Points Plus Money: Uncovering the Impact of Mixed Currency Redemptions

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Abstract. Many loyalty points are earned and redeemed each year. Yet, despite the continued growth of loyalty programs, many consumers struggle to accumulate enough points for meaningful rewards, creating an engagement barrier. To address this, some firms offer mixed currency redemptions, allowing consumers to combine points and money for rewards, expanding access and value, especially for those with low point balances. However, many firms remain hesitant due to concerns about whether the strategy could reduce profitability or weaken program loyalty, reflecting mixed views on its value. Despite this divergence, little is known about its impact. Using detailed transaction data from a major loyalty program, this study examines how mixed currency redemptions influence consumer behavior and firm profitability through an instrumental variables control function approach that leverages variation in the pricing of mixed redemption menus. Results show that mixed currency redemptions significantly increase both consumer engagement and program profitability, particularly through higher direct point purchases, without reducing activity in other channels. Contrary to concerns that they might weaken the program's lock-in effect, mixed redemptions do not increase disengagement. Although designed and marketed as a solution for low balance consumers, they also drive strong behavioral responses from high balance consumers, a segment often overlooked in mixed redemption strategy. Behavioral patterns suggest a cognitive mechanism whereby mixed redemptions enhance consumers' understanding of point value. These findings demonstrate that mixed currency redemptions can unlock broader and more profitable engagement across consumer segments and offer underutilized strategic value.

Key words: consumer behavior; loyalty program; mixed currency redemption; operations-marketing interface; rewarded behavior

1. Introduction

Loyalty programs incentivize consumer spending by awarding points that can be redeemed for additional products and services. In recent years, the issuance and usage of point currencies have expanded rapidly, with consumers earning and redeeming billions of dollars in value annually. For instance, in 2024, members of American Airlines' loyalty program earned airline miles valued at approximately $4.5 billion (American Airlines 2024), and Southwest Airlines passengers redeemed loyalty points for 10.1 million flights, accounting for 14.7% of the airline's total revenue passenger miles (Southwest Airlines 2024).

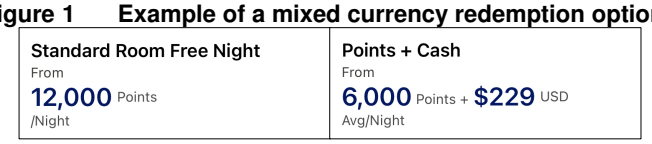
This recurring cycle of earning and redeeming points enhances customer loyalty and generates high-margin revenue, positioning loyalty programs as a strategic driver of firms' profitability. Delta Air Lines, for example, reported $7.4 billion in revenue from its SkyMiles loyalty program in 2024,

a major driver of its $6 billion operating profit that year (Delta Air Lines 2024). As *The Economist* notes, without SkyMiles, Delta would have operated at a loss, underscoring that loyalty programs can be more lucrative than the core transportation service (Economist 2025). United Airlines, in a 2020 investor presentation, similarly highlighted the exceptional profitability of its MileagePlus program, which generates stable revenue by selling miles to partners such as banks and credit card companies (United Airlines 2020). These transactions occur at high margins, with the cost of fulfilling redemptions significantly lower than the revenue earned from mile sales. The financial significance of loyalty programs became especially evident during the COVID-19 pandemic, when airlines used them as collateral to raise billions of dollars in financing for the first time in history. United Airlines was the first to do so, raising $6.8 billion in June 2020 backed by its MileagePlus program. In March 2021, American Airlines set a new record by securing $10 billion in financing backed by its AAdvantage program, marking the largest such transaction in aviation to date. These deals, along with increased transparency and reporting, have revealed the remarkable valuations attached to loyalty programs, often exceeding the market capitalization of the airlines themselves (Chun and de Boer 2021).

The sustained profitability of loyalty programs depends on continued consumer engagement in both earning and redeeming points. As noted in a Financial Times article, "burn drives earn," meaning that the act of redeeming points encourages consumers to remain active by continuing to accumulate them (Georgiadis and Rees 2025). Despite the large and growing volume of redemptions in recent years, however, many consumers still face challenges in accumulating enough points to access meaningful rewards. A McKinsey report highlighted that while many consumers are drawn to loyalty programs by the appeal of rewards, they frequently find these rewards difficult to attain due to insufficient point balances (Carluccio et al. 2021). Redemptions for airline flights or hotel nights, for example, typically require tens of thousands of points, which can feel out of reach for many participants.

To address this barrier, some firms such as Hyatt Hotels and United Airlines offer mixed currency redemption options, allowing consumers to pay partially with points and cover the remaining balance with money. For instance, as illustrated in Figure 1, a consumer may redeem either 12,000 points or 6,000 points plus $229 for a hotel stay. This option lowers the point threshold for redemption, thereby increasing accessibility and potentially encouraging greater engagement. However, other firms such as American and Frontier Airlines do not offer mixed currency redemption, reflecting ongoing uncertainty about its broader impact on consumer behavior and program profitability.

Figure 1 Example of a mixed currency redemption option.



There are several potential advantages to offering mixed currency redemptions. It provides additional redemption options by allowing consumers to redeem rewards using either points alone or a combination of points and money. This lowers both psychological and practical barriers to redemption, potentially increasing overall engagement with the loyalty program. These benefits may enhance the rewarded behavior effect, wherein receiving a reward reinforces positive emotions and strengthens consumer loyalty, leading to increased spending with the firm (Bandi et al. 2024, Taylor and Neslin 2005, Bijmolt et al. 2010). Additionally, mixed currency redemptions may amplify the point pressure effect, as they help consumers get closer to a reward goal by allowing partial redemptions. This sense of goal proximity can increase motivation to accelerate purchases and point earning efforts in order to reach the next attainable redemption opportunity (Liu et al. 2021, Kivetz et al. 2006).

However, mixed currency redemption also introduces potential drawbacks that may explain firms' hesitations. While it offers flexibility, it may compromise a structural feature central to loyalty program effectiveness: the consumer's point balance functions as a switching cost (Klemperer 1987). When consumers exit a program, they forfeit any unredeemed points, creating a "lock-in" effect that incentivizes continued engagement. By allowing consumers with limited point balances to redeem rewards using a mix of points and cash, mixed currency options make it easier for them to fully deplete point balances. This may inadvertently weaken the lock-in effect and increase the likelihood of consumer inactivity or defection. Furthermore, prior research on the positive rewarded behavior effect has so far only focused on traditional full point redemptions, where rewards are perceived as entirely "free." In mixed currency redemptions, the required monetary payment may reduce the psychological value of the reward by increasing the pain of paying (Soman 2001, Thomas et al. 2010). This could diminish the emotional satisfaction and behavioral reinforcement typically associated with redeeming rewards. Similarly, the point pressure literature finds that when reward thresholds are too low, consumers may feel less motivated to make purchases, as the reward goals are perceived as too easy and not sufficiently challenging (Drèze and Nunes 2011). As a result, mixed currency redemptions may weaken both the rewarded behavior effect and the point pressure effect, ultimately reducing purchases and overall engagement in loyalty program activities.

These divergent perspectives highlight the need for further research on mixed currency redemptions, a practice that is growing in popularity but has received limited attention in the literature. This study addresses the gap by examining timely and managerially important questions: How do mixed currency redemptions influence consumer behavior, particularly with respect to subsequent point earning, monetary spending, and redemption patterns? Do they lead to higher overall profitability for the firm, and what drives these outcomes? Additionally, how do different consumer segments respond to mixed currency redemptions?

We empirically investigate these questions using proprietary data obtained from a major loyalty program. Consumers in the program can earn points through the firm's extensive network of partners, including airlines, commercial brands, and financial institutions that offer cobranded or general-purpose credit cards.[1] Consumers can also acquire points by purchasing them directly from the firm. The comprehensive dataset includes over 3.1 million point earning and redemption transactions spanning a 22-month period. It contains detailed information on transaction dates and times, sources of point earnings, redemption types, the number of points transacted, each consumer's point balance, and the monetary amounts associated with direct point purchases.

One of the key empirical challenges in this study is that consumers may endogenously self-select into using mixed currency redemptions rather than full point redemptions. To address this, we implement a two-stage instrumental variables control function approach (Wooldridge 2010, 2015, Hill et al. 2021, Rutz and Watson IV 2019), leveraging the binary nature of the redemption choice between mixed currency redemption and full point redemption. This method allows us to identify the impact of mixed currency redemptions on subsequent consumer behavior and firm profit.

Specifically, we propose two instruments for the endogenous treatment variable. The first instrument captures the mean treatment propensity of other consumers, excluding the focal consumer, in the days leading up to the focal consumer's redemption decision. This measure serves as a proxy for the attractiveness of mixed currency redemptions and is relevant for predicting treatment. It is also likely to satisfy the exclusion restriction, as the redemption decisions of other consumers should not directly influence the focal consumer's post-redemption behavior.

Additionally, leveraging contextual knowledge of the program, we construct a novel second instrument based on the pricing structure of the mixed currency redemption menu. When redeeming

[1] Cobranded credit cards allow consumers to earn points directly in the focal loyalty program when making purchases. General-purpose or non-cobranded credit cards reward consumers with points issued by the bank, which can later be converted into loyalty points or redeemed for other rewards.

points, consumers are presented with a price menu which displays the full point redemption price along with available mixed currency options. A mixed currency redemption involves substituting some points with money, where the monetary portion is calculated by multiplying the number of points substituted by an internal exchange rate set by the firm. This exchange rate exhibits a quantity discount: the more points substituted, the more favorable the exchange rate. This pricing structure creates random variation in whether the resulting money prices end in .00 (that is, round number prices) or not. Motivated by research on cognitive processing and price perception, we construct an instrument that captures the percentage of round number prices in the menu offered to the consumer at the time of their redemption decision. This instrument is relevant for predicting treatment, as menus with more round number prices are easier to process and increase the likelihood of selecting mixed currency redemption. It also satisfies the exclusion restriction because the presence of round number prices is mechanically generated and not tied to individual-level transactions. Therefore, it should not directly influence post-treatment consumer behavior. To our knowledge, this is the first study to use round number pricing as an instrument for endogenous redemption decisions.

1.1. Summary of findings

The analyses reveal that mixed currency redemptions, which allow consumers to combine points with money, lead to a significant improvement in firm performance through both higher profitability and increased engagement in the loyalty program. Mixed currency redemptions encourage consumers to earn more points overall, and interestingly, most of this increase comes from direct point purchases, where consumers buy points from the firm. In contrast, point accumulation through other channels such as air travel, credit card use, and commercial partner activity remains similar to levels observed under full point redemptions. This suggests that mixed currency redemptions create additional value without displacing activities in other earning channels. They deliver similar rewarded behavior and point pressure effects as full point redemptions within these channels, while uniquely driving higher levels of direct point purchases. In addition to changes in earning behavior, mixed currency redemptions also result in higher point redemption levels overall, suggesting stronger ongoing participation in the program. Together, these results underscore the effectiveness of mixed currency redemptions in sustaining consumer participation that supports program profitability.

