestimating some consumers' travel cost for accessing cash. Therefore, in

future research, we plan to use information about individual travel patterns from alternative data sources to compute a more realistic distance metric by differentiating the origin home location from the origin workplace or shopping location.

Appendix A: Sampling procedure and weights for the origin points

We randomly sampled 1% of dwellings within each census subdivision (CSD) in Canada, excluding all pseudo households with zero population. To ensure the sample is representative, we used the population value attached to each dwelling to construct weights. Specifically, the weight is calculated as:

$$\text{Weight} = \left(\frac{1}{SFP}\right) * SPHP * \left(\frac{TP\_CSD}{\sum SPHP}\right),$$

where

- SFP = sampling fraction
- SPHP = sampled pseudo household population
- TP_CSD = total population of the census subdivision
- ΣSPHP = sum of the pseudo-household populations of all sampled pseudo households within the CSD

To compute the travel metrics, we calculated the weighted mean and median of the sample and applied these weights to compute the cumulative population having access to cash within a certain driving distance or time.

Appendix B: Construction of automated banking machine location data

This appendix outlines the steps taken to construct the automated banking machine (ABM) data used in this paper. The construction process proceeded in two steps, outlined below.

Step 1: Geocode missing coordinates

The MasterCard data contained some observations with missing latitude and longitude coordinates, so we first had to geocode those locations. More specifically, data from November 2019 had 4,535 missing coordinates, which represents 7.5% of the total ABMs. Data from November 2022 had 434 missing coordinates, which represents approximately 1% of the total data. We used the following variables to geocode the missing coordinates: address, city or town, province and country. This information was combined into one character vector and sent through the Google Maps API. For example, "1857 Rue Saint Louis, Saint Laurent, QC, Canada" is one address we geocoded.

Step 2: Updating the 2022 Mastercard data with web-scraped data from the Canadian Credit Union Association and Desjardins

After examining the MasterCard ABM data, we identified two issues: (1) Desjardins ceased providing updated ABM information after 2019, and (2) some credit unions' ABMs were missing. We addressed these concerns by web scraping the Desjardins ABM locator tool and the Canadian Credit Union Association website listing ABM locations. These web scrapings were done in the fall of 2022, allowing us to update the 2022 Mastercard data.

It is important to note that our 2019 ABM data might be missing data from some credit unions; however, we cannot apply step 2 to address this concern because of the lack of historical Canadian Credit Union Association data from 2019. Overall, the data quality is high, and we have been able to construct a comprehensive dataset that allows us to analyze ABM accessibility across Canada.

Appendix C: Construction of the 2022 branch location data

To create the 2022 branch location data, we used the 2019 branch location list provided by the Financial Consumer Agency of Canada (FCAC). The FCAC compiled this list by manually recording all branches listed on each financial institution's (FI) website and by conducting random verification visits through its mystery shopper program.

We updated this 2019 list through two main methods: public accountability statements (PAS) for larger banks, and web scraping for other FIs. Annual PAS reports are required for federally regulated FIs with over $1 billion in equity, and PAS list all branch and automated banking machine openings and closures, including their addresses. We updated the list by adding the opening branches and deleting the closing branches as reported in the PAS between 2019 and 2022. Using Google Maps and Streetview, we resolved any confusing cases by manually checking whether those branches were open or closed.[14]

For FIs with no published PAS, such as Alberta Treasury Branches, Desjardins, small banks[15] and most credit unions, we web scraped either their branch locator websites or the Canadian Credit Union Association's website in October and November 2022 to obtain their current branch locations. We then replaced the 2019 list with the corresponding FIs' 2022 locations.

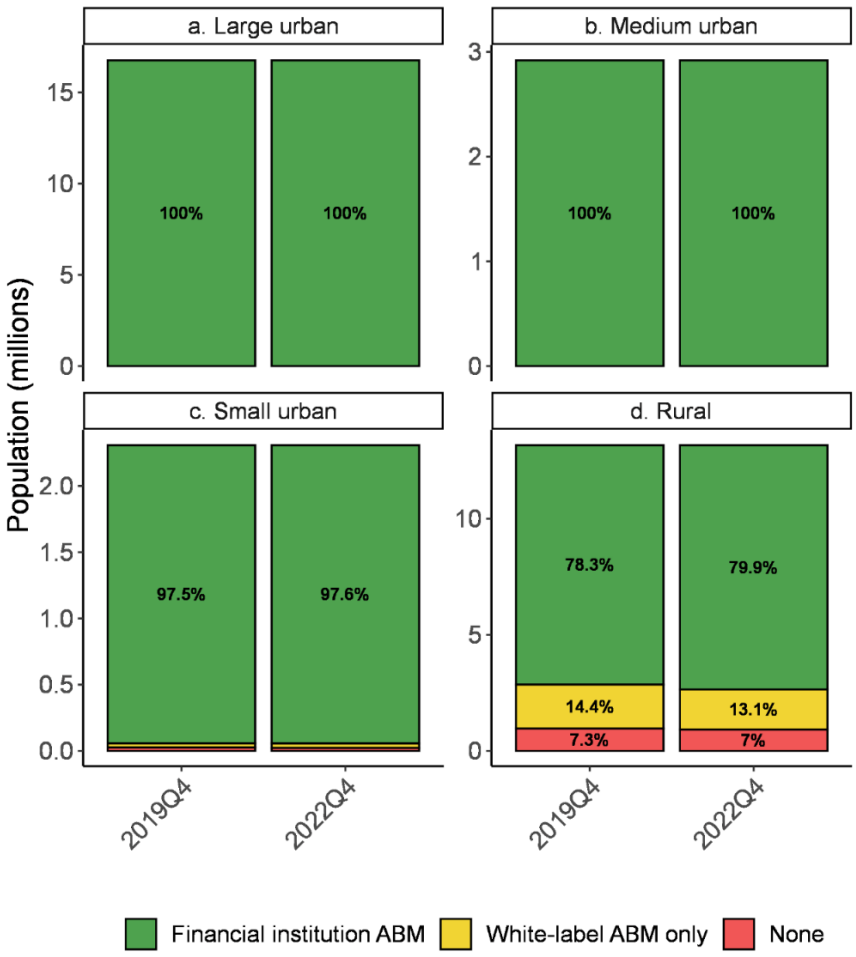
[14] For example, the PAS of the National Bank of Canada includes openings and closures of wealth management offices, so we excluded them through manual verification in Google Maps and Streetview.

