Unbanked Transit Riders and Open Payment Fare Collection

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Several transit agencies are considering accepting contactless credit and debit cards directly at turnstiles and bus fare boxes. By using the expertise and scale economies of the payments industry, agencies may reduce fare collection costs and improve regional interoperability and ease of use. One issue with bankcard-based fare collection systems is how to serve transit riders who do not have or do not want to use contactless bankcards. In this paper, based on Chicago, Illinois, data, discrete choice models of the likelihood of transit users to have credit and debit cards or to use alternative financial services such as currency exchanges are estimated. A significant fraction of transit riders in Chicago do not have credit or debit cards; these riders come from groups with lower incomes, lower levels of education, and minority ethnicities. To meet the needs of this unbanked group of transit users, agencies may accept cash fares, agency-issued cards, or payment industry–issued prepaid cards that can be loaded with cash at retail locations or in rail stations. These options serve unbanked users to varying degrees and with different costs to the agency.

During the past two decades, many large public transit agencies have introduced contactless smart card fare collection systems, such as the Chicago, Illinois, Transit Authority's (CTA) Chicago Card (1). A smart card is a small plastic card with an embedded integrated circuit or processor that is used to store value or data and perform simple fare logic. Smart card fare collection systems have been custom designed for each transit agency, and they have delivered many benefits to agencies and riders, including reducing ticket fraud, enabling flexible fare policies, improving the customer experience, and expediting boarding of buses and passage through turnstiles in stations (2, 3). However, the cost of fare collection in these systems can be as high as 15% of all fare box revenue, and transit agencies are looking for increased efficiency in this function (4). In addition, smart card systems are generally not interoperable between major metropolitan areas, requiring users to carry and load multiple cards for intercity travel (5, 6). Last, some smart cards have come under criticism for weak data security standards (7–9).

Financial institutions in the United States have recently begun to issue contactless credit and debit cards (collectively referred to as contactless bank cards). These commercial products appear to meet many of the business needs of transit fare collection systems, including faster boarding, rigorous data security standards, and potentially

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lower cost of revenue collection. These developments have created an opportunity for convergence between transit fare collection systems and the payments industry (6, 10–12). Many transit agencies have recognized the economies of scale and expertise of the payments industry, which could help to reduce fare collection costs, and some organizations are actively moving toward accepting contactless bank cards directly at the gates in rail stations and on boarding buses (4). In such an open payment system, transit riders do not have to purchase a ticket or load a transit-only smart card before riding. Instead, the costs of their trips are billed to them via their debit or credit card accounts, just as any other credit or debit retail transaction.

Transit agencies in the United States are in different stages of assessing, planning, and implementing open payment fare collection systems. A leader in implementation is the Utah Transit Authority (UTA) in Salt Lake City, Utah. UTA already accepts contactless bankcards systemwide (13) and has recently undergone a procurement process to expand its system to include prepaid cards (14). In 2010 the Metropolitan Transportation Authority (MTA) in New York partnered with the Port Authority of New York and New Jersey and New Jersey Transit to conduct a pilot program for contactless bank card acceptance on select train and bus routes in New York City and New Jersey (15). The Port Authority Transit Corporation in Pennsylvania and New Jersey has also recently conducted a pilot program for contactless prepaid cards (16). Other agencies have awarded contracts for open fare collection systems, including the Chicago Transit Authority (17, 18) and the Southeastern Pennsylvania Transportation Authority in Philadelphia (19). The Washington, D.C., Metropolitan Area Transit Authority recently published a technical specification for a new electronic payment system that includes contactless bank cards (20), and Dallas Area Rapid Transit in Texas released a concept of operations for new payments (21).

MOTIVATION AND OBJECTIVES

As part of this movement toward open payments in transit fare collection systems, one key issue that must be addressed is how to meet the needs of riders who do not have or do not want to use contactless bank cards. Public transportation providers have diverse rider constituencies, and fare collection systems must be accessible to all patrons. This paper analyzes the size and demographics of the non-bank-card-holding ridership segment. Survey data from the CTA are used in a discrete choice analysis to assess the extent to which socioeconomic characteristics explain the division between riders who have and use bank cards and riders who do not.