Despite the appeal of offering mixed currency redemption options, some firms remain hesitant due to fears that this flexibility may weaken the program's lock-in effect by allowing point constrained consumers, who hold low point balances, to fully deplete their points, potentially leading

to inactivity or defection. Speaking directly to this concern, however, our analysis finds no evidence that mixed currency redemptions increase the likelihood of program exit or disengagement. Instead, they drive continued engagement with the program and generate substantial profit through increased post-redemption activity. These results suggest that, rather than undermining the lock-in effect, mixed currency redemptions support the retention of point constrained consumers who might otherwise disengage, and turn their continued participation into a profitable outcome for the firm.

Beyond the effects observed among point constrained consumers, our analysis also uncovers a notable response within the point unconstrained segment. These are consumers with high point balances who are not limited in their abilities to redeem fully in points. Although mixed currency redemptions are typically designed with low balance consumers in mind, we find that they also increase post-redemption engagement among point unconstrained consumers. Despite making up a smaller share of mixed redemption users, this segment contributes significantly to the overall profit impact. Their response is particularly noteworthy because positioning and marketing efforts around mixed redemptions are often aimed exclusively at low balance consumers, overlooking the high balance group that also responds positively. For example, Air Canada currently markets its Points + Cash redemption option to consumers who "don't have enough points for a flight reward."[2] These findings suggest that mixed currency redemptions have broader appeal than commonly assumed and that firms may be missing an opportunity by focusing communication too narrowly.

As a complement to the main findings, we also explore several plausible behavioral mechanisms that may help explain the observed effects. Our analysis suggests a cognitive mechanism as a potential driver of these behavioral shifts. Mixed currency redemptions may enhance consumers' abilities to understand and evaluate point value by presenting combinations of point and money prices together. This explanation is consistent with our finding that mixed currency redemptions lead to higher levels of direct point purchases, a behavior that requires a stronger grasp of what points are worth. We also find that mixed currency redemptions lead to more efficient point usage, often involving redemptions for higher value rewards. These patterns are consistent with a cognitive mechanism in which the mixed currency format improves consumers' understanding of point value.

In summary, these findings demonstrate that mixed currency redemptions are an effective tool for increasing consumer engagement and program profitability. While typically viewed as a way to help point constrained consumers access rewards, the mixed currency option also drives meaningful

[2] https://www.aircanada.com/ca/en/aco/home/aeroplan/redeem/air-canada.html

behavioral changes among point unconstrained consumers who already hold sufficient point balances. Importantly, these benefits are achieved without weakening the lock-in effect that underpins loyalty program success. In fact, mixed currency redemptions help retain at-risk consumers and unlock value from segments that are often overlooked. These results suggest that firms may benefit from rethinking how they position and promote mixed redemption options, and recognizing their broader appeal and potential to enhance overall program performance.

2. Literature Review

Our study contributes to several streams of literature spanning payment methods, consumer purchase behavior, and loyalty program redemptions. One relevant body of work examines how payment methods, purchase options, and prices influence consumer spending decisions. Consumers tend to spend more when using less salient payment methods, such as credit cards rather than cash, because the pain of paying is reduced when the loss of wealth is less immediate or visible (e.g., Soman 2001, Thomas et al. 2010). Subsequent research further demonstrates that variations in payment structure and framing can systematically shape decision behavior more broadly through both economic and psychological channels (e.g., Onen Oz et al. 2025, Chen et al. 2013). Related research further explores how the design of purchase and pricing options affects consumer behaviors, including the influence of default product settings (Gallino et al. 2025), upgrade opportunities (Cui et al. 2019), personalization options (Cui et al. 2021), and price exposure and spillover effects within a product line (Baron et al. 2024, Becerril-Arreola 2020). While this literature has focused on single-currency payment modes, our study extends these insights by examining a hybrid payment format that allows consumers to combine loyalty points with money. This mixed-currency structure introduces a distinct psychological framing and unique tradeoffs between currencies, making the behavioral effects of payment more complex and less predictable, an area that remains largely underexplored in prior work.

Another stream of research focuses on consumers' redemption and purchase decisions in loyalty programs and related reward mechanisms. Prior work has shown that redemption behavior is shaped by economic, cognitive, and psychological factors. For example, consumers may stockpile points due to perceived value and cognitive constraints (Stourm et al. 2015), delay redeeming credit card rebates to better align redemptions with past spending (Chung 2020), or adjust their spending behavior when the purchase can be offset by gift card redemptions (Kadiyala et al. 2024) or when loyalty discounts are offered to program members (Yang et al. 2025). Other work finds

that redemption likelihood is lower when point-to-money exchange rates are variable rather than fixed (Chun and Hamilton 2024), and that the decision to pay with points versus money depends on mental accounting, reference exchange rates, and point-earning sources (Lim et al. 2024). These findings demonstrate that firms can influence consumer behavior and increase revenue by designing pricing strategies that reflect these behavioral considerations, in line with the broader perspective in operations management that emphasizes integrating behavioral insights into operational design (Swaminathan 2025). We contribute to this literature by modeling consumers' choices between full point redemptions and mixed currency redemptions, and by linking this choice to post-redemption behavior using an instrumental variables control function approach.

More specifically, our study contributes to the limited body of research on mixed currency redemptions. To our knowledge, only two prior studies have explored similar practice. One combines laboratory experiments with theoretical modeling to show that when consumers' utility functions for points are convex, they may prefer to substitute a portion of point usage with cash, suggesting that mixed redemptions can reduce the psychological cost of payment (Drèze and Nunes 2004). A second study analyzes a temporary promotion in a retail reward program that allowed consumers to partially pay for a free reward using cash (Montoya and Flores 2019). The findings indicate that the promotion attracted consumers with lower transaction activity and documented a post-promotion decline in purchases. Our study extends this literature by examining mixed redemptions within the context of an ongoing loyalty program and by focusing on their behavioral and financial consequences. We empirically investigate how mixed currency redemptions influence consumer engagement and firm profitability, while addressing potential confounds related to consumer selection through an instrumental variables control function approach. In doing so, we provide new evidence on the role of mixed redemptions as a sustained loyalty strategy and highlight their implications for program design and firm performance.

Finally, our study relates to the literature on rewarded behavior and point pressure effects (see Bijmolt et al. 2010 for a review). This stream has shown that reward redemption can increase consumer activity both before and after receiving a reward. For example, consumers at a supermarket chain who received a reward during a promotion spent more during and after the promotional period (Taylor and Neslin 2005). Similar effects have been documented in coalition programs, where redemptions lead to more frequent purchases, demonstrating the rewarded behavior effect (Dorotic et al. 2014). Other research highlights point pressure effects, where consumers accelerate purchases as they approach a reward threshold (Kivetz et al. 2006, Liu et al. 2021). These studies

focus on traditional redemptions fully paid by points. We extend this literature by showing that these effects can persist even when the reward is only partially covered by points, and we uncover additional behavioral responses that are unique to mixed currency redemptions.

3. Program Description and Data

We obtain proprietary data from a major coalition loyalty program, where consumers earn and redeem points across a broad network of partners. This includes earning points through flying with airlines, spending on cobranded and general non-cobranded credit cards, and shopping with the program's commercial partners. Consumers can also directly purchase points on the firm's program website, by paying money directly to the firm. After earning points, consumers can redeem them on air travel or other products and services with the firm's partners, through the firm's redemption website.[3] Consumers can either perform full point redemptions or mixed currency redemptions, which combine points and money.

A key performance metric for the program, and for coalition loyalty business models more generally, is gross billings, which is defined as the total sale of points to partners and consumers (Deloitte 2015). The program sells points to its airline, banking, and commercial partners, who in turn issue them as rewards to their customers. It also sells points directly to consumers, often at a premium. When points are redeemed, the program incurs the cost of procuring the associated rewards. However, because the price at which points are sold is set higher than the fulfillment cost, the program captures an attractive margin. This business model supports high-margin, recurring profit with relatively low capital intensity, allowing for scalable growth and operational efficiency.

The dataset, spanning 22 months, contains over 3.1 million point earning and redemption transactions made by more than 44,000 consumers. These consumers range in age between 21 and 80 years old, and each performed at least one redemption. For each transaction, the variables we observe include the date and time of transaction, the source of point earning (airline, cobranded or general card, commercial partner, or direct point purchase) or the type of point redemption (air travel or non-air travel products), the amount of points transacted, the point balance of the consumer, and the amount of money that is spent if the transaction is a direct point purchase with the firm. The data period is also free of major program or policy changes that may confound the results.

[3] Earned points expire after a set number of months of inactivity, but any kind of activity extends the expiration. As a robustness check, we confirm that the results remain robust if we exclude consumers who *may* have expiring points, i.e., they have no point earning or redemption activities before they make a redemption. These consumers only make up 2.9% of our dataset and they do not drive the results.

3.1. Mixed currency redemption option

When consumers visit the program's redemption website, they can either perform a full points redemption or a mixed currency redemption, which involves a combination of points and money. To begin the process, consumers first select the product they wish to redeem, such as an airline ticket for a specific flight. After the selection, the website displays the full point redemption price along with available mixed currency options such as:[4]

| 5,000 points + $0 | 4,000 points + $25.62 | 3,000 points + $40.00 | 2,000 points + $46.00 |

The offered point prices are in increments of 1,000 points, subject to a minimum amount of points that must be used in any redemption. If consumers are constrained by their point balance, they are only shown the mixed currency redemption options that they can afford. For example, in our illustration, if they have a point balance of 4,200 points, they will be offered a redemption menu that comprises the last three options. Consumers do not earn points on the portion of the redemption paid with money in a mixed currency transaction.

The money price portion of a mixed currency redemption is determined by the firm's internal exchange rate function between points and money. For example, if a consumer redeems 4,000 points plus $25.62 for a ticket that would otherwise cost 5,000 points, they are effectively substituting 1,000 points with $25.62. The more points a consumer substitutes with money, the more favorable the exchange rate becomes from the consumer's perspective, reflecting a quantity discount.

In our dataset, a sizeable proportion (20%) of consumers have used mixed currency redemptions. In this study, we focus on redemption choices for air tickets, as these make up more than 98% of all mixed currency redemptions. Out of all air ticket redemptions, 91% are redeemed using full point redemptions, and 9% are redeemed with mixed currencies.

