**Supporting Information to**

# Shifts in ridership, satisfaction, and willingness to pay when buses are electrified

## S.1 Study 1 on quantities: Transaction-based bus ridership data

**Preregistration.** By submitting a "Data Sharing Form – Academia" in August 2020, we preregistered the structure of the bus ridership data with the Land Transport Authority. Preregistration happened a year before the end of the study period: "All ride data from 1 July 2019 to 30 June 2021 on the e-bus routes of interest and other mutually agreed control bus routes… The research methodology requires identification of two types of routes: Control and Treatment routes. This dataset will only include 5 e-bus routes (treatment) and up to 10 non-e-bus routes, identified as suitable controls, to the 5 e-bus routes." We did not list specific bus lines (routes) in August 2020 because some of the transit agency's electric bus deployments were as yet unknown (Fig. 1). In July 2021, and before gaining access to any data, we specified a more balanced dataset, with 7 partially electrified and 8 always-diesel lines, totaling bus 15 lines, as we had preregistered. The transit agency extracted and shared the July 2019 to June 2021 ride data in August 2021. All analysis was conducted on the single data extraction, and only subsequent to extraction.

As described, the longitudinal dataset consists of 104 million rides on 15 fully diesel and partially electrified bus lines (Table S.1). Besides ride characteristics (e.g., bus line and origin-destination locations and times), we observe commuter characteristics, specifically, rider category (e.g., adult, senior citizen, student) and anonymized card number (e.g., a top-up farecard, bank card, or seasonal pass). As for bus characteristics, we observe the license plate of the bus for each individual ride. The transit agency also shared separate lists of license plates of electric buses (vs. diesel buses) and double-deck buses (vs. single-deck buses); no hybrid bus was deployed to any of the 15 lines during the 2-year period.

**Data handling.** To calculate the proportion of buses serving a line in each year-week that were electric or double-deck, we need to know how many trips were undertaken by the line's buses and how many of these bus trips were electric and/or double-deck. The data does not directly inform the line-period specific fleet composition, e.g., what proportion of buses serving line 991 in year-week 10 were electric and/or double-deck. So, we infer these proportions using the following procedure.

For each line, we take the modal boarding bus stop over the 2-year period, verifying that all modal stops are well frequented in all months. We then divide time into roughly 17-minute segments, i.e., one million milliseconds noting that each rider's boarding time is to the nearest millisecond. For each 17-minute segment, we count how many buses picked up riders at the line's busiest stop, and how many of these buses were electric and how many were double-deck. We then sum over 17-minute periods within each year-week. For example, of the 732 line-991 bus trips that picked up riders at modal stop 43571 (Opp Bt Gombak Stn) in year-week 10, no bus was electric and 372 buses were double-deck, thus $propBusElectric_{991,10} = \frac{0}{732} = 0$ and $propBusDoubleDeck_{991,10} = \frac{372}{732} \cong 0.51$.

This procedure can slightly overstate the number of bus trips, to the extent that a bus's stay at the stop picking up riders flows from one 17-minute segment into another, e.g., one rider taps in at 16min45sec of a 17-minute segment and another rider boarding the same vehicle from the same stop taps in at 0min15sec of the subsequent 17-minute segment. However, the overstatement is limited, e.g., $\frac{30}{(17\times60)} \cong 3\%$ if buses stay at stops for 30 seconds on average. At the same time, this procedure can slightly underestimate the number of bus trips, to the extent that a bus vehicle passes by the line's modal stop without picking up riders.

**S.2 Study 2 on mechanisms: Intercept surveys of rider satisfaction**

**Recruiting student surveyors.** While we used a professional market research firm to collect preference data in people's homes for study 3, we hired students to collect satisfaction data for study 2, given the shorter interviews in public spaces. In November 2020, we posted job openings on the NUS Student Work Scheme portal. The post informed that candidates should be interested in communicating with members of the public and would "work in pairs… at specific bus stops surveying consumers' awareness of the introduction of electric buses", and that fieldwork would start over the December break. After interviews, we selected eight students (five female, three male, aged 19-24 years, all very familiar with the Singaporean public) in years 2-4 of their undergraduate studies and majoring across a range of disciplines (Economics, Environmental Studies, Philosophy, Political Science, Social Work, Sociology, and Southeast Asian Studies).

In training sessions, each surveyor role-played once as a surveyor and once as a respondent. Surveyors provided feedback on the wording of the questionnaires and how to conduct the intercept surveys. We reviewed all steps including at what point when collecting samples to record a bus's license plate. To ensure consist field implementation, we met regularly to continue role-playing: every week at first, then spacing out to every 2-4 weeks. Meeting regularly with surveyors also signaled that we cared about the quality of their work.

Our key messages were that surveyors must avoid framing a response and that they should not worry about the number of responses collected. For example, some surveys would happen at locations and times with low commuter flows, and that was fine. Surveyors were paid by time worked, including during the regular training sessions. We experienced no attrition in surveyors.

**Intercepting commuters at bus stops and rail stations.** In addition to surveying commuters at bus stops (Section 4, Tables 5, 6, and S.3), we sent surveyors to rail stations to survey satisfaction with train rides (Table S.13). This survey consists of 559 rail commuters who were intercepted as they tapped out at 8 rail stations between January and March 2021 (Fig. 1).

**Deploying surveyors to the field.** We equipped surveyors with NUS-branded polo shirts, lanyards to carry their NUS cards, clipboards, and single-page survey printouts. We deployed surveyors in pairs, to locations and times that took their preferences into account, e.g., closer to their residence, avoiding conflicts such as classes in the later months of implementation. To avoid weary surveyors, a day's work session consisted of 90 minutes of surveys followed by a required 45-minute break and ending with another 60 minutes of surveys. We also paid surveyors during the 45-minute breaks and while commuting to and from a work location. Within surveyor, work days were spaced out. Over the survey period, work was quite balanced across the eight surveyors.

A day's work session started at a set time. We instructed surveyors to send time-stamped selfie pictures with the identifying bus stop sign (e.g., 40311 Blk 439C) or rail station[1] in the background once they and their pair were ready to start. We explained that this procedure was not about mistrust but standard quality control/quality assurance protocol. We communicated regularly with surveyors on WhatsApp and encouraged them to report any incident; no major incident was reported. Surveyors approached commuters who had just alighted and were walking away from the bus stop. Surveyors showed their NUS card and specifically pointed in the direction of where the bus had departed (or in the direction of the rail platform in the rail station survey) as

[1] Surveying commuters alighting at rail stations followed a similar protocol and here we focus on the main bus stop survey. The survey instruments are available on demand and will be published.

they asked the commuter for "help with two quick questions on that ride." Surveyors did not sample commuters waiting at bus stops, because our objective was to survey a commuter's very recent ride and assess whether their salient experience and associated perceptions varied by bus engine type. Our questions were worded as to focus away from energy technology and started with the rider's perceived service attributes (noise, fumes/smell, smoothness, and speed of the ride).

The bus stops were in quiet residential neighborhoods. Surveyors typically had some downtime between respondents. This means that surveyors approached commuters alighting from each incoming bus, e.g., all buses from lines 160M and 944 at stop 40311. We instructed surveyors to alternate an approached commuter's position off the bus lest, say, the first commuter who alights tends to be more impatient than average which could bias the sample. We focused on weekdays (with some Saturdays) and afternoons including peak hours (with some mornings).