[15] The small banks that we web-scraped are Bank of China, CTBC Bank, First Nations Bank of Canada, Habib Canadian Bank, Industrial and Commercial Bank of China, ICICI Bank Canada, KEB Hana Bank Canada, State Bank of India, and Shinhan Bank Canada.

Appendix D: Population-weighted density metrics

Chart D-1 shows the percentages of the population in each of these census subdivision (CSD) types that have at least one automated banking machine (ABM) in their CSD. The chart specifically highlights that rural areas have worse ABM access than urban areas do, but access to ABMs was relatively stable from 2019 to 2022.

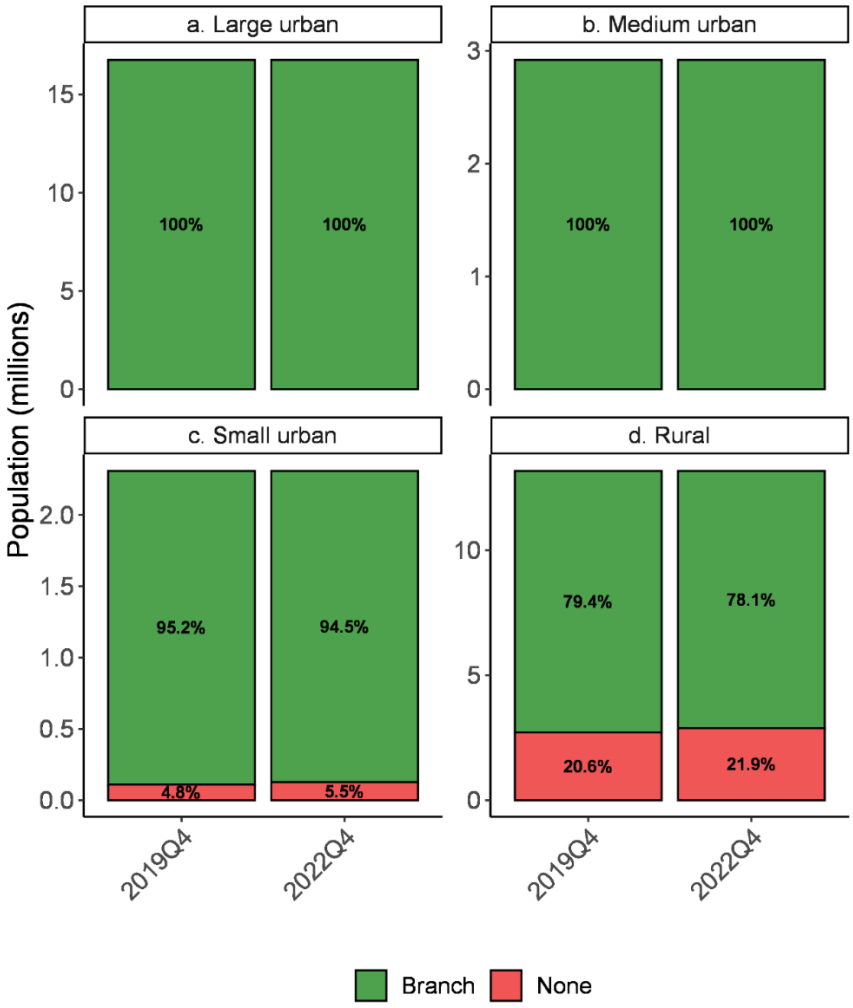
Chart D-1: Proportion of population living in census subdivisions having automated banking machines, by census subdivision type and automated banking machine type



Note: In panel c, values for "White-label AMB only" are 1.4% in 2019Q4 and 1.4% in 2022Q4.
Values for "None" are 1.1% in 2019Q4 and 1% in 2022Q4.

Chart D-2 looks at branch availability at the CSD level weighted by CSD population. It shows that 20.6% of the population in rural CSDs did not have a branch within their CSD in 2019, and this share increased to 21.9% in 2022. This decrease in branch availability is consistent with results from the travel-based metrics.

Chart D-2: Proportion of population living in census subdivisions having bank branches, by CSD type



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