4. Econometric Analysis

In this section, we describe the econometric approach used to examine the impact of offering mixed currency redemption options alongside full point redemptions. One of the key empirical challenges in this study arises from the potential for endogenous self-selection into mixed currency redemptions. Simply comparing outcomes between consumers who choose mixed currency redemptions and those who opt for full point redemptions may yield biased estimates of treatment effects. For example, less engaged consumers may be more likely to adopt mixed redemptions because they do not accumulate enough points for full redemptions, and they may also exhibit lower post-redemption

[4] These mixed currency redemption options are for illustration only, and do not reflect the firm's actual pricing.

activity. In this case, treatment effect estimates from ordinary least squares (OLS) regression would be biased downward. Conversely, if more engaged or knowledgeable consumers are more likely to adopt mixed redemptions and show higher post-redemption activity, OLS estimates would be biased upward.

To address this empirical challenge and isolate the exogenous effect of treatment, we employ an instrumental variables (IV) approach. Specifically, we use the control function method with instruments to account for consumers' endogenous self-selection into mixed currency redemptions (Wooldridge 2010, 2015, Wolfolds and Siegel 2019). This approach is well-suited for binary endogenous variables, offering greater efficiency and accommodating non-continuous outcome variables (Hill et al. 2021, Rutz and Watson IV 2019, Wooldridge 2015). It also allows for interaction terms involving the endogenous regressor without requiring separate instruments for each interaction (Wooldridge 2015). The control function approach is widely used to address endogenous binary treatment selection across domains. Examples include applications in loyalty program research (Taylor and Neslin 2005, Bombaij and Dekimpe 2020), operations management (Kajaria-Montag et al. 2024), and finance and management (Campa and Kedia 2002, Chang et al. 2016).

In addition, we conduct robustness checks using alternative econometric approaches, including the two-stage least squares (2SLS) instrumental variables estimator and a matching approach, as described in Section 6.3.

4.1. Control function with instruments

We study consumer i's activity levels in the loyalty program, denoted by y_i, after their mixed currency redemption (our treatment of interest) using the following outcome equation:

$$y_i = \beta_0 + \beta_1 D_i + \boldsymbol{\beta}' \boldsymbol{x}_i + e_i, \tag{1}$$

where β_0 is the intercept, D_i is a (possibly endogenous) binary treatment indicator equal to 1 if consumer i used a mixed currency redemption and 0 otherwise, and β_1 is the average treatment effect and our parameter of interest. $\boldsymbol{x}_i$ is a $k \times 1$ vector of control variables, which include consumer i's pre-treatment program activity levels, demographic characteristics, redemption occasion parameters, and the year-week of the redemption occasion. The list of control variables and detailed descriptions are given in Section 4.3. $\boldsymbol{\beta}'$ is a $1 \times k$ vector of corresponding coefficients. Given the control variables $\boldsymbol{x}_i$, we can interpret β_1 as the marginal effect of mixed currency redemptions when comparing two consumers with the same pre-treatment activity levels, demographics, and who face

a similar redemption decision in the same year-week. e_i denotes the error term of the regression, and $\mathrm{E}(e_i) = 0$. Our primary continuous outcomes y_i include consumers' average monthly point earnings and redemptions across different channels. Our main binary outcome of interest is whether the consumer becomes inactive in the program, for which we estimate the probit outcome equation $y_i = \mathbf{1}(\beta_0 + \beta_1 D_i + \boldsymbol{\beta}'\boldsymbol{x}_i + e_i > 0)$.

The binary treatment variable D_i may be endogenous and correlated with e_i, due to unobservable consumer characteristics that are correlated with their decision to adopt mixed currency redemptions. This will result in biased estimates for β_1. Therefore, we use a control function approach with instruments to address the endogeneity issue. This method proceeds in two stages: selection and outcome stages. In the selection stage (first stage), selection into treatment is modeled with a probit model with instruments:

$$D_i = \mathbf{1}(\alpha_0 + \boldsymbol{\alpha_z}'\boldsymbol{z}_i + \boldsymbol{\alpha}'\boldsymbol{x}_i + u_i > 0), \tag{2}$$

such that consumer i selects mixed currency redemption, i.e., $D_i = 1$, if $\alpha_0 + \boldsymbol{\alpha_z}'\boldsymbol{z}_i + \boldsymbol{\alpha}'\boldsymbol{x}_i + u_i > 0$, and $D_i = 0$ otherwise, α_0 is the intercept, and $\boldsymbol{z}_i$ is a $q \times 1$ vector of instrumental variables that is correlated with a consumer's selection into treatment but is uncorrelated with e_i in (1). $\boldsymbol{\alpha}_z'$ and $\boldsymbol{\alpha}'$ are $1 \times q$ and $1 \times k$ vectors of corresponding coefficients, respectively, and $u_i \sim N(0,1)$ denotes the error term of the probit regression. For notational convenience, we define $U_i \equiv \alpha_0 + \boldsymbol{\alpha_z}'\boldsymbol{z}_i + \boldsymbol{\alpha}'\boldsymbol{x}_i$ for use in the rest of this section. In the outcome stage, outcome variables of interest are modeled with a linear model for continuous outcomes and with a probit model for binary outcomes, as described above. The error terms of the two stages may be correlated, so the factors affecting consumers' decisions to use mixed currency redemptions may also influence their post-treatment behaviors.

The estimation of (1) and (2) follows the procedure described in Wooldridge (2015). First, note that the expected post-treatment activity of a treated consumer i, accounting for self-selection into treatment, is given by $\mathrm{E}(y_i|D_i = 1) = \beta_0 + \beta_1 + \boldsymbol{\beta}'\boldsymbol{x}_i + \mathrm{E}(e_i|u_i > -U_i)$. The error terms e_i and u_i are assumed to follow a bivariate normal distribution such that:

$$\begin{bmatrix} e_i \\ u_i \end{bmatrix} \sim MVN\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_e^2 & \rho\sigma_e \\ \rho\sigma_e & 1 \end{bmatrix}\right).$$

The expectation $\mathrm{E}(e_i|u_i > -U_i)$ is a standard result from the conditional bivariate normal distribution (see, e.g., Heckman 1979) and is given by $\mathrm{E}(e_i|u_i > -U_i) = \rho\sigma_e\lambda_{1,i}$ where $\lambda_{1,i} = \frac{\phi(-U_i)}{1-\Phi(-U_i)}$, with $\phi(\cdot)$ and $\Phi(\cdot)$ denoting the standard normal density and standard normal distribution functions, respectively. This expression, known as the inverse Mill's ratio,[5] will be included in the

[5] In general, the Mill's ratio is defined as $\frac{1-\Phi(\cdot)}{\phi(\cdot)}$. In addition to econometrics, it is also widely used in reliability engineering, where the inverse of the Mill's ratio represents a hazard or failure density conditional on prior survival.

outcome equation to adjust for selection bias (Wooldridge 2015). Thus, the expected post-treatment activity of a treated consumer becomes $\mathrm{E}(y_i|D_i = 1) = \beta_0 + \beta_1 + \boldsymbol{\beta}'\boldsymbol{x}_i + \rho\sigma_e\lambda_{1,i}$. Similarly, the expected activity of a control (non-treated) consumer i is $\mathrm{E}(y_i|D_i = 0) = \beta_0 + \boldsymbol{\beta}'\boldsymbol{x}_i + \mathrm{E}(e_i|u_i \leq -U_i) = \beta_0 + \boldsymbol{\beta}'\boldsymbol{x}_i + \rho\sigma_e\lambda_{0,i}$, where $\lambda_{0,i} = -\frac{\phi(U_i)}{1-\Phi(U_i)}$. This is the negative of the inverse Mill's ratio defined for control consumers.

Finally, we augment the outcome equation (1) with the inverse Mill's ratios and estimate the following augmented outcome equation:

$$y_i = \beta_0 + \beta_1 D_i + \boldsymbol{\beta}'\boldsymbol{x}_i + \beta_\lambda\hat{\lambda}_i + \eta_i, \tag{3}$$

where $\mathrm{E}(\eta_i) = 0$, $\hat{\lambda}_i = D_i\hat{\lambda}_{1,i} + (1 - D_i)\hat{\lambda}_{0,i}$, $\hat{\lambda}_{1,i}$ and $\hat{\lambda}_{0,i}$ are the estimated inverse Mill's ratios obtained using the fitted values $\hat{U}_i$ from the selection equation (2), and $\beta_\lambda = \rho\sigma_e$. We can verify that the conditional expectations of the augmented outcome equation (3), $\mathrm{E}(y_i|D_i = 1)$ and $\mathrm{E}(y_i|D_i = 0)$, align with the earlier derivations, except that $\hat{\lambda}_{1,i}$ and $\hat{\lambda}_{0,i}$ are now estimated quantities.

Following Wooldridge (2015), for binary outcomes y_i, we estimate a probit augmented outcome equation such that $y_i = \mathbf{1}(\beta_0 + \beta_1 D_i + \boldsymbol{\beta}'\boldsymbol{x}_i + \beta_\lambda\hat{\lambda}_i + \eta_i > 0)$. Then, we examine the interaction of the treatment variable with some covariate $x_{1,i}$ (an element of $\boldsymbol{x}_i$) by estimating the augmented outcome equation $y_i = \mathbf{1}(\beta_0 + \beta_1 D_i + \beta_2 D_i x_{1,i} + \boldsymbol{\beta}'\boldsymbol{x}_i + \beta_\lambda\hat{\lambda}_i + \eta_i > 0)$. Finally, we report standard errors for the augmented outcome equation based on 1,000 bootstrap replications, to account for $\hat{\lambda}_i$ being estimated quantities from the selection stage.