To make a bank card–based fare payment system feasible, alternative fare payment options must be offered by the transit agency to serve riders without bank cards. Five potential options are presented: cash, two forms of transit-agency-issued cards, and two forms of

payment-industry cards. On the basis of insights from the discrete choice model, as well as the availability and costs of the five options, an assessment is done of whether these are acceptable alternative channels for transit riders without bank cards in an open payment system.

LITERATURE REVIEW: DEMOGRAPHICS OF THE UNBANKED

Individuals who do not have a basic checking account, savings account, or other type of transactional account at a bank or credit union are referred to as the unbanked by the Federal Deposit Insurance Corporation (FDIC). Individuals who have limited relationships with financial institutions are called underbanked; they may have a basic checking or savings account, but they do not have other common financial instruments, such as credit or debit cards. The unbanked and the underbanked often rely heavily on alternative financial services for their financial needs (22). Alternative financial services operate separately from banks and credit unions; these include check-cashing outlets, money transmitters, payday loan stores, car title lenders, and pawnshops (23).

Banking and Socioeconomic Characteristics of American Households

The FDIC recently conducted a nationwide survey of unbanked and underbanked households (22). This survey aimed to fill a gap in the availability of comprehensive data on this subset of the population. The FDIC estimated that at least 17 million adults residing in approximately 9 million U.S. households (7.7%) are unbanked. Likewise, another 43 million adults residing in approximately 21 million households (17.9%) are underbanked. Last, another 4.1% of households in the United States may be banked or underbanked, but because of data limitations, their status could not be verified. Combining these figures, a maximum of up to 29.7% of U.S. households may be un- or underbanked (22).

The FDIC further examined the demographics of the unbanked and found that households with the following characteristics are more likely to be unbanked than the population as a whole: minorities, noncitizens, Spanish-speaking, lower incomes, lower education, and lower ages. This result is similar to findings of other surveys of the unbanked conducted by various organizations (24–26). The FDIC also described many similar trends between the unbanked and underbanked households and found that demographic patterns are more pronounced among unbanked households than underbanked households. For example, similar to the unbanked, underbanked households have a higher tendency to be minorities, live in Spanish-speaking households, and live in single households, but their income levels and education levels tend to be somewhat higher than the unbanked.

Banking Characteristics of Transit Riders

While the FDIC study provides insight about unbanked and underbanked individuals in the United States, it does not address this group in a public transportation context. That fact is particularly relevant because many agencies have a large number of transit-dependent customers, many of whom come from low-income groups (27). Therefore, this demographic could be larger in transit systems than in the nationwide study.

Because unbanked individuals were not previously a major concern for transit agencies planning fare collection systems, there has been little research published on this topic. One notable exception was a recent survey from the Southwest Ohio Regional Transit Authority (28) in Cincinnati, Ohio, that was presented in a white paper on the unbanked published by the Smart Card Alliance (29). The results showed that the majority of riders (69%) have a checking account, 62% of riders have debit cards, but only 49% have a credit card (N = 430). Because the survey did not ask about savings accounts, its data could not be directly compared with the FDIC definition of unbanked. Since Cincinnati as a whole has a comparatively high percentage of residents living below the poverty line, these results may differ from other major American cities (30). In addition, the survey data were not broken down to allow for further study of the demographics of these riders. Consequently, additional research could provide significant insight for transit agencies moving toward open payment systems. The following analysis begins to fill this gap in the literature.

CHICAGO TRANSIT AUTHORITY RIDER ANALYSIS

The CTA operates the second largest public transportation system in the United States, including the elevated railway network ("L" trains) and the bus system in the greater Chicago area (31). Currently, transit riders can pay fares by using two contactless smart card options, the Chicago Card and the Chicago Card Plus, which are both stored-value cards that offer pay-as-you-go fares. The Chicago Card Plus has added functionality for automatic refill of pay-as-you-go value or 30-day period passes by being linked with a credit or debit card. In addition, magnetic stripe cards are available for pay-as-you-go fares and all period passes. Cash is directly accepted on bus fare boxes, but rail turnstiles are cashless. Smart cards and magnetic stripe cards can be loaded in rail stations at a limited number of local retailers and grocery stores and in some alternative financial service providers, which are commonly referred to as currency exchanges in Chicago (32).