Surveyors also recorded the number of commuters, by gender, whom they approached but declined to participate. Across 1,292 responses in the bus stop survey, on average 0.8 commuter (0.4 male, 0.4 female) declined to participate before a commuter agreed to respond (Table S.3), i.e., in total $1{,}292 \times (0.8 + 1) = 2{,}326$ commuters were intercepted and $1{,}292/2{,}326 = 56\%$ agreed to participate in the 1-minute survey. Because rail stations are bigger and busier spaces than residential bus stops, and thus the interview experience in the former is perhaps less personal, approached rail commuters were less likely to participate than bus commuters (Table S.13). Surveyors were equipped with Participant Information Sheets, which provided study details and answers to frequently asked questions, and would hand them out if respondents had questions.

Each surveyor was asked to digitize their data collection in a personalized online spreadsheet at the latest by noon the next day, and to keep the paper forms to hand in subsequently. A surveyor did not have visibility into another surveyor's spreadsheet. We checked the digitized responses within a day and clarified any issues, for example, if the surveyor had not entered the respondent's gender. Each time we clarified issues, we noted that it was reasonable to miss some variables during collection (such as the bus's license plate or the respondent's gender), given the several demands placed on the surveyor. We asked that surveyors only complete missing variables in the spreadsheet if these had been recorded on the paper form. To avoid biasing data collection, we did not discuss interim results during the ongoing training sessions (and asked surveyors to refrain from doing so too), noting that upon completion of the fieldwork we would hold a session to share findings, including on regression methods and estimation. This session took place on May 28, 2021 (ahead of the third limited-duration intercept survey); six out of eight surveyors attended.

**Knowledge of the engine type of the latest bus ride.** After stating their satisfaction with four service aspects of the bus trip they had just completed, respondents in the bus stop survey were asked to define the engine type of the bus they had just taken. Surveyors offered respondents an ordered menu, "The engine type (of) the bus you just rode on… is it Diesel, Electric, Hybrid, Other, or Don't Know?"

About one-half of respondents—and similarly across diesel vs. electric bus riders—chose the alternative Don't Know (Table S.10). Respondents may have perceived this question as tricky or quiz-like. Most Singaporean households do not own cars and, as such, may not be familiar with motor fuels. Most of Singapore's passenger cars run on petrol and thus petrol is advertised more widely than diesel. Respondents may have thought that buses with combustion engines run on petrol, and Petrol was not an option among the alternatives in the engine type question. They may not know the distinction among petroleum derivatives, i.e., diesel vs. petrol. In hindsight, we could have tested the inclusion of Petrol in the menu of possible answers to bus engine type.

It is also possible that respondents do not know the distinction between Electric and Hybrid among alternative-energy buses (battery electric vehicle, plug-in hybrid electric vehicle, hybrid vehicle, and so on). It may be that the relatively long menu of engine types the surveyor read out, including Hybrid (with only 50 hybrid buses in the entire fleet and none serving the surveyed stops) and Other as alternatives, was confusing. Don't Know was the last alternative on the menu and may have been more salient when responding. Future research can examine responses when respondents are offered a more detailed menu of responses to bus engine type.

Moreover, "engine type" when asked at the bus stop may be less simple to grasp than "bus type" as used in the choice experiment at home and with the help of a picture (study 3, Fig. 5). In addition, surveyors assessed that 30% of respondents were not proficient in English and switched to another language (Mandarin, Hokkien) for most of these cases and particularly with older respondents (Table S.3).

Despite the multiple interpretations of the observed difficulty in answering the engine type question, one can assume that respondents were knowledgeable if they alighted from a diesel bus and accurately stated that it was equipped with a diesel engine. Either they knew the engine type was diesel or thought it was fueled by a petroleum derivative "similar" to diesel and thus chose diesel. One-third of respondents who alighted from a diesel bus chose Diesel ($0.34, N = 904$). Similarly, we assume that respondents were knowledgeable if they alighted from an electric bus and accurately stated that its engine type was electric. The share of electric bus riders who defined their trip's engine type as Electric was one-quarter ($0.24, N = 338$).

The mix of diesel buses and electric buses serving some lines may have been confusing to that line's commuters, making it hard to define the engine type of the bus they had just taken. Yet when we restrict the sample to commuters in lines served only by diesel buses, such as line 991, we find similarly low rates of knowledge, with one-half choosing Don't Know vis-à-vis 36% who accurately chose Diesel. Comparing commuters in the most electrified line (944) with those in a line one-half as electrified (189, 41% electrification), the engine type powering the latest ride was similarly difficult to define. By way of advertising, single-deck electric bus labels referenced "Eco Bus" whereas double-deck electric bus labels advertised "Eco-friendly Electric Bus" (Fig. S.1). Even though double-deck electric buses had larger and more detailed environmental labels than single-deck electric buses, the engine type question was similarly difficult for commuters alighting from both types of electric buses. Because the deployment of electric buses in 2020 marked only the beginning of a transition, there was limited advertising that suggested or referenced electrification.

We nestled the engine type question between other "describe your bus" questions, on bus age (before asking about the engine) and deck number (asked after). In contrast to engine type, we find that bus age (described qualitatively) and deck number are salient, easier-to-define features of the vehicle one rides on. Most respondents described the age of the bus they had just taken as either New (50%) or OK/Normal (38%), and only a few chose Old (5%) or Don't Know (7%) (Table S.3). The low proportion of respondents choosing Don't Know when asked to describe bus age suggests that they were mostly attentive. Perceived bus age is consistent with Singapore's transit buses being retired after about a decade in service; the average age of the buses taken by respondents in our sample is 5 years. Similar to bus age, only 3% of respondents chose Don't Know when asked to describe the number of decks in their bus. Nine in 10 respondents accurately described the number of decks in their most recent bus trip, which indicates that this attribute was clear to them (Table S.10).

We examine the heterogeneity in an intercepted commuter's response when asked to define the engine type of the bus they had just taken. Table S.11 shows that commuters who (i) lived in larger dwellings, (ii) were younger, (iii) were male, or (iv) were proficient in English were more likely to accurately define the term for the energy powering their ride, and less likely to choose the alternative Don't Know, compared with commuters living in smaller apartments or who were older, female, or not proficient in English. Larger dwellings in Singapore are associated with higher household incomes per person (Salvo, 2018; DOS, 2019; Salvo, 2020). From the later subsample in which we extended the demographic questions to include the respondent's schooling, we learn that the likelihood that the respondent can identify petroleum-powered buses in operation as Diesel and Singapore's alternative-energy buses as Electric increases with formal education. These demographic differences in the difficulty of defining the engine type do not apply to describing the vehicle's deck number, which is high for all demographic groups.

**Knowledge of the engine type of trains.** After a month in the field that indicated that the engine type of buses was not straightforward to define for many respondents, and with more months of fieldwork planned, we added a question at the end of the bus stop survey to investigate whether bus commuters could describe the engine type of another public transit mode, trains, "as a point of comparison" to buses. Of the 505 bus commuters in this later subsample, 47% accurately stated that "Singapore's MRT trains" (mass rail transit) ran on electricity, and 42% chose Don't Know (Table S.3). Only 118 of the 505 bus commuters (23%) accurately defined the engine types of both their latest bus ride and that of trains. One interpretation is that Singaporeans are not familiar with the distinctions between Diesel and Petrol (this was not an option neither for buses nor for trains) or between Hybrid and Electric.

Turning to the rail station survey, of the 559 rail commuters who were asked to define the engine type of Singapore's trains, 38% accurately chose Electric from the menu of alternatives, 24% answered incorrectly (Diesel, mainly), and 54% chose Don't Know (Table S.13). Preceding the train engine type question, respondents were asked how frequently they had used rail in the previous week. That no respondent chose Don't Know when asked their rail use frequency, despite that alternative again being on the menu, suggests that they were attentive to the surveyor.