4.2. Model specifications

We define the treatment occasion as a consumer's first use of mixed currency for an air ticket redemption, which occurs during a treatment observation period. For consumers in the control group who never use mixed currency and only redeem with full points, we define a benchmark redemption occasion as their first full point redemption for an air ticket during the same period.[6]

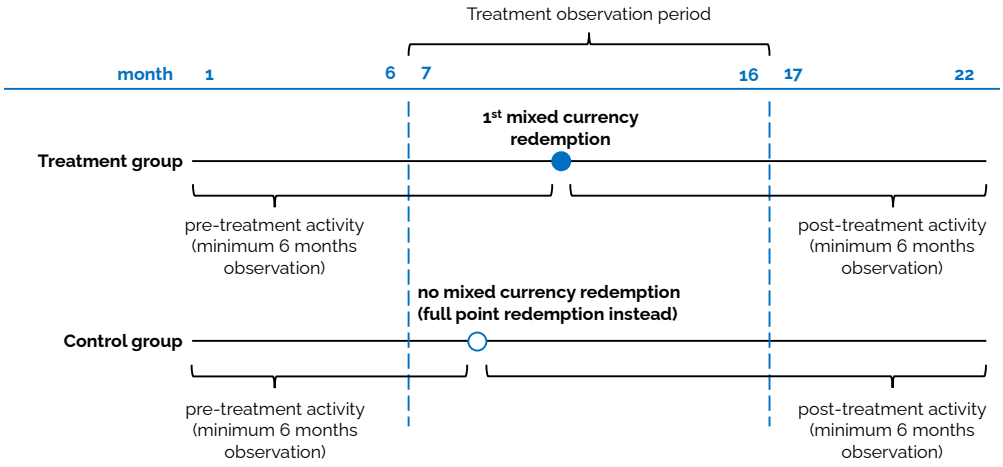
We require a minimum activity observation window both before and after the redemption occasion to accurately measure consumers' pre and post-treatment loyalty program activities. On average, consumers make a point earning transaction every 0.3 months, and a point redemption every 5.4 months. Based on this, we set a minimum activity observation period of 6 months before and after the treatment occasion to capture at least one redemption activity on average.[7] Under this setup, the

[6] We perform robustness checks with different compositions of treatment and control groups in Section 6.1, and we find that our main results and conclusions remain robust.

[7] We perform robustness checks for shorter and longer activity observation periods in Section 6.1. Our main findings remain robust.

start of month 7 is the earliest treatment occasion that we analyze, ensuring a 6-month pre-treatment window. Similarly, the end of month 16 is the latest treatment occasion that we analyze. In other words, our treatment observation window spans month 7 to month 16 out of a total 22 month data period. For example, if a consumer's treatment occasion falls on the first day of month 7, their pre-treatment window spans 6 months from months 1 to 6, and their post-treatment window spans almost 16 months from the second day of month 7 to the last day of month 22. On average, we observe 10.6 months of consumer activity prior to treatment and 11.7 months after. Figure 2 shows a schematic of this setup.

Figure 2 Schematic of analysis setup.



4.3. Control variables

We include the control variables $\boldsymbol{x}_i$, shown in Table 1, when we estimate the selection equation (2) and the augmented outcome equation (3). There are three groups of control variables: a) consumers' pre-treatment behaviors, b) consumer demographics, and c) treatment occasion parameters. This allows us to compare the post-treatment behaviors of treated and control consumers who have similar pre-treatment behaviors and demographics, and who made a decision on using mixed currency redemption for a similar redemption occasion in the same year-week.

For the first group of control variables describing a consumer's pre-treatment behaviors, we include their total pre-treatment monthly point earning level, $EARN$, and monthly point redemption level, $REDEEM$. In addition to total point earning and redemption levels, we also break down consumers' total point earning into its channels, namely, cobranded credit cards ($CO.CARD$), general credit cards ($CARD$), commercial partners ($COMMERCIAL$), and direct point purchase ($PT.PURCHASE$). Similarly, we include consumers' point redemptions on non-air travel products

and services ($NON.AIR$). We omit the point earning and redemption channels of air travel, which serve as the base category. We also control for a consumer's mean monthly number of air ticket full point redemption transactions, $REDEEM.N$.

Next, for the second group of control variables, we control for the observable demographic variables, $TENURE$, $ELITE$, AGE, and $FEMALE$, because they may influence consumers' affinity for mixed currency redemptions and also their post-treatment activity levels. Finally, the third group of control variables describe consumers' treatment occasions. We include the full redemption point price ($PRICE$) of the treatment occasion and also account for seasonality effects with $YEAR.WEEK$ indicator variables, which reflect the year-week of the treatment occasion. In addition, consumers' point balances ($BALANCE$) and the depletion of their point balances relative to their target redemption levels ($DEPLETE$) during the treatment occasions may also influence their post-treatment activity levels. Therefore, we also control for these two additional variables in the augmented outcome equation (3). All pairwise correlations among the control variables are below 0.7, and the variance inflation factors from a probit regression of the treatment variable on these controls are below 10, suggesting that multicollinearity is unlikely to be a serious concern.

4.4. Instruments

We include instruments $\boldsymbol{z}_i$ that are relevant for predicting selection in equation (2), i.e., the coefficients $\boldsymbol{\alpha}_z$ are nonzero. The instruments should also satisfy the exclusion restriction, i.e., they are uncorrelated with the error term e_i. In other words, the instruments $\boldsymbol{z}_i$ affect the outcome y_i only through D_i. We propose two instruments for our analysis, as also presented in Table 1. We next describe each instrument in more detail.

The first instrument, $MEAN.PCT$, is defined for a consumer i as the percentage of mixed currency redemptions (out of all air ticket redemptions) for the same air ticket type (international or domestic), among consumers similar to consumer i but excluding the redemptions of consumer i, around the time of consumer i's treatment occasion. Specifically, we set a 3 day window matching bandwidth before and including consumer i's treatment occasion date, and find similar consumers with point balances that are within ±20% of consumer i's point balance in the construction of this instrument.[8] The $MEAN.PCT$ instrument satisfies the relevance condition because it captures the attractiveness of mixed currency redemptions around the time of consumer i's treatment occasion, among consumers similar to consumer i. We also confirm from the results presented in Section

[8] We also perform robustness checks with (i) program tenure and total point earnings as the consumer similarity measure, (ii) a 7 day window matching bandwidth, and (iii) a ±10% point balance matching bandwidth in Section 6.2, and our results remain robust.

Table 1 Variables in x_i and z_i.

Consumers' pre-treatment behaviors in x_i	
$EARN_i$	consumer i's mean monthly point earnings, total ('000s)
$CO.CARD_i$	consumer i's mean monthly point earnings, from cobranded credit cards ('000s)
$CARD_i$	consumer i's mean monthly point earnings, from general credit cards ('000s)
$COMMERCIAL_i$	consumer i's mean monthly point earnings, from commercial partners ('000s)
$PT.PURCHASE_i$	consumer i's mean monthly point earnings, from direct point purchases ('000s)
$REDEEM_i$	consumer i's mean monthly point redemptions, total ('000s)
$NON.AIR_i$	consumer i's mean monthly point redemptions, on non-air travel ('000s)
$REDEEM.N_i$	consumer i's mean monthly number of air ticket redemption transactions
Consumer demographics in x_i	
$TENURE_i$	consumer i's program membership in years
$ELITE_i$	indicator variable for consumer i's elite tier status (1: elite, 0: non-elite)
AGE_i	consumer i's age in years
$FEMALE_i$	indicator variable for consumer i's gender (1: female, 0: non-female)
Treatment occasion parameters in x_i	
$PRICE_i$	full point price of consumer i's air ticket during the treatment occasion ('000s)
$YEAR.WEEK_i$ indicators	indicator variables for the year-week of the treatment occasion for consumer i
$BALANCE_i$	consumer i's point balance during the treatment occasion ('000s) *(only included in augmented outcome equation)*
$DEPLETE_i$	consumer i's point balance depletion relative to their personal target redemption level during the treatment occasion, $\max\left(\frac{\text{target redemption level}-\text{points balance}}{\text{target redemption level}}, -2\right)$ *(only included in augmented outcome equation)*
Instruments in z_i	
$MEAN.PCT_i$	percentage of mixed currency redemptions of other consumers similar to consumer i for the same air ticket type, in the 3 day window before and including the treatment occasion date, *excluding* the redemption decisions of consumer i
$ROUND.PRICES_i$	indicator variable (1: at least half of the money prices in the mixed currency redemption menu during the treatment occasion are round number prices, i.e., ending in .00, 0: otherwise)

Note: The $DEPLETE_i$ variable follows the construction in Lim et al. (2024). Its upper bound is 1 and we restrict its lower bound to -2, so that hoarding very large point balances does not have an outsized effect on this variable, since the effect of point balance is separately captured. A consumer's target redemption level is defined as the mean of their past redemptions up to and including the day of the treatment occasion. Following Freeman et al. (2021), we exclude the variables $BALANCE_i$ and $DEPLETE_i$ in the selection equation (2) to prevent the issue whereby the binary outcome variable can be separated along these variables, and the maximum likelihood algorithm for the probit model may not converge.

5.1 that the coefficient of $MEAN.PCT$ is positive and statistically significant at the 1% level. By construction, this instrument excludes the redemption decisions of consumer i, and the redemption decisions of other consumers should not directly affect the earning and redemption activities of the focal consumer in the following months after the treatment occasion date. Therefore, this instrument should also satisfy the exclusion restriction.

Similar instruments that capture the mean treatment level of others have been widely used in the literature. For example, Allon et al. (2023) study the labor decisions of drivers on a ride hailing platform, and use other drivers' average hourly offers as an instrument for a focal driver's hourly earnings. They construct this instrument by obtaining a set of drivers by matching on dimensions such as availability for work and past work shift decisions. Similarly, Xu et al. (2023) study the incentive structure of a delivery platform, and use the average earnings of other workers on a

delivery platform (excluding the focal worker) as an instrument for the earnings of the focal worker on the same day. Chang et al. (2016) study firms' endogenous decisions to diversify, and use an industry level instrument that captures the proportion of firms that choose to diversify and that are in the same industry as the focal firm. They use this mean treatment level as an instrument to proxy for the attractiveness of diversification.

The novel second instrument, $ROUND.PRICES$, is uniquely developed by leveraging contextual knowledge of the program. This instrument captures the round number money prices offered to consumers in the mixed currency menu, where round number money prices are defined as money prices that end with the decimal digits .00 (Wieseke et al. 2016). Specifically, we define the $ROUND.PRICES$ instrument as an indicator variable which takes on the value 1 if at least half of the money prices in the menu are round prices, and 0 otherwise. To the best of our knowledge, we are the first to propose this novel use of round number money prices as an instrument for consumers' redemption payment choices.

As described in Section 3.1, when consumers proceed with redemption for a product, they are presented with a menu of mixed currency price options. As an illustration, consider the following mixed currency menu:[9]

| 4,000 points + \$25.62 | 3,000 points + \$40.00 | 2,000 points + \$46.00 |

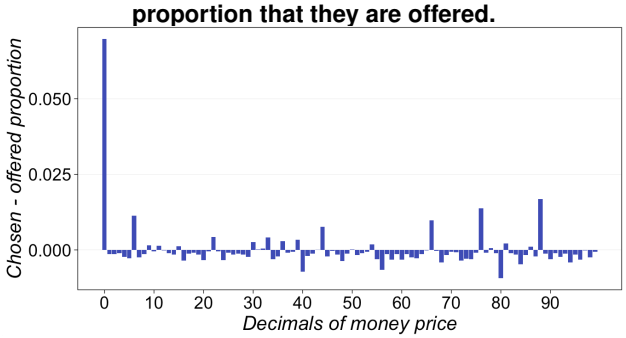
In this example, 2/3 of of the money prices in the menu are round number money prices, and 1/3 are non-round number money prices. Therefore, the instrument takes the value 1. We show in the results presented in Section 5.1 that, after controlling for other variables in $\boldsymbol{x}_i$, this instrument is positively correlated with consumers' selection into treatment and is statistically significant at the 1% level. This instrument is relevant for predicting treatment because it serves as a proxy for the cognitive simplicity of the price menu. Deciding on a specific mixed currency choice from among the full menu of options might be cognitively demanding since consumers need to consider many mixed point and money prices, and the exchange rates being offered. A cognitively simpler mixed currency menu can ease this evaluation process and increase the use of mixed redemptions.