Data Source

In the fall of 2008 the CTA conducted a comprehensive customer experience survey that included questions on ridership, general perceptions of the CTA, fare payment, service attributes, customer loyalty, technology use, and socioeconomic status. Data were collected by telephone by using random digit dial sampling as well as computer-assisted telephone interviewing technology. The sample was stratified by geographic area of residence and by the respondent's primary mode (CTA-operated buses or CTA-operated trains). This data collection process yielded a total sample size of 2,439, weighted to be representative of area of residence and primary mode. The resulting cell size allowed for statistically reliable results. The raw survey data were provided by the CTA to the authors to conduct the following analysis.

Banking Characteristics of Chicago Transit Authority Riders

On the CTA survey, respondents were asked what financial instruments they used. As can be seen in Table 1, the majority of CTA riders (64%) have credit cards and 55% of riders have debit cards.

TABLE 1 Financial Instruments Used by CTA Riders

Financial Instrument	Respondents (weighted)	Percentage of All Riders ($N = 2,439$)
Checking account	1,664	68
Credit card	1,554	64
Checks	1,363	56
Debit card	1,338	55
Currency exchanges	596	24
Other	36	1
None	222	9
No answer	64	3

Of the riders, 24% use currency exchanges for their financial services, which may be disproportionately popular among CTA riders because many currency exchanges retail CTA tickets.

From this question, any CTA riders who had a checking account, checks, debit card, or credit card were considered to be banked, and this included 1,900 (weighted) respondents, or 80% of CTA riders. The other 475 (20%), were considered to be unbanked. The percentage of unbanked transit riders was significantly greater than the percentage of unbanked individuals from the nationwide FDIC study, which may in part be the result of the CTA survey question, which did not include the option of a basic savings account. Therefore, this classification is between the FDIC definitions of unbanked and underbanked.

While the number of unbanked riders can be used for comparison with previous literature, two other classifications of riders are more relevant to open payment system planning in Chicago. The first classification includes riders with bank cards, who can immediately use bank cards for fare payment at the CTA (provided their card has contactless functionality). Therefore, if a respondent had either a credit or a debit card, the respondent was considered to be a bank card user, which represents 79% of CTA riders. The remaining 21% of CTA riders do not have credit or debit cards. One percent of respondents use checks or checking accounts but not credit or debit cards.

The second classification focuses on riders who use alternative financial services. Information on this segment is particularly important for the CTA because the agency sells tickets at many of these locations, and understanding the demographics of this market segment could help in future fare media planning. If respondents used a currency exchange, regardless of whether they have a credit or debit card, they were considered to be a currency exchange user. Approximately 25% of CTA riders fell into that category.

Analysis of Chicago Transit Authority Riders

The survey data were first analyzed by cross-tabulation to provide descriptive statistics of the two key classifications of transit riders (bank card users and currency exchange users); the results are shown in Table 2. Then, the survey data were used in a discrete choice modeling framework to determine the extent to which different socioeconomic characteristics, such as age, annual income, and ethnicity, related to the choice of financial instruments. This general framework has been used to understand the choices of unbanked individuals in the United Kingdom, but it has not been used in a transportation context (33). For this analysis, two binary logit models were specified. The first model was for riders choosing a bank card versus not having a bank card, and the second model was created for those riders who use currency exchanges, as shown in Table 3.

The two discrete choice models were estimated by using the BIOGEME software package (34). Weighting of the data was not necessary to obtain unbiased and consistent results because the sample was stratified on the basis of exogenous variables (35). In these models, household size, which ranged up to 14 people, was the only continuous independent variable. All of the other independent variables were binary and set equal to one if the respondent fell into that category. For each category with binary variables, a reference variable was defined, and the coefficients were interpreted relative to the reference category. Respondents who refused to answer questions were excluded, which reduced the total sample size to 1,726 respondents. The results are shown in Table 3, and they are discussed in subsequent paragraphs.

Model 1. Bank Card Results

The overall goodness of fit in Model 1 is very good; a rho-squared of .521 suggests that the independent variables have significant explanatory power. The alternative specific constant (0.674) indicates that, all else being equal in this model, CTA riders choose to have bank cards, but its low t-statistic indicates that the alternative specific constant is not statistically significant.