As with the engine type quiz question applied to bus commuters, we find that the likelihood that a rail commuter knows the engine type of Singapore's trains is higher for males than for females and is positively associated with an income proxy (dwelling size), education, and English proficiency (Table S.14). We do not find that frequency of rail use is associated with knowledge of train engine type.

A lower proportion of rail commuters (38%, $N = 559$, Table S.13) knew that Singapore's trains run on electricity compared with the *bus* commuters to whom we asked this same question about trains (47%, $N = 505$, Table S.3). This is despite rail commuters being even more educated than bus commuters (respectively, 90% vs. 84% having at least secondary education, and age distributions being similar).

As we learned, engine type was a tricky or confusing question to answer after hearing a menu that included Hybrid, did not include Petrol (likely a more familiar petroleum derivative to consumers than Diesel) and without the help of pictures. To provide a contrast, study 3's choice experiments at home used pictures of an oil drop and diesel pump for diesel buses and of an electric spark and battery for electric buses (Fig. 5). Compared with bus stops, we suspect that because rail stations are busier and less personal spaces, rail commuters—when unsure—may have been more likely to choose Don't Know than bus commuters.

### S.3 Study 3 on prices: Choice experiments with local neighborhood residents

**Attribute manipulation for bus-type choice experiments.** For each of thousands of potential implementations of the bus-type preference choice experiment—many more than what we would need—we started by drawing:

1. The walk time to the bus stop, in minutes, from the discrete distribution $(1, 5, 10)$ with probabilities $(\frac{1}{3}, \frac{1}{3}, \frac{1}{3})$, independently across the two alternatives A and B. Denote these random draws $walkA$, $walkB$.
2. The bus type from the discrete distribution $(electric, diesel)$ with probabilities $(\frac{1}{2}, \frac{1}{2})$, independently across the two alternatives A and B. Denote these random draws $busA$, $busB$.
3. The ride time while seated, in minutes, from the discrete distribution $(10, 15, 20)$ with probabilities $(\frac{1}{3}, \frac{1}{3}, \frac{1}{3})$, independently across the two alternatives A and B. Denote these random draws $rideA$, $rideB$.

Attribute values for walk time, bus type, and ride time were drawn independently for each of the two alternatives and independently over attributes. The box below summarizes.

"For this section, we will describe different imagined scenarios. For each question, please choose truthfully which one scenario you prefer. **There are no right or wrong answers**. This is a **matter of personal preference** and, again, your answers are anonymous."

**A**: "One bus leaves from a stop that is a **«text_walk_A» minute** walk away from your block. It is a **«text_bus_A»** bus, and the duration of the ride to reach your destination is **«text_ride_A» minutes**."

**B**: "Another bus leaves from a stop that is a **«text_walk_B» minute** walk away from your block. It is a **«text_bus_B»** bus, and the duration of the ride to reach your destination is **«text_ride_B» minutes**."

| "Which option do you prefer?" | **"Option A"** | **"Option B"** |
|---|---|---|
| Walk time to the bus stop (minutes) | «text_walk_A»<br><br>Pr(1) = 1/3<br>Pr(5) = 1/3<br>Pr(10) = 1/3 | «text_walk_B»<br><br>Pr(1) = 1/3<br>Pr(5) = 1/3<br>Pr(10) = 1/3 |
| Wait time (minutes) | Similar | Similar |
| Bus type | «text_bus_A»<br><br>Pr(Electric) = 1/2<br>Pr(Diesel) = 1/2 | «text_bus_B»<br><br>Pr(Electric) = 1/2<br>Pr(Diesel) = 1/2 |
| Ride time sitting on the bus (minutes) | «text_ride_A»<br><br>Pr(10) = 1/3<br>Pr(15) = 1/3<br>Pr(20) = 1/3 | «text_ride_B»<br><br>Pr(10) = 1/3<br>Pr(15) = 1/3<br>Pr(20) = 1/3 |

After drawing the attribute values for walk time, bus type, and ride time for each of two alternatives (within a question), we imposed some rejection rules. We deemed that the choice between the paired alternatives under these potential realizations of a question would be less informative.

4. [Identical choices] Drop the question if the three attribute values are identical across the two choices, i.e., $walkA = walkB$, $busA = busB$, $rideA = rideB$.

5. [Excessively long commute difference] Drop the question if $|walkA + rideA - walkB - rideB| \geq 10$ minutes.
6. [Likely dominant time choice] Drop the question with probability ½ whenever $busA = busB$ and either
   a. $walkA > walkB$ and $rideA = rideB$, or
   b. $walkA = walkB$ and $rideA > rideB$, or
   c. $walkA > walkB$ and $rideA > rideB$, or
   d. $walkA < walkB$ and $rideA = rideB$, or
   e. $walkA = walkB$ and $rideA < rideB$, or
   f. $walkA < walkB$ and $rideA < rideB$.

It can be shown that empirically 52% of questions implemented in this manner have exactly two attributes that differ across alternatives A and B—for example, the bus type and the ride time vary between A and B but the walk time is the same. For 25% of questions, one attribute varies across alternatives A and B (lower cognitive load). For 23% of questions, three attributes vary across alternatives A and B (higher cognitive load).

**Attribute manipulation for value-of-time choice experiments.** For each of thousands of potential implementations of the value-of-time choice experiment—many more than what we would need—we started by drawing uniformly from the distribution summarized in the box below. For each question, there are 40 possible combinations of attributes and each was sampled randomly with probability 1/40. The cost per minute of time savings are within the transit agency's previous estimates (Hess et al., 2017). Express bus fare premiums start low, since the current fare premium in Singapore is only 60 cents, yet rise considerably to include larger time savings such as 15 minutes, because riders may not respond much to saving just 5-10 minutes of time.

| Ride time (min), Regular bus | Ride time (min), Express bus | Fare ($), Regular bus | Fare ($), Express bus |
|---|---|---|---|
| 20 | 15 | 1.00 | 1.10 |
| 20 | 15 | 1.00 | 1.30 |
| 20 | 15 | 1.00 | 1.50 |
| 20 | 15 | 1.00 | 1.70 |
| 20 | 15 | 1.00 | 1.90 |
| 20 | 10 | 1.00 | 1.70 |
| 20 | 10 | 1.00 | 1.90 |
| 20 | 10 | 1.00 | 2.10 |
| 20 | 10 | 1.00 | 2.30 |
| 20 | 10 | 1.00 | 2.50 |
| 35 | 30 | 1.25 | 1.35 |
| 35 | 30 | 1.25 | 1.55 |
| 35 | 30 | 1.25 | 1.75 |
| 35 | 30 | 1.25 | 1.95 |
| 35 | 30 | 1.25 | 2.15 |
| 35 | 25 | 1.25 | 1.95 |
| 35 | 25 | 1.25 | 2.15 |
| 35 | 25 | 1.25 | 2.35 |
| 35 | 25 | 1.25 | 2.55 |
| 35 | 25 | 1.25 | 2.75 |
| 35 | 20 | 1.25 | 2.15 |
| 35 | 20 | 1.25 | 2.45 |
| 35 | 20 | 1.25 | 2.75 |
| 35 | 20 | 1.25 | 3.05 |
| 35 | 20 | 1.25 | 3.35 |
| 50 | 45 | 1.50 | 1.60 |
| 50 | 45 | 1.50 | 1.80 |
| 50 | 45 | 1.50 | 2.00 |
| 50 | 45 | 1.50 | 2.20 |
| 50 | 45 | 1.50 | 2.40 |
| 50 | 40 | 1.50 | 2.20 |
| 50 | 40 | 1.50 | 2.40 |
| 50 | 40 | 1.50 | 2.60 |
| 50 | 40 | 1.50 | 2.80 |
| 50 | 40 | 1.50 | 3.00 |
| 50 | 35 | 1.50 | 2.40 |
| 50 | 35 | 1.50 | 2.70 |
| 50 | 35 | 1.50 | 3.00 |
| 50 | 35 | 1.50 | 3.30 |
| 50 | 35 | 1.50 | 3.60 |