Both model-free evidence and existing literature support this logic. Figure 3 presents empirical evidence confirming consumers' tendencies to choose round number money prices from mixed currency price options. In the literature, Wadhwa and Zhang (2015) find that round number prices can lead to higher purchase intentions compared to non-round prices. Similarly, Wieseke et al.

[9] These mixed currency money prices are for illustration only, and do not reflect the firm's actual pricing. We exclude the full point redemption option because the money price of the full redemption option is trivially \$0 and is always a round price.

(2016) examine consumers' reaction times to prices and find that round number prices are more cognitively accessible and can increase sales.

Figure 3 Round number money prices in mixed currency redemption menus are over-chosen relative to the proportion that they are offered.



Note. The chosen proportion refers to the proportion of times that a money price ending in the given decimals is chosen by consumers. The offered proportion refers to the proportion of times that a money price ending in the given decimals is offered.

This instrument also satisfies the exclusion condition, as its value is exogenously determined and varies in a non-systematic manner, and is independent of individual transactions. Exogenous variation in the round money prices naturally arises from multiplying substituted points by the internal points-to-money exchange rate, which is not adjusted to target specific decimal figures. Therefore, this instrument is unlikely to have a direct effect on consumers' subsequent program activities.

5. Empirical Results

In this section, we describe the results of the selection and outcome stages, followed by an analysis of different consumer segments to understand how they may respond differently to mixed currency redemptions. Finally, we explore potential mechanisms that may explain the results.

5.1. Selection stage

Table 2 shows the results of the probit regression of selection equation (2). All 3 columns include the two instrumental variables, but column 1 includes only consumers' pre-treatment behaviors as control variables, and columns 2 and 3 incrementally add consumer demographics, and treatment occasion parameters as control variables, respectively. We compare the model fits with the Akaike information criterion (AIC) score. The AIC is defined as the log likelihood of the model with the number of estimated parameters subtracted. This score is then multiplied by -2. The AIC therefore rewards model fit as indicated by the log likelihood, and penalizes the number of model parameters used to estimate the model. Smaller AIC values indicate better model fit. We find that the signs

Table 2 Probit regression of selection equation (2), with instruments.

	(1)	(2)	(3)
EARN	−0.063*** (0.006)	−0.051*** (0.006)	−0.088*** (0.008)
CO.CARD	0.022*** (0.007)	0.011 (0.007)	0.016* (0.009)
CARD	0.035*** (0.007)	0.026*** (0.007)	0.038*** (0.008)
COMMERCIAL	0.048** (0.021)	0.034* (0.019)	0.069*** (0.024)
PT.PURCHASE	0.060*** (0.009)	0.047*** (0.009)	0.062*** (0.010)
REDEEM	0.022*** (0.004)	0.024*** (0.004)	0.029*** (0.004)
NON.AIR	−0.026* (0.015)	−0.030* (0.016)	−0.030 (0.023)
REDEEM.N	0.783*** (0.080)	0.799*** (0.080)	1.248*** (0.099)
TENURE		−0.011*** (0.002)	−0.015*** (0.002)
ELITE		−0.094*** (0.027)	−0.134*** (0.028)
AGE		−0.004*** (0.001)	−0.006*** (0.001)
FEMALE		0.000 (0.019)	0.019 (0.020)
PRICE			0.007*** (0.000)
MEAN.PCT	2.948*** (0.276)	2.919*** (0.279)	2.728*** (0.259)
ROUND.PRICES	0.401*** (0.019)	0.408*** (0.019)	0.342*** (0.020)
YEAR.WEEK variables	N	N	Y
N	26,994	26,994	26,994
AIC	22,583	22,481	21,832

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors in parentheses.

and magnitudes of the estimated coefficients remain relatively stable as we include more control variables, and the full model in column 3 yields the best model fit.

As expected, we find that consumers who earn more points in total are less likely to make partial redemptions with mixed currencies. Controlling for total points earned, consumers who earn more points from credit cards, commercial partners, and direct point purchases instead of air travel (the omitted base category) are also more likely to use mixed currency redemptions. In addition, consumers who redeem more points in total and make more air ticket redemption transactions are more likely to redeem with mixed currencies. Next, analyzing the effects of consumer demographics and point price, we find that consumers with longer program tenure, elite status, and older age are less likely to perform mixed currency redemptions. If the point price is high, consumers are more likely to use mixed currency redemptions.

Next, we assess the relevance and strength of the proposed instruments. Table 2 reports that the coefficients on both instruments are statistically significant at the 1% significance level, providing strong evidence of their relevance in predicting consumer selection into treatment. The effective F-statistic (Montiel-Olea and Pflueger 2013) for the instruments is 87.5, which is well above the conventional threshold of 10 (Andrews et al. 2019). This alleviates potential concerns regarding

Table 3 Post-treatment consumer point earning, money spending, and point redemption behaviors.

All consumers' post-treatment outcomes, $N = 26,994, N_{treat} = 4,288, N_{control} = 22,706$								
	Points earned					**Money spent**	**Points redeemed**	
	air travel	cobranded card	general card	commercial	direct point purchase	direct point purchase	air travel	non-air travel
Treatment, D_i	−0.215	0.312	0.097	0.240	0.724**	8.768**	3.343***	0.154
	(0.262)	(0.285)	(0.646)	(0.221)	(0.298)	(3.531)	(0.949)	(0.142)
$\hat{\lambda}_i$	0.155	−0.144	0.063	−0.137	−0.326**	−4.005**	−1.257**	−0.092
	(0.150)	(0.161)	(0.369)	(0.130)	(0.158)	(1.883)	(0.538)	(0.079)
R^2	0.72	0.70	0.22	0.09	0.13	0.13	0.42	0.04

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors in parentheses are based on 1,000 bootstrap replications.
All dependent variables (DVs) are mean monthly levels. Points DVs are in thousands, and money DV is in dollars.
Points redeemed include the full point price for mixed currency redemptions.

weak instruments.[10] The instruments remain significant even after controlling for pre-treatment point earning and redemption patterns, demographic variables, point price, and seasonality effects. Specifically, a 10 percentage point increase in the proportion of mixed currency redemptions of other consumers ($MEAN.PCT$) around the treatment occasion date increases the focal consumer's probability of mixed currency redemption by 6.8 percentage points, on average.[11] In addition, if the mixed currency price menu is comprised of at least 50% round number money prices ($ROUND.PRICES$), i.e., it is cognitively simpler, consumers are on average 7.7 percentage points more likely to use mixed currency redemptions than when it is not. To the best of our knowledge, this is the first study to leverage round number money prices as an instrument for consumers' redemption choices. The empirical results also provide additional field evidence consistent with the idea that consumers are more likely to select price options that are cognitively simpler.

5.2. Outcome stage: post-treatment consumer behaviors

Table 3 shows the main results of the augmented outcome equation (3). Accounting for endogenous self-selection and other relevant control variables, we find that mixed currency redemptions increased monthly point earning and money spending on direct point purchases, compared to full point redemptions. The higher level of monthly point purchases is economically meaningful, and can be sufficient for redeeming a domestic round trip air ticket per year. Interestingly, the higher

[10] In the absence of formal weak instrument diagnostics for control function models with nonlinear first stages, we follow standard empirical practice by reporting the effective F-statistic from the 2SLS framework as a practical proxy for assessing instrument relevance (see, e.g., Freeman et al. 2021, Chang et al. 2016).

[11] All effect sizes are obtained by computing the difference between the predicted probabilities of treatment at two different levels of a variable of interest. From the selection equation (2), the predicted probability of treatment is $\Phi(\alpha_0 + \boldsymbol{\alpha_z}'\boldsymbol{z}_i + \boldsymbol{\alpha}'\boldsymbol{x}_i)$. Due to the non-linearity, the effect sizes differ when we shift $\boldsymbol{z}_i$ for different consumers, and we take the mean of the consumer-specific effect sizes.

level of point earning from direct point purchases does not come at the expense of point earnings from other accrual sources such as air travel, credit cards, and commercial purchases, which remain similar to levels observed under full point redemptions. This suggests that mixed currency redemptions deliver comparable positive rewarded behavior and point pressure effects as full point redemptions within other point earning channels, but uniquely drive higher levels of direct point purchases. In addition to changes in earning behavior, mixed currency redemptions also resulted in higher monthly air travel point redemptions. This suggests that consumers are more actively earning and burning points, reflecting stronger engagement with the program. Taken together, these results highlight the effectiveness of mixed currency redemptions in sustaining and encouraging consumer participation and engagement.[12]

Next, we quantify the profit impact of mixed currency redemptions. In the post-treatment period, when consumers earn points from air travel, credit cards, and commercial channels, or purchase points directly from the firm, the firm receives S dollars. This reflects a sale of points, either to its partners, who use the points to reward their customers, or directly to consumers. In accordance with the accounting standard of IFRS 15 (KPMG 2022), the firm recognizes a portion of the sales as revenue in the period when points are issued, deferring an amount L as deferred revenue (i.e., liability). This represents the value of the firm's future obligations related to the points earned by consumers. When consumers redeem their points, the firm recognizes the corresponding deferred revenue. At the same time, it incurs expenses associated with providing the redeemed products or services, typically paid to partner firms. Therefore, upon redemption, the firm realizes a profit of P that is the difference between the recognized deferred revenue and the associated expenses. Hence, the total profit of the firm (averaged monthly across all consumers) in the post-treatment period is total sales minus deferred revenue, plus realized profit, i.e., $S - L + P$. To isolate the contribution of mixed currency redemptions to this total, let S_T, L_T, and P_T denote the portions of sales, deferred revenue, and realized profit, respectively, that are attributable specifically to the effects of mixed currency redemptions. In their absence, the firm's profit would be $(S - S_T) - (L - L_T) + (P - P_T)$. Accordingly, the profit contribution of mixed currency redemptions is $\Pi_{mix} = \frac{S_T - L_T + P_T}{(S-S_T)-(L-L_T)+(P-P_T)}$.