The age variable was evaluated with a reference group of individuals 16- to 17-years-old. Individuals in all other age groups are more likely to have a bank card, which is indicated by the positive coefficients of the other age variables. Examining the magnitude of the coefficients reveals that as age increases from 18 to 24 up to 55 to 64, the respondent is more likely to have a bank card. The oldest age group (≥ 65) had a low t-statistic of only 1.51, making it insignificantly different from the reference group.

For the employment category, the only statistically significant variable was unemployment. The negative coefficient of -0.809 indicates that unemployed respondents are less likely to have bank cards than employed respondents, which was the reference variable.

For ethnicity, only two variables were significant, and these were for African American and Hispanic respondents. The negative values of these coefficients (-0.493, -0.569, respectively) indicate that respondents of these two ethnicities are less likely to have bank cards than Caucasian respondents.

The significant, positive coefficients for income show a greater likelihood of having a bank card as income increases, which is indicated by the increasing magnitudes of the positive coefficients between income groups. Likewise, the significant, positive coefficients for riders with at least some college education (1.22), a bachelor's degree (1.88), or an advanced degree (2.01) suggest that as education increases, the likelihood of having a bank card increases.

Primary mode of transportation reveals that bus riders, in comparison with train riders, are less likely to have bank cards, as is shown by the negative, significant coefficient of -1.09 for bus riders. Similarly, household size has a negative, significant coefficient, which indicates that as household size increases, the probability of having a bank card decreases.

Last, gender and respondents having disabilities were not statistically significant in this analysis.

Model 2. Currency Exchange Results

The results of the currency exchange choice set proved to be significantly different from the first model. The overall goodness of

TABLE 2   Socioeconomic Characteristics of CTA Riders

Category[a]	Independent Variable	Bank Card Users		Currency Exchange Users		All Riders	
		Count (weighted)	% of Column	Count (weighted)	% of Column	Count (weighted)	% of Column
Age	16–17	17	1	28	5	81	3
	18–24	140	7	68	11	211	9
	25–34	328	17	101	17	394	16
	35–44	371	20	116	20	446	18
	45–54	382	20	122	20	467	19
	55–64	337	18	96	16	403	17
	≥65	293	16	60	10	412	17
	No answer	12	1	6	1	26	1
Employment status[b]	Employed	1,316	70	356	60	1,519	62
	Homemaker	73	4	38	6	112	5
	Retired	297	16	74	12	424	17
	Student	183	10	96	16	303	12
	Unemployed	149	8	98	16	254	10
	Other	15	1	9	1	29	1
	No answer	1	0	2	0	13	1
Sex	Female	1,084	58	363	61	1,428	59
	Male	797	42	233	39	1,011	41
Ethnicity[b]	Caucasian	1,150	61	154	26	1,319	54
	American Indian or Alaskan native	30	2	15	2	41	2
	Asian	93	5	16	3	104	4
	African American	508	27	364	61	787	32
	Hispanic	103	5	52	9	176	7
	Other	36	2	19	3	56	2
	Don't know	5	0	0	0	7	0
	No answer	31	2	12	2	52	2
Annual income	Less than $20,000	190	10	152	25	361	15
	$20,000 to $54,999	457	24	209	35	572	23
	$55,000 to $84,999	366	19	78	13	404	17
	$85,000 or more	492	26	46	8	518	21
	No answer	376	20	111	19	584	25
Education level	Less than high school	83	4	92	15	247	10
	High school or GED	185	10	121	20	330	14
	Technical degree or some college	521	28	219	37	650	27
	Bachelor's degree	538	29	97	16	591	24
	Advanced degree	543	29	60	10	591	24
	No answer	11	1	7	1	29	1
Primary mode	Train	346	18	31	5	373	15
	Bus	531	28	152	25	754	31
	Bus and train	1,003	53	414	69	1,312	54
Disability	No disability	1,741	93	518	87	2,223	91
	Disability	135	7	75	13	204	8
	No answer	4	0	3	1	12	0

NOTE: Respondents for bank card users, currency exchange users, and all riders were 1,881, 596, and 2,439, respectively.
[a]Numbers and percentages rounded to nearest whole number.
[b]Riders could select all that apply. Total may add to more than 100%.

fit is moderate with a rho-squared of .34. The alternative specific constant (−1.24) indicates that, all else being equal, CTA riders are less likely to use currency exchanges.