Notes: Across panels from top to bottom: (i) Express bus 5 minutes faster than 20-minute Regular bus @ $1, and Express fare increases at $0.20 increments starting with $0.10 premium over Regular fare; (ii) Express bus 10 minutes faster than 20-minute Regular bus @ $1, and Express fare increases at $0.20 increments starting with $0.70 premium over Regular fare; (iii) Express bus 5 minutes faster than 35-minute Regular bus @ $1.25, and Express fare increases at $0.20 increments starting with $0.10 premium over Regular fare; (iv) Express bus 10 minutes faster than 35-minute Regular bus @ $1.25, and Express fare increases at $0.20 increments starting with $0.70 premium over Regular fare; (v) Express bus 15 minutes faster than 35-minute Regular bus @ $1.25, and Express fare increases at $0.30 increments starting with $0.90 premium over Regular fare;

(vi) Express bus 5 minutes faster than 50-minute Regular bus @ $1.50, and Express fare increases at $0.20 increments starting with $0.10 premium over Regular fare; (vii) Express bus 10 minutes faster than 50-minute Regular bus @ $1.50, and Express fare increases at $0.20 increments starting with $0.70 premium over Regular fare; and (viii) Express bus 15 minutes faster than 50-minute Regular bus @ $1.50, and Express fare increases at $0.30 increments starting with $0.90 premium over Regular fare.

**Appendix Figures**


**Fig. S.1.** Labels on the outside body of single-deck and double-deck electric buses. Single-deck and double-deck electric buses varied on where the labels were placed, as shown, e.g., “Eco Bus” label by the front door used for boarding the single-deck 944, “Eco-friendly Electric Bus” label on the side by the rear of the double-deck plying line 189. Note that green painting did not distinguish electric buses because Singapore’s diesel buses were often painted green. Source: Authors’ pictures.

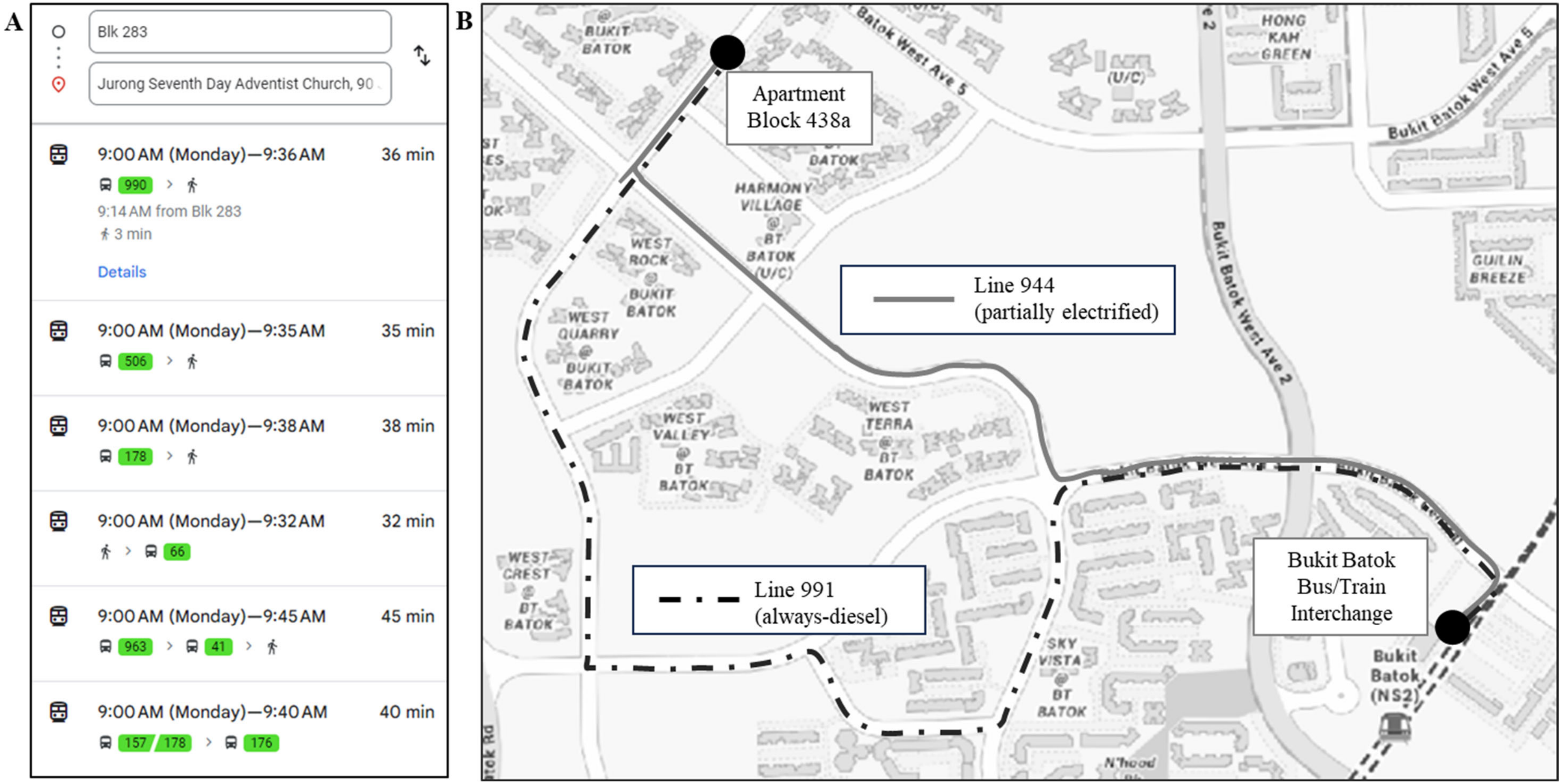



**Fig S.2.** Illustrating Singapore's dense public transit network. **A.,** For a relatively long trip—i.e., a given origin-destination pair, Apartment Block 283 to the Jurong Seventh Day Adventist Church—a trip planner (Google Maps) shows that six alternative public transit routes are available at that time to commuters. The six alternatives illustrated here are all on public buses, may use multiple buses from different lines, and may require alighting and boarding at nearby but different bus stops; trip duration ranges from 32 to 45 minutes. **B.,** Even for a relatively short trip—i.e., Bukit Batok Bus/Train Interchange to Apartment Block 438a—the map shows two alternative bus lines are available to commuters. Source: Google Maps.