We use information from our data to compute each component starting with $S = p_{earn}\bar{\tau} + m_{purch} + m_{mix}$, where p_{earn} is the total points that consumers earn per month on average from air travel, credit

[12] To preserve data confidentiality, the estimates are scaled by undisclosed multiplicative factors. This prevents the disclosure of sensitive information. It is important to note that this rescaling affects only the magnitudes of the estimated coefficients and does not alter the direction, statistical significance, model fit, and interpretation of the results.

cards, or commercial channels, $\bar{\tau}$ represents the average selling price of a point (in dollars) charged to its partners, m_{purch} is the average monthly money amount consumers pay to directly purchase p_{purch} points from the firm, and m_{mix} is the average monthly money amount that consumers pay in the cash portion of mixed currency redemptions, which substitutes for p_{mix} points. Deferred revenue is computed as $L = (p_{earn} + p_{purch} + p_{mix})\bar{\pi}$, where $\bar{\pi}$ denotes the average redemption value of a point (in dollars). Realized profit is calculated as $P = p_{redeem}(\bar{\pi} - \bar{c})$, where p_{redeem} is the monthly average number of points redeemed by all consumers, and $\bar{c}$ is the average cost of fulfilling the redemption of a point (in dollars).[13]

We next compute the sales, deferred revenue, and realized profit attributable to mixed currency redemptions, denoted S_T, L_T, and P_T, respectively. Specifically, $S_T = \beta_1^{m_{purch}} N_{treat} + m_{mix}$, where $\beta_1^{m_{purch}}$ is the additional money spent on direct point purchases per treated consumer per month, which is obtained from the results in Table 3, and N_{treat} is the number of treated consumers who used mixed redemptions. Similarly, $L_T = (\beta_1^{p_{purch}} N_{treat} + p_{mix})\bar{\pi}$, where $\beta_1^{p_{purch}}$ is the additional points purchased per treated consumer per month. Finally, $P_T = \beta_1^{p_{redeem,air}} N_{treat}(\bar{\pi} - \bar{c})$, where $\beta_1^{p_{redeem,air}}$ reflects the additional points redeemed per treated consumer per month on air travel.

The estimates for the selling price $\bar{\tau}$ and cost $\bar{c}$ of a point are not directly observed and are subject to confidentiality constraints. We therefore complement our data with information from publicly available industry reports. Using values drawn from external sources,[14] we estimate the profit lift from mixed currency redemptions to range from approximately $\Pi_{mix} \approx 3.0\%$ to $\Pi_{mix} \approx 8.8\%$, which is substantial given the scale and profitability of loyalty program operations. It also underscores how small changes in redemption structure can generate meaningful financial gains.

5.3. Segment analysis: point constrained and unconstrained consumers

The strategic implications of offering mixed currency redemptions can vary across different consumer segments. For consumers with low point balances who are point constrained (i.e., their point balance is lower than the full redemption point price), this feature lowers the barrier to redemption by enabling access to rewards that might otherwise feel out of reach. This increased accessibility

[13] Note that m_{mix}, the money payment in mixed currency redemptions, can also be viewed as paying for the indirect purchase of p_{mix} points which will be immediately redeemed. Therefore, there is an immediate deferred revenue of $p_{mix}\bar{\pi}$ which is captured as part of L. The p_{mix} points are then immediately combined with the consumer's existing points and redeemed for an air ticket worth p_{redeem} points. Therefore, there is also an immediate realized profit of $p_{redeem}(\bar{\pi} - \bar{c})$.

[14] In practice, firms structure agreements with partners to ensure a profit margin between the selling price $\bar{\tau}$ and cost $\bar{c}$ of a point. These contracts typically establish both the sales margin (the difference between the selling price $\bar{\tau}$ and redemption value $\bar{\pi}$ of a point) and the redemption margin (the difference between the redemption value $\bar{\pi}$ and cost $\bar{c}$ of a point). For example, public financial disclosures from United Airlines report that $\bar{\tau} = 0.02$ and $\bar{c} = 0.01$ (United Airlines 2020), and third-party valuations, e.g., The Points Guy (The Points Guy 2025) and NerdWallet (NerdWallet 2025), indicate that $0.011 \le \bar{\pi} \le 0.016$ for most airlines.

can encourage consumers to engage more actively with the program. However, there is a potential downside: the mixed currency redemption option may lead these consumers to use up their points more quickly (balance drainage), after which they may disengage entirely.

For high balance consumers who are unconstrained by points (i.e., their point balance is higher than the full redemption point price), mixed currency redemptions still offer added flexibility, though its practical appeal may be lower, as these users often have enough points to redeem rewards in full. Additionally, mixed currency redemptions may be viewed as partial redemptions which require some money payment in order to obtain a reward. This may dilute the symbolic value of achieving a reward purely through loyalty points, potentially weakening the positive psychological effect associated with full redemptions.

5.3.1. Balance drainage behaviors and post-treatment program activity Mixed currency redemptions may undermine a critical feature of loyalty program design: the point balance acts as a switching cost (Klemperer 1987). When consumers abandon the loyalty program, they risk forfeiting the value of any unredeemed points, creating a "lock-in" effect that encourages continued engagement. This reduction in consumer attrition can significantly increase customer lifetime value (Gopalakrishnan et al. 2021). However, by allowing consumers who are constrained by points to redeem rewards using a combination of points and cash, firms make it easier for them to drain their balance. This may inadvertently reduce the lock-in effect, leading to higher rates of consumer inactivity. Hence, some firms may be hesitant to offer mixed currency redemption options, especially given that the proportion of active consumers is a key performance indicator for the health of loyalty programs (Deloitte 2015).

In this section, we investigate consumers' point balance drainage behaviors and how this affects their program engagement. We first examine whether mixed currency redemptions make balance drainage easier and whether they lead to greater consumer inactivity. We define a consumer as having drained their point balance if they have less than 1,000 points remaining after a redemption.[15] Table 4 reports the results. In the dataset, we indeed observe that 71% of treatment group consumers drain their point balances when they perform mixed currency redemptions, compared to only 6% of control group consumers who drain their balances through full point redemptions. Interestingly, however, even though it is easier for consumers to drain their balances through mixed currency

[15] When consumers use mixed currency redemptions, they face a menu of mixed currency prices where the offered point prices are in increments of 1,000 points. If they have less than 1,000 points remaining after a mixed currency redemption, it implies that they cannot choose the next higher point price option, effectively draining their point balance as much as possible.

Table 4 Post-treatment consumer inactivity and money spending.

All consumers' post-treatment outcomes, $N = 26,994, N_{treat} = 4,288, N_{control} = 22,706$						
	1(become inactive)			Money spent on direct point purchase		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment, D_i	−0.011			8.768***		
	(0.201)			(2.656)		
$(D_i = 1) \times (Drain_i = 1), N = 3,061$		0.073	−0.159		8.798***	8.237***
		(0.202)	(0.204)		(2.663)	(2.727)
$(D_i = 1) \times (Drain_i = 0), N = 1,227$		−0.021	−0.252		10.651***	10.090***
		(0.214)	(0.217)		(2.812)	(2.892)
$(D_i = 0) \times (Drain_i = 1), N = 1,444$		0.232***			0.561	
		(0.047)			(0.813)	
$(D_i = 0) \times (Drain_i = 0), N = 21,262$			−0.232***			−0.561
			(0.047)			(0.813)
$\hat{\lambda}_i$	−0.061	−0.060	−0.060	−4.005***	−4.318***	−4.318***
	(0.114)	(0.114)	(0.114)	(1.475)	(1.483)	(1.483)
Pseudo R^2 or R^2	0.30	0.30	0.30	0.13	0.13	0.13

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors in parentheses are based on 1,000 bootstrap replications.

redemptions, we find no evidence that this increases their probability of becoming inactive in the program (Column 1; D_i, coefficient = −0.011, not statistically significant).[16]

Next, we further investigate these results by categorizing consumers into four groups. To do so, we interact the binary treatment variable, D_i, with a binary variable, $Drain_i$, which takes the value 1 if a consumer drained their point balance, and 0 otherwise. Columns 2, 3, 5, and 6 of Table 4 show the results. In Columns 2 and 5, the omitted (base) category for comparison is the control group consumers who did not drain their balances, whereas Columns 3 and 6 use control group consumers who did drain their balances as the base category.

In the absence of mixed currency redemptions, consumers who drain their balances are indeed more likely to become inactive (Column 2; $(D_i = 0) \times (Drain_i = 1)$, coefficient = 0.232, $p < 0.01$). This is consistent with the switching cost explanation: consumers who drain their balances have lower switching costs and are more likely to abandon the program. However, compared to the same base group, consumers who drain their point balances with mixed currency redemptions are not more likely to become inactive (Column 2; $(D_i = 1) \times (Drain_i = 1)$, coefficient = 0.073, not statistically significant). Moreover, they continue to contribute to firm revenue through increased money spending on direct point purchases (Column 5; $(D_i = 1) \times (Drain_i = 1)$, coefficient = 8.798, $p < 0.01$). We see similar patterns when using an alternative base group (Columns 3 and 6). Compared to consumers who drained their points with full redemptions, consumers who did so with

[16] We define a consumer as inactive if they both earn and redeem less than 1,000 points over the post-treatment period.

Table 5 **Post-treatment consumer point earning, money spending, and point redemption behaviors. D_i^c and D_i^{uc} denote the treatment effects for point constrained and point unconstrained consumers, respectively.**

All consumers' post-treatment outcomes, $N = 26,994, N^c_{treat} = 3,501, N^{uc}_{treat} = 787, N_{control} = 22,706$

	Points earned					**Money spent**	**Points redeemed**	
	air travel	cobranded card	general card	commercial	direct point purchase	direct point purchase	air travel	non-air travel
Treatment, D_i^c	−0.229	0.322	0.149	0.246	0.747**	9.035**	3.364***	0.155
	(0.262)	(0.294)	(0.661)	(0.223)	(0.299)	(3.548)	(0.978)	(0.138)
Treatment, D_i^{uc}	−0.352	0.415	0.612	0.306	0.955***	11.411***	3.549***	0.169
	(0.279)	(0.317)	(0.743)	(0.235)	(0.361)	(4.269)	(1.094)	(0.160)
$\hat{\lambda}_i$	0.179	−0.163	−0.030	−0.149	−0.368**	−4.478**	−1.294**	−0.095
	(0.151)	(0.169)	(0.381)	(0.132)	(0.162)	(1.924)	(0.560)	(0.079)
R^2	0.72	0.70	0.22	0.09	0.13	0.13	0.42	0.04

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors in parentheses are based on 1,000 bootstrap replications.
All dependent variables (DVs) are mean monthly levels. Points DVs are in thousands, and money DV is in dollars.
Points redeemed include the full point price for mixed currency redemptions.

mixed currency redemptions are not more likely to become inactive (Column 3; $(D_i = 1) \times (Drain_i = 1)$, coefficient = −0.159, not statistically significant), but again spend significantly more, which contributes to firm revenue (Column 6; $(D_i = 1) \times (Drain_i = 1)$, coefficient = 8.237, $p < 0.01$). Taken together, these results suggest that mixed currency redemptions enable balance drainage without increasing the risk of program abandonment. In contrast to common concerns, this added flexibility appears to maintain consumer engagement and enhance revenue, rather than weaken the loyalty program.