Only two age groups had significant coefficients, which were respondents from 18 to 24 years of age and those age 65 or older. The large, negative coefficients for these two groups indicate that they are the least likely to use currency exchanges.

In the ethnicity category, two variables were significant, African American and American Indian respondents. The positive values of these coefficients (1.27 and 1.44, respectively) indicate that respondents of these two ethnicities are more likely to use currency exchanges than Caucasian respondents. The t-statistic (8.31) is very high for the African American group.

For income, the two highest annual income variables were significant. The large, negative coefficients of −0.709 and −1.21 indicate that respondents with higher incomes are least likely to patronize currency exchanges.

Riders who use the bus or those who use both modes (CTA bus and "L" trains) are more likely to visit currency exchanges than those whose primary mode is the train. The reason may be that the CTA sells tickets in currency exchanges, as well as train stations. Differences in demographics between bus and rail users may also apply. The bus-only mode variable was not statistically significant.

Last, the remaining independent variables were not statistically significant, including employment status, gender, education level, disability, and household size.

TABLE 3 Binary Logit Results

Category	Independent Variable	Model 1. Bank Card		Model 2. Currency Exchange	
		Coefficient	t-Statistic	Coefficient	t-Statistic
Age	16–17 (reference)	—	—	—	—
	18–24	0.799	1.74	−0.927	−2.14
	25–34	0.861	1.79	−0.786	−1.78
	35–44	0.933	1.88	−0.603	−1.33
	45–54	1.15	2.27	−0.7	−1.53
	55–64	1.18	2.23	−0.866	−1.82
	≥65	0.84	1.51	−1.43	−2.76
Employment status	Employed (reference)	—	—	—	—
	Homemaker	−0.268	−0.9	0.0147	0.06
	Retired	−0.585	−1.95	−0.308	−1.13
	Student	0.0714	0.28	−0.166	−0.76
	Unemployed	−0.809	−3.51	0.0347	0.17
Sex	Female (reference)	—	—	—	—
	Male	−0.205	−1.31	0.0669	0.51
Ethnicity	Caucasian (reference)	—	—	—	—
	American Indian or Alaskan native	0.0401	0.04	1.44	2.34
	Asian	0.152	0.27	−0.0939	−0.24
	African American	−0.493	−2.6	1.27	8.31
	Hispanic	−0.569	−2.26	0.222	1
Annual income	Less than $20,000 (reference)	—	—	—	—
	$20,000 to $54,999	0.798	4.32	−0.0979	−0.57
	$55,000 to $84,999	1.22	4.82	−0.709	−3.33
	$85,000 or more	1.36	4.48	−1.21	−4.87
Education level	Less than high school (reference)	—	—	—	—
	High school diploma or GED	0.488	1.99	0.392	1.58
	Technical degree or some college	1.22	5.04	0.443	1.86
	Bachelor's degree	1.88	5.85	0.0322	0.12
	Advanced degree	2.01	5.28	−0.221	−0.73
Primary mode	Train (reference)	—	—	—	—
	Bus	−1.09	−2.95	0.173	0.66
	Bus and train	−0.757	−2.11	0.749	3.19
Disability	No disability (reference)	—	—	—	—
	Disability	−0.164	−0.67	0.351	1.55
Household	Household size (up to 14 people)	−0.202	−4.32	0.069	1.75
Summary statistics	Number of observations	1,726		1,726	
	Initial log likelihood	−1,202.851		−1,202.851	
	Final log likelihood	−576.318		−794.385	
	Likelihood ratio test	1,253.065		816.932	
	Rho-squared	.521		.34	
	Adjusted rho-squared	.498		.317	

NOTE: Alternative specific constants for Model 1 coefficient and t-statistic were 0.674 and 1.09, respectively, and for Model 2 coefficient and t-statistic were −1.24 and −2.42, respectively. — = reference variable in regression analysis.

Implications for Open Payment Fare Collection Systems

The CTA survey data revealed that there is a sizable population of CTA riders who do not have bank cards. The discrete choice analysis showed that when all else is held equal, CTA riders without bank cards tend to be from some of the most disadvantaged groups in society, including those with lower incomes, those with lower levels of education, and those who are unemployed. In addition, individuals from some minority ethnicities had a higher propensity to be without bank cards.