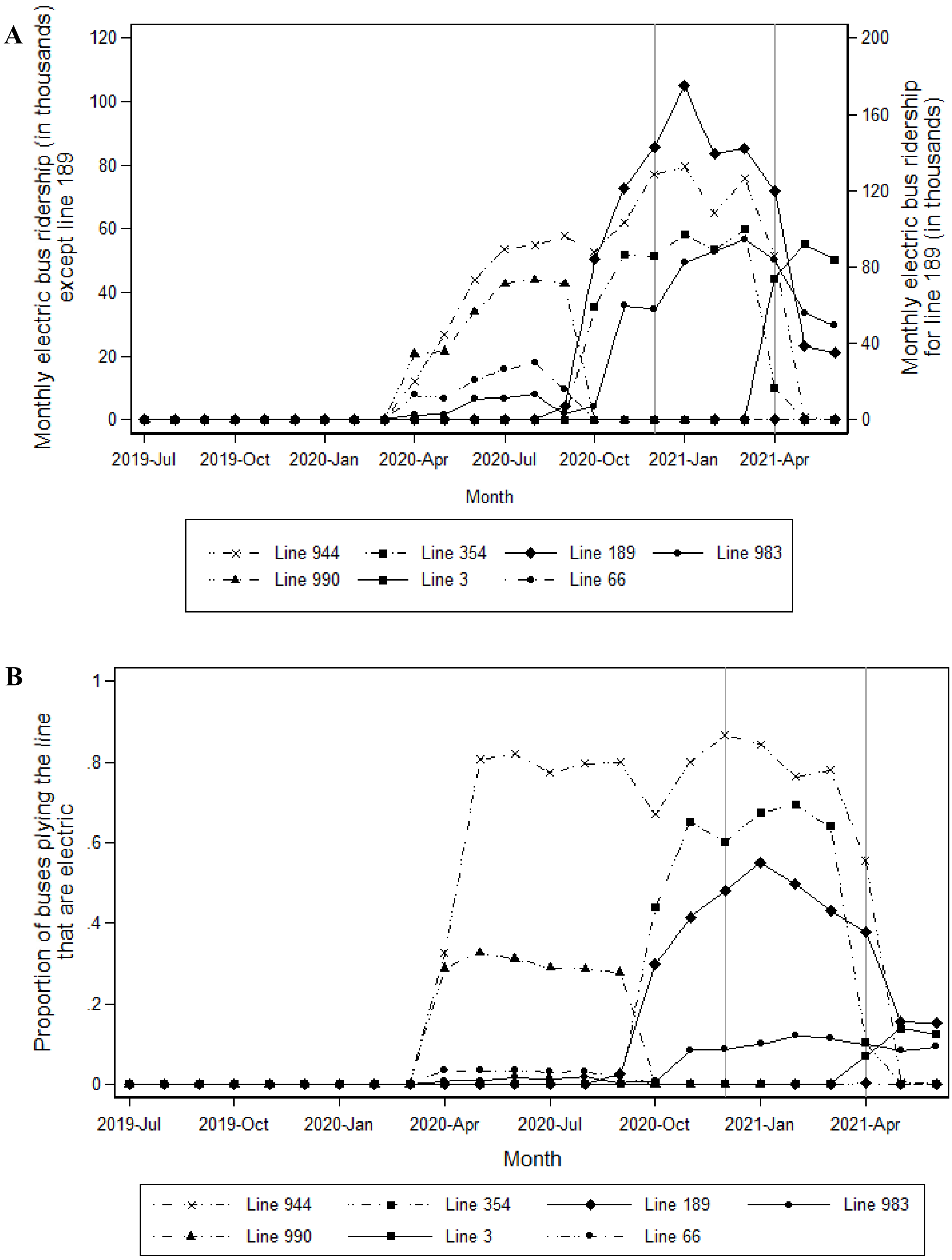



**Fig. S.3. A.,** Monthly electric bus ridership on the seven bus lines served by electric buses in the bus ridership data. **B.,** Proportion of buses serving the seven bus lines that are electric. December 2020 to April 2021 mark the period of the bus stop survey, which focused on rider satisfaction. Source: Bus ridership data.

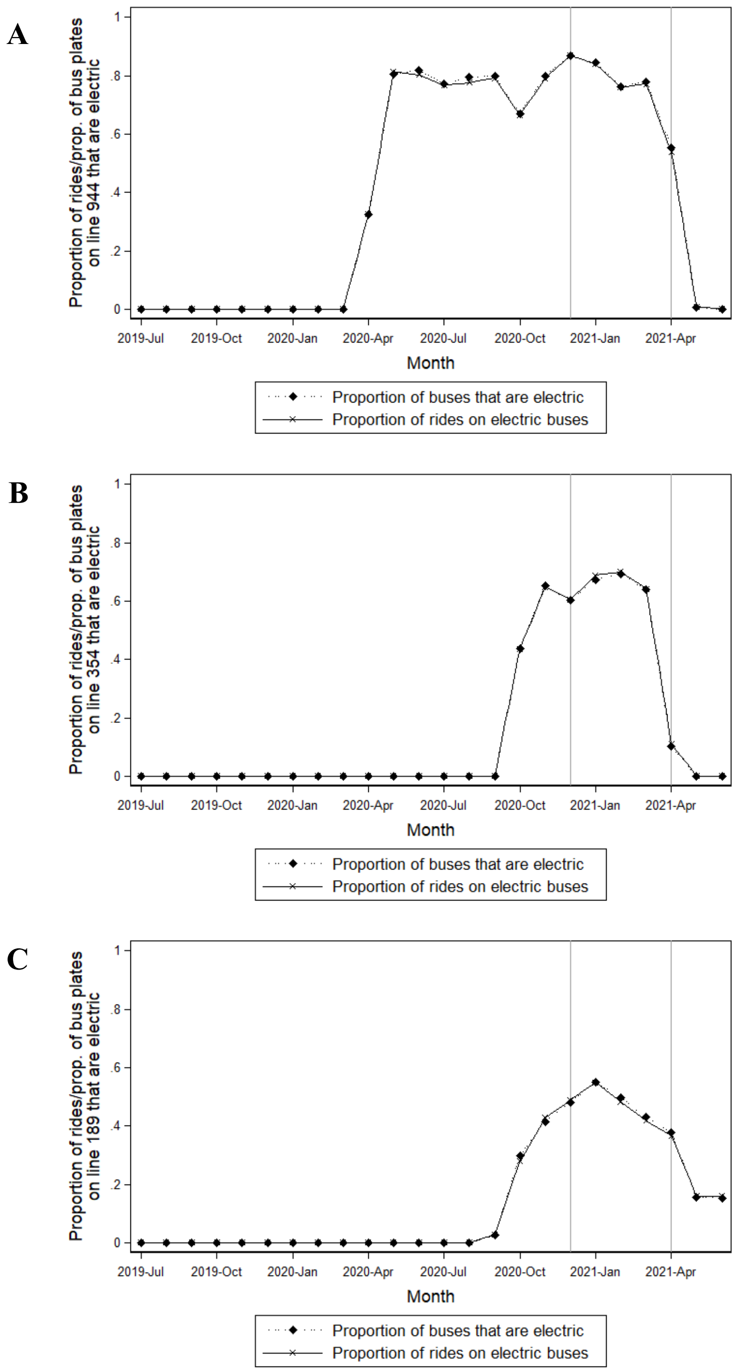
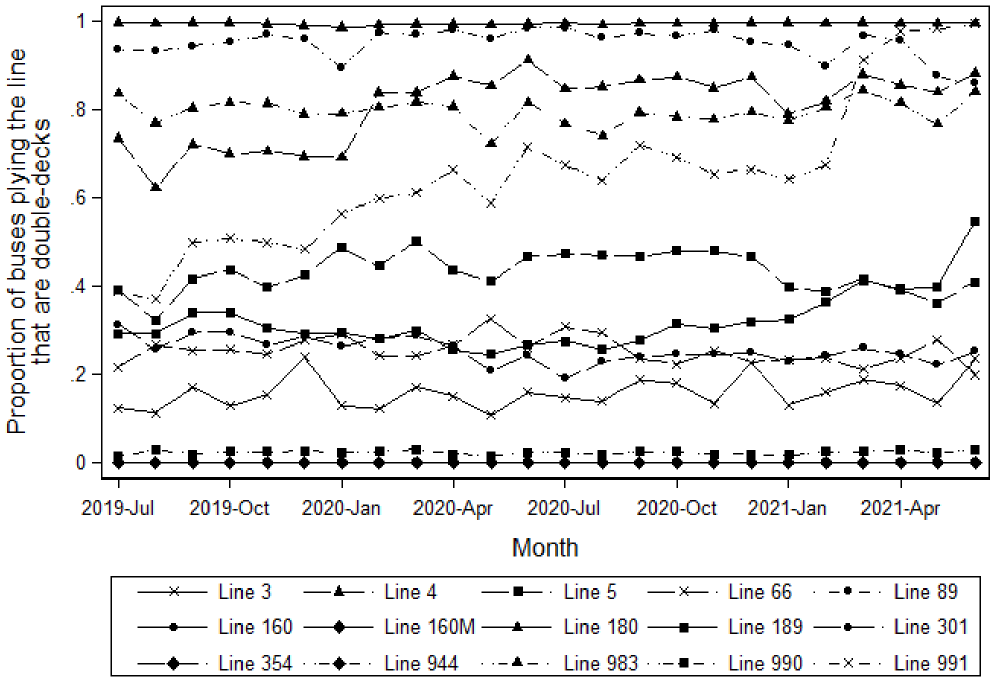