5.3.2. Post-treatment consumer behaviors and profit contribution In this section, we extend the results presented in Section 5.2, Table 3, by including separate indicators for point constrained and point unconstrained treated consumers, denoted as D_i^c and D_i^{uc}, respectively. Treated point constrained consumers are those who made mixed currency redemptions when their point balances are below the point price, and treated point unconstrained consumers are those with point balances equal to or above the point price. Of the 4,288 consumers who used mixed currency redemptions, 3,501 (82%) did so when they were point constrained, and 787 (18%) did so when they were point unconstrained. Table 5 shows the results.

Similar to the results presented in Section 5.2, after accounting for self-selection and other relevant control variables, mixed currency redemptions increased direct point purchases and air travel redemptions for both point constrained and point unconstrained consumers. Importantly, the higher levels of point earning from direct point purchases do not come at the expense of point earnings from other accrual sources such as air travel, credit cards, and commercial purchases, which remain similar to levels observed under full point redemptions.

Next, we compute the contribution of each consumer segment to the more conservative firm profit increase of 3.0% presented in Section 5.2. Using the same approach outlined previously, we quantify the profit impact separately for each segment. For the point constrained consumer segment, mixed currency redemptions increased firm profit by $\Pi^c_{mix} = \frac{S^c_T - L^c_T + P^c_T}{(S - S^c_T) - (L - L^c_T) + (P - P^c_T)}$, where S^c_T, L^c_T, and P^c_T are the sales, deferred revenue, and realized profit, respectively, that are attributable to mixed currency redemptions by point constrained consumers. For this segment, we estimate that mixed currency redemptions increased firm profit by 2.3% (which accounts for about 77% of the total profit lift). Based on a similar calculation, we also find that for the point unconstrained consumer segment, mixed currency redemptions increased firm profit by 0.7% (which accounts for about 23% of the total profit lift). Notably, while point unconstrained consumers represent only 18% of treated consumers, they contribute 23% of the total profit lift. This means their per capita contribution is approximately 28% higher than expected based on segment size. This pattern suggests that point unconstrained consumers may represent an underexplored source of value for firms.

In practice, mixed currency redemptions are typically positioned as a solution for point constrained consumers, i.e., those who struggle to accumulate enough points to redeem rewards in full. This intent is clearly reflected in how firms promote the feature. For example, Air Canada markets its Points + Cash redemption option as a way for consumers who "don't have enough points for a flight reward ... to take the trip [they] want".[17] Similarly, Accor promotes their mixed currency redemption option to consumers who "haven't quite got enough points" for a hotel stay.[18] Interestingly, JetBlue's approach is notable for its broader framing. While the airline still targets consumers who are "short on points for an award trip" for its Cash + Points redemption option, it also acknowledges a second, often overlooked segment: consumers who "do have a high point balance". .[19] Although this kind of positioning remains rare in practice, our findings underscore its relevance and highlight the profit potential associated with engaging point unconstrained consumers through mixed currency redemption options.

More generally, these results suggest that firms may benefit from broadening how they frame and position mixed currency redemption options. Traditionally viewed as a fallback for point limited members, these options also support high value engagement from point rich consumers. Actively engaging this segment could help unlock additional revenue potential, yet it remains largely overlooked in current loyalty strategies.

[17] https://www.aircanada.com/ca/en/aco/home/aeroplan/redeem/air-canada.html

[18] https://all.accor.com/loyalty-program/use/booking-with-points/index.en.shtml

[19] https://www.jetblue.com/trueblue/using-points

5.4. Mechanisms

Having established the positive impact of mixed currency redemptions, we now explore several plausible behavioral mechanisms that may help explain the observed patterns further, as a complement to the main findings. While the observational nature of the dataset limits the ability to formally test these mechanisms, we present suggestive evidence.

One potential mechanism is that the observed effects are driven by heightened rewarded behaviors and point pressures following mixed currency redemptions. The literature on the rewarded behavior effect finds that consumers increase their purchases and engagement levels with the firm after receiving a reward (Bijmolt et al. 2010, Taylor and Neslin 2005, Dorotic et al. 2014). Similarly, the literature on the point pressure effect finds that consumers increase their purchases when they are closer to a redemption goal (Liu et al. 2021, Kivetz et al. 2006). Mixed currency redemptions may amplify both effects by allowing consumers to redeem more easily and more frequently. Additionally, by lowering the number of points required for redemption, mixed currency options may create the perception that consumers are closer to their next reward, reinforcing the motivation to continue earning points. If this mechanism is the primary driver, we should observe increased engagement across multiple earning channels as documented in prior literature, consistent with a general post-reward behavioral lift.

Another potential mechanism is the enhanced perception of flexibility and control. Mixed currency redemption design offers more choices over the structure of redemptions. The notion that perceived control increases engagement and satisfaction is well established in behavioral science. According to Self-Determination Theory (Deci and Ryan 1985), autonomy, which is defined as the experience of acting with a sense of volition and self-endorsement, is a core psychological need that enhances intrinsic motivation. This logic has also been applied to loyalty programs. For example, the literature finds that flexible redemption policies, such as the absence of black-out dates for hotel stay redemptions, can increase consumers' commitment to a program and their desire to achieve rewards (Melancon et al. 2011). This mechanism suggests that consumers derive psychological satisfaction from the act of redeeming itself, as they exercise autonomy in tailoring redemptions to their preferences, even when the monetary value of the redemption (i.e., the effective value of points used) is not maximized. Thus, if this mechanism is indeed a key driver, we would expect to observe greater redemption frequency and diversity in redemption choices, including variation in the types of products selected and in the monetary value of redemptions. Such patterns would reflect consumers' preferences for flexibility and alignment with personal preferences.

Table 6 Post-treatment consumer behaviors. Analysis is restricted to consumers for whom we observe both the pre and post-treatment outcomes. We control for consumers' pre-treatment levels of the outcome of interest in both the selection and augmented outcome equations.

All consumers' post-treatment outcomes					
	# of airlines redeemed with	# of routes redeemed on	Mean days bet. pt. earning and redemption	% redemptions at baseline point prices	% high point value tickets
Treatment, D_i	0.030 (0.047)	0.054 (0.077)	−9.282 (7.808)	0.131** (0.059)	0.252*** (0.060)
N	26,994	26,994	5,748	6,051	6,051
R^2	0.29	0.32	0.14	0.06	0.54

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors in parentheses are based on 1,000 bootstrap replications.

A third potential mechanism is cognitive in nature: mixed currency redemptions may enhance consumers' abilities to evaluate point values by presenting combinations of point and money prices together. Numerical information, such as prices, is easier to evaluate when options are presented jointly (Nowlis and Simonson 1997), and such comparisons can facilitate tradeoff assessments across different price dimensions (Hsee et al. 1999). When consumers use a mixed currency redemption, they choose from a menu of price options. Each option is a combination of a point price and a money price, e.g., 5,000 points + $0, 4,000 points + $25.62, and so on. This can make it easier for consumers to compare the tradeoff between point and money prices, and they may view the two options as substituting 1,000 points with $25.62. This increased salience and transparency of point values may empower consumers to make more informed redemption decisions, which in turn can lead to greater engagement with the loyalty program. Thus, if this cognitive mechanism is the main driver, we would expect consumers to increasingly redeem points for options that offer greater monetary value in terms of point efficiency, as mixed currency redemptions help clarify the cash equivalent value of points. This improved understanding may also boost confidence in the utility of points, potentially leading to increased point purchase behavior.

The results in Sections 5.2 and 5.3 show that mixed currency redemptions uniquely increase consumers' direct point purchases, but do not significantly increase consumers' point earning activities through other channels such as air travel, credit cards, and commercial purchases compared to full point redemptions. That is, while there is evidence of increased engagement, it appears to be concentrated in the form of direct point purchases, rather than reflecting a broader post-reward lift or point pressure across multiple earning channels. Thus, this pattern only provides partial support for the first mechanism. Nevertheless, the mechanism cannot be conclusively ruled out, as the increase in point purchases may still reflect a heightened sense of engagement following a reward, or a greater sense of urgency to accumulate points as the next redemption threshold is closer.

Additional evidence in Table 6 of this section provides little support for the second mechanism. We find no increase in the variety of airlines (*# of airlines redeemed with*) and the variety of routes (*# of routes redeemed on*) that are redeemed. Mixed currency redemptions also do not increase the frequency of point earning and redemption activities: the average number of days between point earning and point redemption events (*Mean days bet. pt. earning and redemption*) remains statistically indistinguishable from that under full point redemptions. These findings might suggest that mixed currency redemptions do not significantly enhance consumers' perceptions of autonomy in redemption behavior.

On the other hand, several results align closely with the third, cognitive mechanism. As discussed earlier, mixed currency redemptions lead to higher levels of direct point purchases, a behavior that requires consumers to make explicit value judgments about whether purchasing points is worthwhile. In addition, as shown in Table 6, mixed currency redemptions drive more efficient point usage, often involving redemptions that offer higher point values such as air tickets with static baseline point prices rather than dynamically upward-adjusted prices (*% redemptions at baseline point prices*), and high point value routes or cabin types, (*% high point value tickets*). In this program, these types of redemptions are typically considered "sweet spots", as they yield greater point value and reflect more value conscious usage.

Collectively, these patterns suggest that mixed currency redemptions improve consumers' abilities to evaluate point values, leading to more informed and value-driven engagement with the loyalty program. Among the mechanisms considered, the evidence is most consistent with, and provide the strongest support for the cognitive mechanism.

6. Robustness Checks

In this section, we conduct three types of robustness checks. First, we assess the stability of our results by constructing alternative treatment and control groups. Second, we evaluate the robustness of our conclusions across different instrument definitions. Third, we compare our main findings with estimates obtained using different econometric approaches.[20] Appendix A, Table A.1, shows the results.

[20] For computational efficiency, we report heteroskedasticity robust standard errors in the robustness checks, instead of bootstrapped standard errors which is computationally more intensive. Even though this does not fully capture the uncertainty in the estimation of $\hat{\lambda}_i$ in the augmented outcome equation, the standard errors are still close to those reported in the main results and our inferences remain robust.