While the models analyze the availability of payment instruments to different CTA users, they do not directly address which media users will actually use to pay transit fares. A bank card user could pay cash on a bus, for example. However, this analysis can provide upper or lower bounds on the use of different media because users

cannot use a medium that they do not possess or that is not available to them. Subsequently, a key finding of this analysis is that even if all users who hold bank cards choose to use them for transit payment, approximately 21% of CTA riders will use a different payment medium, since they do not have bank cards. While the number of bank card holders may change in the future, this is a relatively mature market and changes may be small.

Of the 21% of CTA riders without a bank card, several observations can be made from the models and data that provide guidance in structuring alternative options. First, there is little overlap between the population who have bank cards and those who use currency exchanges. There are also few users who have checking accounts or checks but do not have a credit or debit card. This evidence suggests that there is a sharp divide between the banked and unbanked populations, and that strategies that assume or encourage unbanked users to obtain bank cards may be difficult to execute. Consequently, the

spatial availability of alternative media should be higher in lower-income, lower-education level, and minority neighborhoods, since use of the alternative media will be greatest in those areas. Last, the use of bank cards is lower among bus users. Spatial availability of alternative media must be provided at locations convenient to bus users; doing so requires a more dispersed network than one focused on rail users, which could be provided at rail stations.

POTENTIAL FARE MEDIUM ALTERNATIVES

Given these findings, the next section describes five potential fare medium options to accompany contactless bank cards and ensure equitable access to fare payment for all transit users. While this list does not include all possible alternatives to contactless bank cards (such as tokens and paper tickets), it highlights the options with the most potential for use in future fare collection systems. Options include cash, magnetic stripe tickets, contactless smart cards, and two types of contactless prepaid cards: closed loop gift cards or open loop network branded cards (*36*).

Option 1. Cash

Direct acceptance of cash on board buses and at turnstiles in subway stations is one potential option for transit riders without bank cards. Like many other transit agencies, the CTA has continued to accept cash on buses because of the difficulty of ensuring that all customers have purchased a ticket before traveling.

Option 2. Magnetic Stripe Cards

Magnetic stripe ticketing systems use magnetically encoded cards, and these are commonly used by major transit agencies (*3, 5*). The CTA currently offers both pay-as-you-go flat fares and period passes on magnetic stripe cards, and the CTA could continue to accept this fare medium in parallel with contactless bank cards. It would be operating two technologies in parallel if this option is chosen.

Option 3. Transit-Issued Smart Cards

Transit smart cards generally refer to proprietary, contactless stored value cards in which data can be written directly onto the card (*6, 10*). Well-known transit-issued smart cards include the CTA's Chicago Card, Washington, D.C.'s SmarTrip, and Boston's Charlie Card. To serve those without bank cards, transit agencies could continue to operate their existing proprietary systems in parallel with open payment systems.   balance stored on card (like gift cards)

Option 4. Closed Loop Prepaid Cards

The first type of prepaid card is a closed loop prepaid card, which is sometimes referred to as a gift card. It can be used only at a single merchant or chain of retailers, and the funds are nontransferrable. For transit, closed loop prepaid cards would be accepted only on the transit system. While the term prepaid card is often used interchangeably with stored value card, these terms are different. A stored value card exists when funds or data are physically stored on the card (such as transit-issued smart cards), while prepaid cards have value or data maintained on back-office computer systems. A prepaid account is

balance stored on back-office computer systems

very similar to a debit account, but it is available to all riders, even those without bank cards. Riders obtain a prepaid card from the transit agency or a retail outlet, and use cash at retail or transit reload points to replenish value or passes on the account linked to the card (*37*).

Option 5. Open Loop Prepaid Cards

The second type of prepaid card is an open loop card, which is sometimes referred to as a network branded or general purpose reloadable prepaid card. As the names would imply, these cards carry the label of a major payment network, such as American Express, Discover, MasterCard, and Visa, and they are accepted at any major retailer that accepts credit or debit payments. Open loop prepaid cards can generally be used to withdraw cash from ATM networks. Many prepaid cards do not require background credit checks, and prepaid cards can be acquired and reloaded in retail institutions. For these reasons and others, open loop cards are often aimed toward consumer groups that cannot or will not use traditional bank cards, such as the unbanked (*38–40*).