**Fig. S.4.** Monthly proportion of rides on electric buses and proportion of bus license plates that are electric on the bus lines with the highest rates of electrification **A.,** 944, **B.,** 354 and **C.,** 189. December 2020 to April 2021 mark the period of the bus stop survey. In all three panels, both proportions move in tandem suggesting limited substitution within bus line from diesel to electric buses when electric buses are introduced. If instead commuters waited for an electric bus rather than board the next bus (diesel or electric) passing by their bus stop, then the percent of riders on electric buses would exceed the percent of electric buses in service. Source: Bus ridership data.



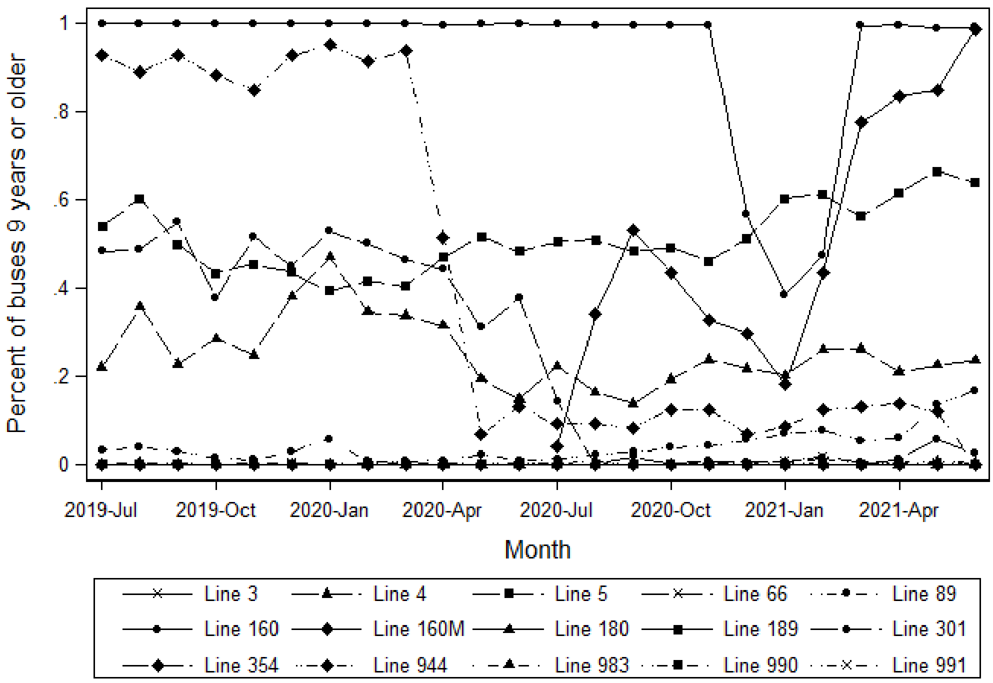




**Fig. S.5.** Monthly proportion of buses serving each bus line that are **A.**, double-deck and **B.**, aged at least 9 years. For the three lines with the highest rates of electrification (i) the diesel buses that replaced the relatively new electric buses on line 944 in May 2021 were also relatively new and (ii) all buses (diesel and electric) on lines 354 and 189 were relatively new. Source: Bus ridership data.

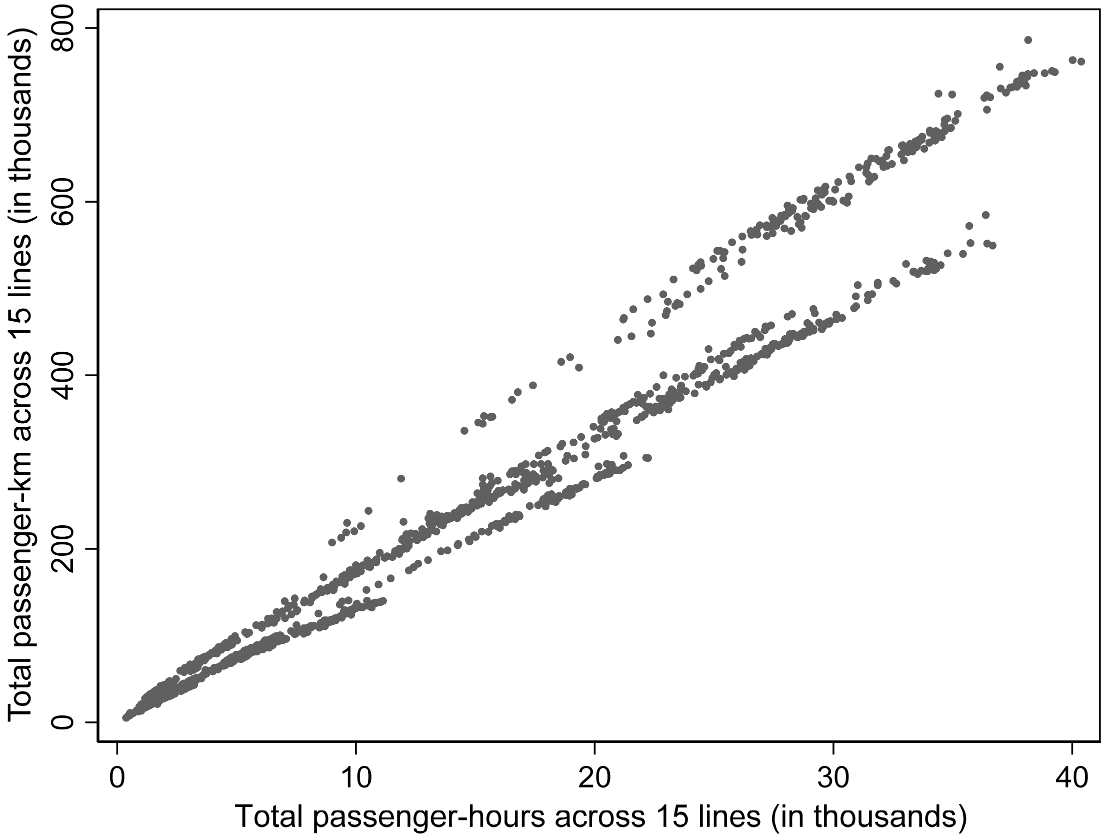



**Fig. S.6.** Bus speed reliability. Total weekly passenger-kilometers (in thousands) against total weekly passenger-hours (in thousands) in the ridership data. An observation in the scatter is a bus line by year-week. Both variables (in logarithms) are used as alternative dependent variables to log weekly ridership in sensitivity analysis. If we condition the plot to any single bus line, the scatter clusters even more around a ray. This is indicative of the reliability of Singapore's bus transit system. A relatively new fleet and good road conditions (well maintained, low congestion) contribute to stable speeds over time including over the lifespan of buses in circulation. Source: Bus ridership data.