6.1. Different compositions of treatment and control groups

In our main analysis, we compare the post-treatment behaviors of consumers who used mixed currency redemptions, with consumers who used full point redemptions. We set a minimum activity observation period pre and post-treatment of 6 months. We conduct a number of robustness checks by varying the compositions of the treatment and control groups, and the main results and conclusions remain robust.

- **Short observation period (Short obs.)**: We set a shorter activity observation period pre and post-treatment of 5 months. This results in a longer treatment occasion observation period, and consequently larger treatment and control groups.
- **Long observation period (Long obs.)**: We set a longer activity observation period pre and post-treatment of 7 months. This results in a shorter treatment occasion observation period, and consequently a smaller sample size.
- **New point purchasers (New purch.)**: In the main results, we find that mixed currency redemptions increase consumers' direct point purchases. We assess the robustness of the results by restricting the analysis to only those consumers who had not purchased points during the pre-treatment period, i.e., they are new point purchasers in the post-treatment period. The results show that mixed currency redemptions also increased these consumers' direct point purchases. This provides further support for the cognitive mechanism such that consumers unfamiliar with direct point purchases start earning through this channel, due to the increased awareness of point values from performing mixed currency redemptions.

6.2. Different instrument definitions

We explore the robustness of our findings to alternative instrument definitions. The main results and conclusions remain stable across these variations, further supporting their robustness.

- **Alt.** $MEAN.PCT$ **1**: In the construction of the $MEAN.PCT$ instrument, similar consumers are defined to be those who have similar program tenure (within ±20%) with consumer i.
- **Alt.** $MEAN.PCT$ **2**: In the construction of the $MEAN.PCT$ instrument, similar consumers are defined to be those who have similar total point earnings (within ±20%) with consumer i.
- **Alt.** $MEAN.PCT$ **3**: The $MEAN.PCT$ instrument is constructed as the percentage of mixed currency redemption choices among consumers similar to consumer i in the 7 day window (instead of the 3 day window in the main results) before and including the treatment occasion.
- **Alt.** $MEAN.PCT$ **4**: In the construction of the $MEAN.PCT$ instrument, similar consumers are defined to be those who have similar point balances (within ±10%) with consumer i (instead of the ±20% bandwidth used in the main results).

6.3. Different econometric approaches

In this section, we compare the main results from the instrumental variables control function approach with those obtained using alternative econometric methods.

- **Two stage least squares instrumental variables (2SLS IV)**: We implement the 2SLS IV approach. Drawing on standard practices in the literature (Wooldridge 2010, Xu 2021, Angrist and Pischke 2009), we use the fitted probability of treatment obtained from selection equation (2) as an instrument. In the first stage, the binary endogenous treatment variable is regressed linearly on the instrument and control variables. This contrasts with the control function approach used in the main results, where the first stage employs a probit model to explicitly account for the binary nature of the treatment. The findings from the 2SLS IV estimation support the robustness of our main conclusions.
- **Propensity score matching (PSM)**: We implement nearest neighbor matching with propensity scores estimated based on the variables $\boldsymbol{x}_i$ listed in Table 1 (Rosenbaum and Rubin 1983), followed by a regression of outcome equation (1) to correct any residual covariate imbalance. Propensity score matching relies on the assumption of unconfoundedness, i.e., treatment assignment is independent of potential outcomes conditional on controlled covariates. In our context, this assumption is likely violated, as consumers may self-select into treatment based on unobserved variables. Nevertheless, we find that the estimated treatment effects are directionally consistent with our main results.
- **Causal random forest (CRF)**: The causal random forest method (Wager and Athey 2018, Athey et al. 2019) estimates an average treatment effect without assuming linear effects of the control variables $\boldsymbol{x}_i$ on the outcome y_i. Instead, the relationship between $\boldsymbol{x}_i$ and y_i is modeled non-parametrically with classification trees. However, similar to PSM, CRF also relies on the unconfoundedness assumption. The estimated treatment effects are comparable in magnitude to those obtained via PSM, reflecting the shared reliance on the unconfoundedness assumption.
- **Ordinary least squares (OLS)**: The OLS approach estimates treatment effect under the assumption that all confounding variables are controlled for, and it does not address potential endogeneity when selection into treatment depends on unobserved factors. The results from OLS exhibit the same directional effects as those reported in our main analysis.

7. Managerial Implications and Conclusion

Many consumers find it difficult to redeem their hard-earned points. Without redeeming points for meaningful rewards, they may lose motivation to continue earning, and firms risk forfeiting a

valuable revenue stream. To address this, some firms have explored mixed currency redemptions, which allow consumers to combine points with money and thereby lower redemption barriers.

Yet this innovation poses a strategic dilemma. On one hand, mixed currency redemptions increase accessibility and can enhance engagement by making rewards more attainable. On the other hand, requiring a monetary payment may reduce the psychological value of "free" rewards. Additionally, the ease of redeeming small point balances could trivialize rewards or unintentionally weaken the program's lock-in effect by encouraging consumers to deplete their balance and disengage from the program altogether.

Our analysis suggests that these concerns are largely unfounded. Using data from a major coalition loyalty program, we find that mixed currency redemptions increase consumer engagement, particularly through direct point purchases. Importantly, this positive effect does not come at the expense of point accumulation from other channels. Contrary to fears of disengagement, we find no evidence that mixed currency redemptions hasten consumers' exit from the program. The findings of this study offer several managerial insights:

First, firms should consider complementing traditional full point redemptions with mixed currency options. Doing so can increase consumer engagement, especially through direct point purchases, and enhance program profitability.

Second, when offering mixed redemptions, firms can further benefit by avoiding framing them solely as a fallback for low balance consumers. While the option clearly supports this segment, our analysis shows that it also drives meaningful engagement and profit among high balance consumers. Yet in practice, this segment is often overlooked in the positioning and marketing of mixed currency redemptions. The low uptake observed among consumers with sufficient points suggests an underused opportunity. Reframing mixed redemptions to appeal beyond just those short on points could unlock further value and broaden their impact.

Third, our findings suggest a cognitive mechanism behind the observed behavioral shifts. Mixed currency redemptions enhance consumers' understanding of point value, which is reflected in increased direct point purchases and a shift toward higher value redemptions. We also find empirical evidence that cognitively simpler price menus (those with round number prices) are associated with higher usage rates of mixed currency redemption. Firms should therefore pay close attention to the design of the redemption interface. This also presents an opportunity for future research: while offering a variety of point–money combinations increases flexibility, it can also lead to choice

overload. Controlled experiments can help identify optimal mixed redemption menu structures that balance flexibility with ease of use.

Finally, our results indicate that firms should be mindful of a broader implication: as consumers become more fluent in evaluating point value, they may also become more sensitive to point prices. This could amplify negative reactions to changes such as point devaluations, inconsistent point pricing, or declines in point purchasing power. To mitigate these risks, firms should manage point valuation carefully by maintaining consistency, adjusting redemption structures gradually, and offering added incentives during pricing transitions when needed. Doing so can ensure that clearer point valuation strengthens rather than undermines consumer trust and long-term engagement.

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Appendix A: Robustness checks

Table A.1 Robustness check of main treatment effects.

	Main results	Short obs.	Long obs.	New purch.	Alt. $MEAN.PCT\,1$	Alt. $MEAN.PCT\,2$	Alt. $MEAN.PCT\,3$	Alt. $MEAN.PCT\,4$	2SLS IV	PSM	CRF	OLS
Points earned												
from air travel	-0.215	-0.120	-0.136	-0.264	-0.272	-0.217	-0.133	-0.191	-0.433	0.012	0.079	0.057*
	(0.262)	(0.228)	(0.266)	(0.276)	(0.345)	(0.369)	(0.237)	(0.309)	(0.465)	(0.044)	(0.075)	(0.032)
from cobranded card	0.312	-0.089	0.135	0.229	0.128	0.069	0.369*	0.258	0.335	0.062	0.081	0.057*
	(0.257)	(0.311)	(0.285)	(0.250)	(0.325)	(0.347)	(0.224)	(0.301)	(0.466)	(0.046)	(0.066)	(0.033)
from general card	0.097	-0.698	0.725	0.265	0.440	0.282	0.671	0.188	0.017	0.177*	0.371**	0.208***
	(0.700)	(0.870)	(0.556)	(0.661)	(0.909)	(0.986)	(1.033)	(0.819)	(1.028)	(0.105)	(0.174)	(0.079)
from commercial	0.240	-0.146	0.371	0.287	0.310	0.337	0.158	0.287	0.140	0.003	0.007	-0.003
	(0.241)	(0.108)	(0.436)	(0.282)	(0.334)	(0.371)	(0.176)	(0.295)	(0.173)	(0.016)	(0.025)	(0.016)
from direct point purchase	0.724**	0.592**	0.841***	0.383**	0.952**	0.800**	0.611**	0.908***	0.988**	0.168**	0.236**	0.148***
	(0.286)	(0.267)	(0.306)	(0.184)	(0.402)	(0.396)	(0.276)	(0.344)	(0.493)	(0.085)	(0.114)	(0.057)
Money spent												
on direct point purchase	8.768***	7.207**	10.022***	4.576**	11.907**	10.069**	8.333**	11.109***	11.234*	1.865*	2.670**	1.705**
	(3.379)	(3.203)	(3.619)	(2.160)	(4.800)	(4.772)	(3.716)	(4.109)	(5.745)	(1.009)	(1.329)	(0.677)
Points redeemed												
on air travel	3.343***	2.508*	4.107***	3.027***	4.419***	4.483***	3.231***	4.200***	4.718***	0.949***	1.317***	1.126***
	(1.040)	(1.460)	(1.031)	(0.939)	(1.327)	(1.418)	(1.016)	(1.183)	(1.728)	(0.157)	(0.275)	(0.116)
on non-air travel	0.154	0.118	0.176	0.153	0.249	0.276	0.244*	0.216	0.067	-0.020	-0.043	-0.009
	(0.138)	(0.133)	(0.157)	(0.139)	(0.170)	(0.182)	(0.146)	(0.157)	(0.258)	(0.025)	(0.037)	(0.016)
N	26,994	30,879	23,063	25,759	26,994	26,994	26,994	26,994	26,994	8,576	26,994	26,994
N_{treat}	4,288	5,098	3,368	4,017	4,288	4,288	4,288	4,288	4,288	4,288	4,288	4,288
$N_{control}$	22,706	25,781	19,695	21,742	22,706	22,706	22,706	22,706	22,706	4,288	22,706	22,706

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors in parentheses.