Because open loop reloadable prepaid card transactions are similar to credit or debit card transactions, many financial regulations apply to them. These include anti–money laundering laws, which require financial institutions to collect certain information from cardholders, such as name, address, date of birth, and tax information number or Social Security number (*37*).

Attributes of the Fare Medium Options

The five fare medium options have two key decision steps from the user perspective, which are similar to any other consumer product: how they are acquired and how they are used. Each decision step is characterized by three attributes: its cost, its spatial availability, and its availability to a given consumer.

Decision Step 1. Acquisition

Acquisition is the process for initially acquiring fare media, and it includes the following:

1. Cost (initial). The fare media could be provided to the user free of charge, for a refundable deposit or for a one-time fee.
2. Spatial availability (acquisition locations). These are the locations where riders can obtain fare media.
3. Consumer availability. This attribute has two related measures
   – Registration. The user may need to provide some registration information to initially acquire the fare medium. A registered user is not anonymous.
   – Identification. The initial registration information may also be verified, as is done with bank cards.

Decision Step 2. Usage

Usage is the process of using the fare media to travel, and it includes the following:

1. Cost (transactions and reloads). This refers to rider-paid fees for using the card for transit transactions, as well as rider-paid fees for reloading fare media.
2. Spatial availability (reload locations). These are the locations where riders can add value or purchase passes.

3. Consumer availability. This attribute has two principal measures, which define the scope of use of the fare medium:

– Fare types supported. The price of a trip may be a flat fare, zonal fare, or distance-based fare, with or without transfer options. In addition, new fare media have enabled innovative fare policies, such as daily capping that sets a maximum fare for the day regardless of the number of trips. A medium may or may not support all options offered by a transit agency.

– Off-system usage. Some options allow consumers to use fare media for transactions at non-transit merchants.

Table 4 summarizes these two decision steps and their three attributes for the five fare medium options. These can be compared with the features of contactless bank cards, which are shown in the rightmost column of Table 4. Representative values are shown for each option in this table; actual values will vary by transit agency and card issuer.

Discussion of Fare Medium Alternatives

As can be seen in Table 4, the five forms of fare media have substantially different costs and spatial and consumer availability. Combined with the survey results, conclusions can be drawn about the five proposed fare medium options from the perspective of the transit rider, focusing on the 21% of CTA users without bank cards.

First, while direct payment with cash is ubiquitously available and easy to understand, cash alone is insufficient to serve riders without bank cards. Cash does not provide riders with access to popular fare policies such as period pass products. While cash fares could be reduced so that the average per-trip cost is the same as for passes, that

option is counter to the trend at the CTA and most agencies to reduce cash as a fare payment means, for cash-handling cost, security, and bus stop dwell time reasons. Making passes unavailable for non–bank card users would be an unacceptable equity impact.

Transit-issued magnetic stripe cards, transit-issued smart cards, and transit-only prepaid cards are all viable from the users' perspective, with prepaid cards having some additional advantages. The spatial availability of all three can be similar since it is determined by the transit agency. Registration and identification are optional for all of them, though very uncommon (and unavailable at the CTA) for magnetic stripe cards. Magnetic stripe cards cannot handle sophisticated fare policies and, thus, limit consumer availability. Transit-issued smart cards can handle most, but not all, sophisticated fare policies. A closed loop prepaid card with back-office processing of fares can handle all fare policies. Thus, there is some variability in fare availability. If an agency moves to sophisticated fare policies such as loyalty programs, an equity issue for magnetic stripe and transit-issued cards will result. In addition, none of these three options provide any payment benefits to users for purchases other than transit. While this is a limitation, it is not an equity issue, since the CTA has no obligation to provide payment media for non-CTA use. Last, transit agencies typically charge a one-time fee when a smart card is acquired, which can be waived in some circumstances, and they typically charge no fees for usage, maintenance, or support. Under current fare policies, there appears to be no significant equity issue.