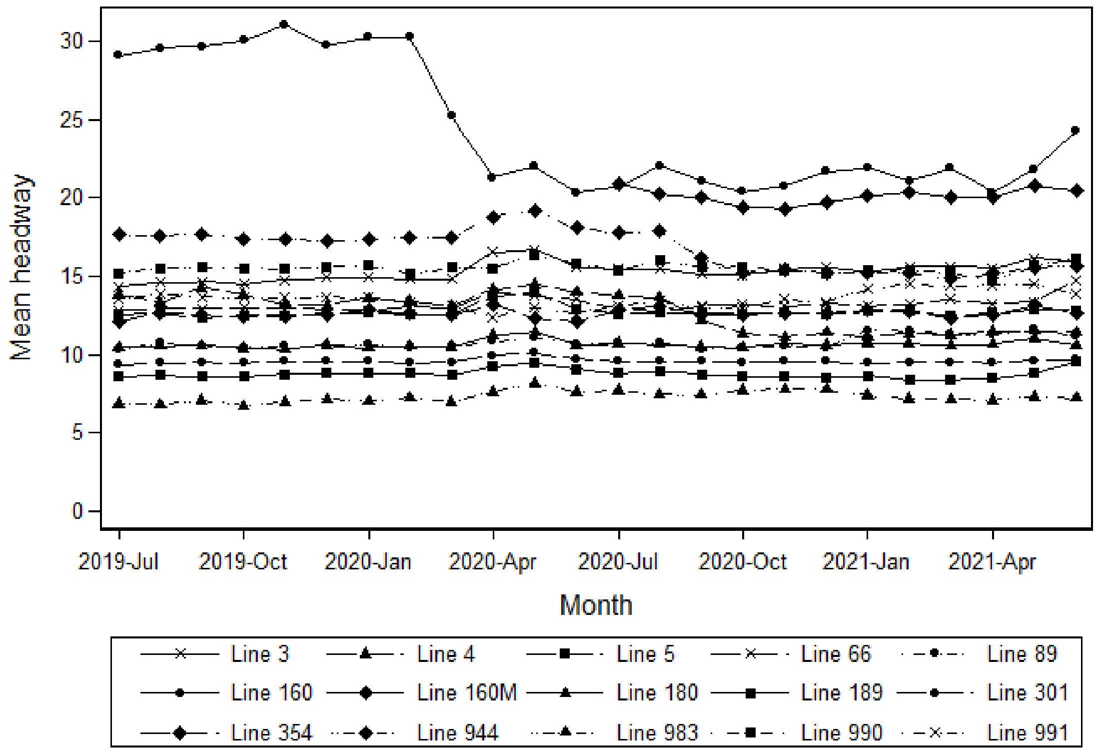



**Fig. S.7.** Monthly mean headway on each bus line is the average time interval between two consecutive buses serving a line that pass by a bus stop. For each day that a bus line is in service, we take the time (in minutes) elapsed between (i) the tap-in time by riders boarding the *first* bus passing the line's modal bus stop on that day and (ii) the tap-in time by riders boarding the *last* bus passing the line's modal bus stop that day (see the text on how we define a line's modal bus stop). We then sum this "daily minutes of bus line service" over all days within a week-of-sample and divide by a count of the buses on the line that passed the modal bus stop that week (e.g., 732 line-991 bus trips picked up riders at modal stop 43571 "Opp Bt Gombak Stn" in week-of-sample 10). Notice that line 160M was introduced in July 2020 as a shorter variant of line 160. Source: Bus ridership data.

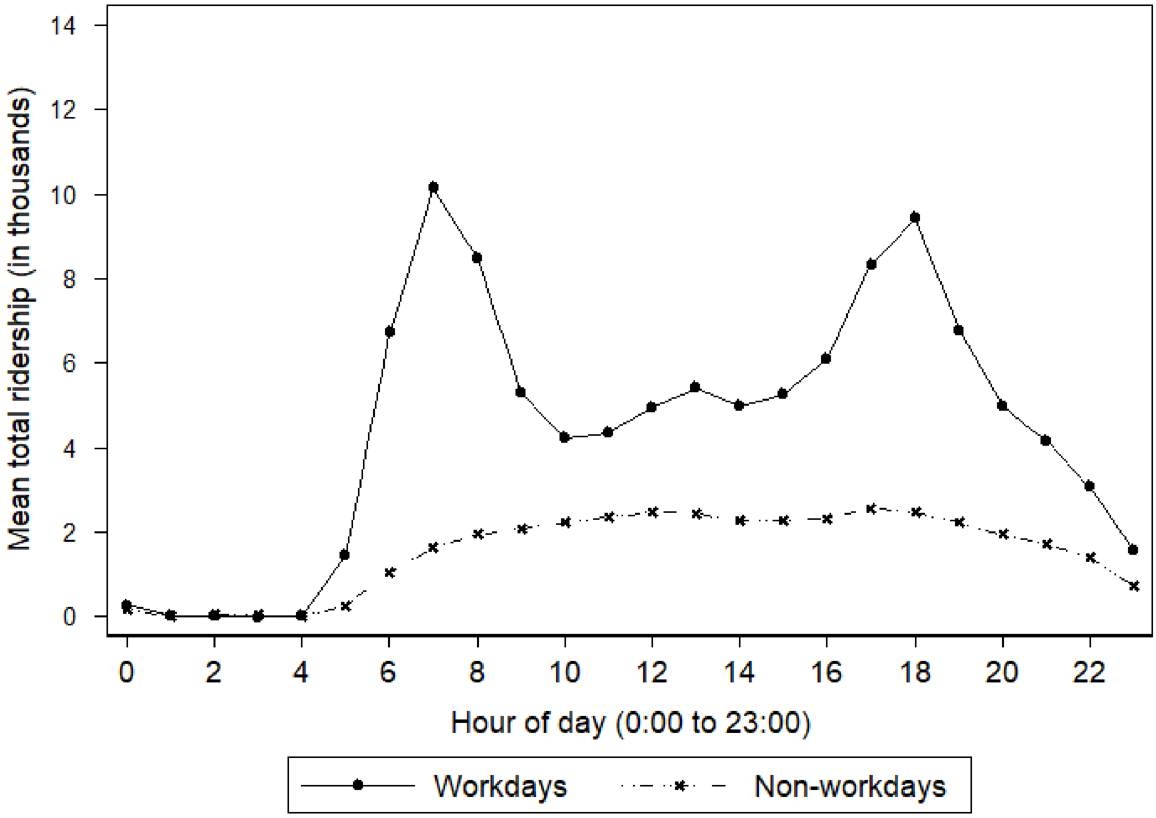



**Fig. S.8.** Diurnal cycle in bus ridership on workdays (Monday to Friday that are not public holidays) and non-workdays (Saturday, Sunday, and public holidays). For each day in the ridership data, we sum the number of rides across all 15 bus lines that start on any given hour, then average the hour-by-hour number of rides over day within either day type. For example, across all 15 bus lines, about 10,000 rides start between 7:00 and 7:59 on the average workday. Source: Bus ridership data.