While these three options meet the requirements of serving unbanked users, an important difference is that prepaid cards use payment industry standards. While this does not directly affect the rider experience, there are secondary effects. Prepaid cards will evolve with other mainstream payment modes since they follow the same standards. As mobile phone payment, online account management

TABLE 4 Decision Steps and Attributes of Fare Medium Alternatives

Decision	Fare Medium Option[a]					
	Option 1. Cash	Option 2. Magnetic Stripe Cards	Option 3. Transit-Issued Smart Cards	Option 4. Closed Loop Prepaid Cards	Option 5. Open Loop Prepaid Cards	Other: Contactless Bank Cards
Decision Step 1. Acquisition						
Cost (initial) ($)	0	0	0–5	0–5	0–10	0
Spatial availability (acquisition locations)	None required	Ticket machines, limited retail, mail	Limited retail, mail	Limited retail, mail	Extensive retail, mail	From financial institutions
Consumer availability (registration)	No	No	Optional[b]	Optional	Required	Required
Consumer availability (identification)	No	No	No	No	Required	Required
Decision Step 2. Usage						
Cost (transactions and reloads) ($)	0	0	0	0	0–5 reload fees[c]	0; overdraft fees
Spatial availability (reload locations)	None required	Ticket machines	Ticket machines, limited retail, Internet	Ticket machines, limited retail, Internet	Extensive retail, Internet, possibly ATMs	None required; passes bought on Internet
Consumer availability (fare types supported)	Single fare	Single fare, period pass	Single fare, period pass	Single fare, period pass	Single fare, period pass	Single fare, period pass
Consumer availability (off-system usage)	Yes	No	No	No	Yes	Yes

[a]Options 1–3 are based on current CTA policy; Options 4–5 are based on typical industry values.
[b]Registration is optional for the Chicago Card, but it is required for the Chicago Card Plus.
[c]Transit agencies would typically absorb the full cost of reload fees as a matter of equity to customers using prepaid cards. The agency may set a minimum reload value.

features, new security features, and other payment mechanisms evolve, prepaid cards will be more likely to provide these features to riders.

Finally, open loop prepaid cards have many of the same features as contactless bank cards. They support all fare types because fare calculations are done at a server, and they can also be used for off-system retail transactions. Open loop prepaid cards can be acquired in retail locations, and they are likely to have the broadest spatial availability because merchants will stock them for non-transit purchases. There is often an initial fee associated with the card, as well as reload fees. Registration of reloadable open loop prepaid cards is generally required to meet Know Your Customer regulations, and user information is verified to confirm the user's identification. This requirement may limit its use by some transit riders who wish to remain anonymous.

The cost of reloads and the requirement for customer identification are significant drawbacks to open loop cards. These issues must be resolved for open loop cards to be a viable option for transit riders without bank cards. One possible strategy is for transit agencies to absorb reload fees (after negotiating them down with the issuers), and for issuers to create unregistered options for open loop cards that limit non-transit spending levels to comply with anti-money-laundering regulations. Some proposals have been made in this area by card companies.

CONCLUSIONS

The first part of this analysis characterized the sizable population of CTA riders without bank cards. Discrete choice analysis showed that when all else is held equal, CTA riders without bank cards tend to have lower incomes, be unemployed, be bus users, and be minorities. Because a significant portion of riders do not have bank cards, the CTA will need to offer alternative fare media to accompany contactless bank cards to ensure equitable fare options for all groups of riders.

The second part of this paper proposed five types of fare media to accompany contactless bank cards in open payment systems. After user costs, spatial availability, and consumer availability are compared, it appears that open loop and closed loop prepaid cards are attractive fare medium options for non–bank card users. These findings are consistent with the CTA's recent announcement for its open payment system—known as Ventra—that will include open loop and closed loop prepaid card options (*17*).

As transit fare collection systems evolve with advances in payment technology, there are many avenues for future research in this area. Additional equity analyses may help transit agencies understand potential availability issues for transit riders. For example, the simple binary logit model used in this research could be supplemented with a spatial analysis of the Chicago region to understand the effect of geographic availability of banking branches and ATMs on transit rider financial choices. Similarly, equity analyses should be conducted in other metropolitan areas to understand general trends that may affect the introduction of open payment systems. Last, as mobile payment options become more commonplace in transit systems, comparison of the adoption of bank cards with mobile devices is another valuable area for further study.

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