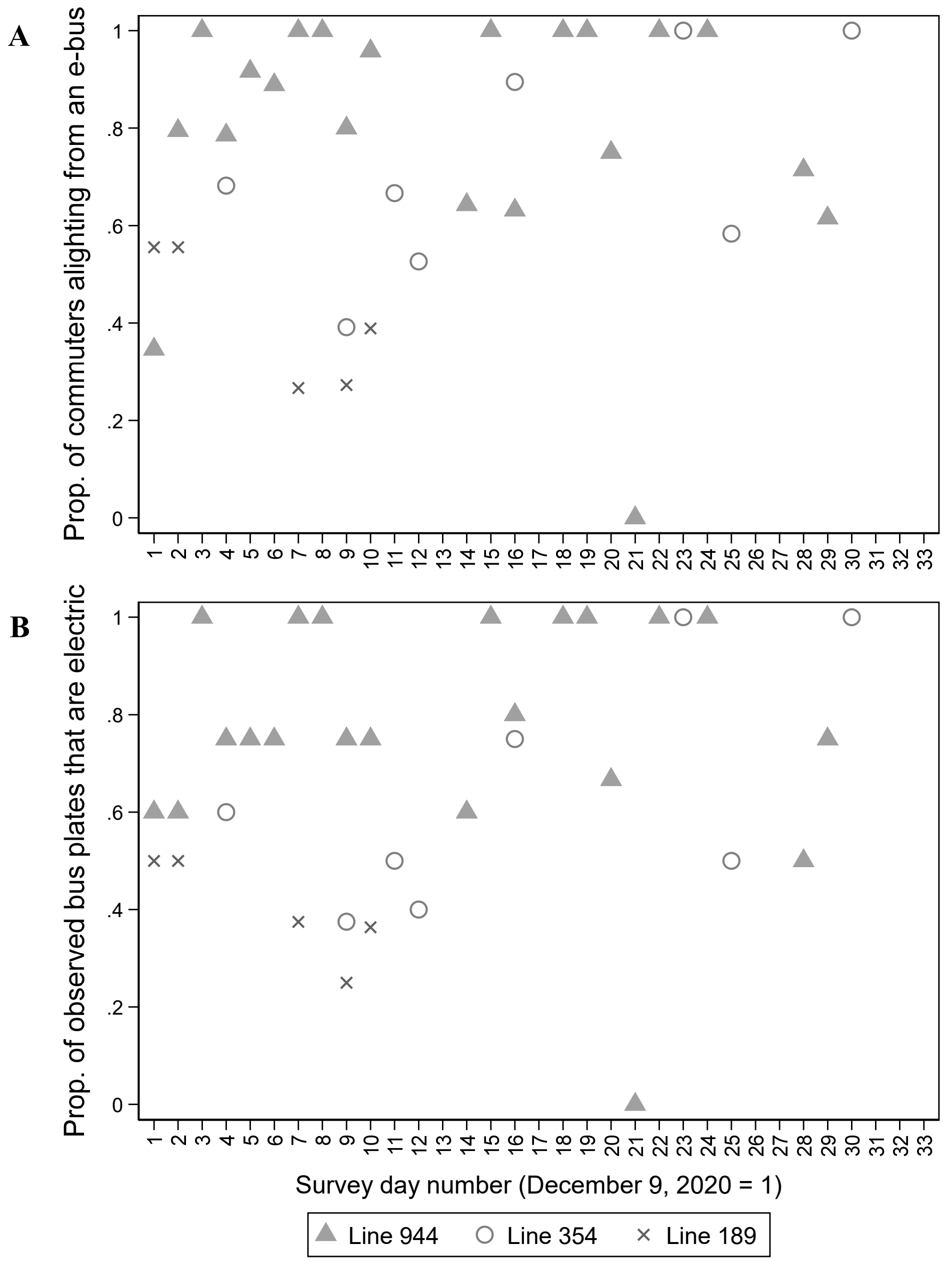



**Fig. S.9. A.,** Proportion of riders surveyed who alighted from an electric bus, and **B.,** Proportion of observed bus license plates that are electric, by sequential day number in the bus stop survey for bus lines 944, 354, and 189. Lines 944, 354, and 189 were partially electrified in early April, early October, and late September 2020, respectively, at least two and as much as eight months before the survey started in December 2020. Due to maintenance of electric buses, all respondents (12) who took line 944 on the survey's 21st day alighted from diesel buses. Compared with the shorter "feeder" lines 944 (Bt Batok Int ⟲ Blk 436A, with 13 stops) and 354 (Pasir Ris Int ⟲ Casa Pasir Ris, with 12 stops), line 189 was a longer "trunk" line (Bt Batok Int ⟲ Opp Nan Hua High Sch, with 31 stops). Source: Bus stop survey.

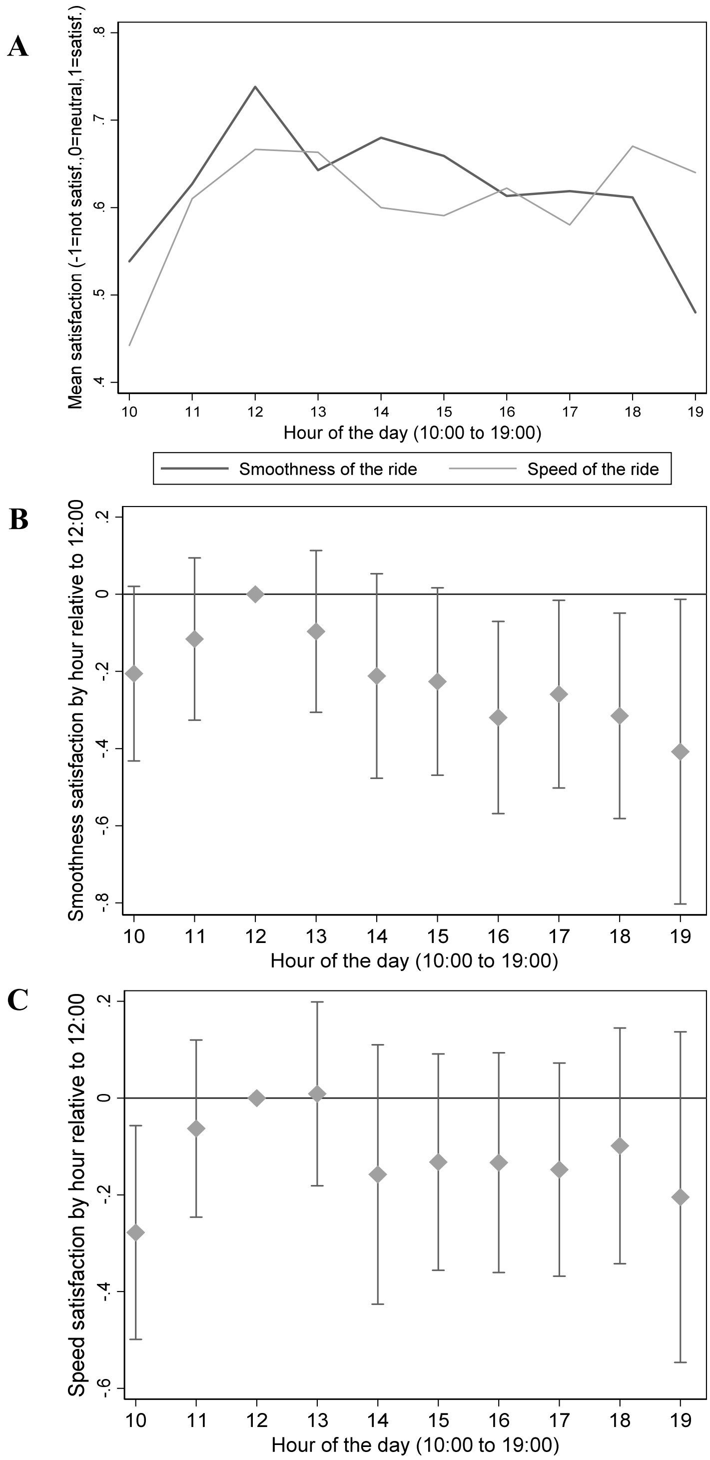



**Fig. S.10.** Diurnal cycle of commuters' stated satisfaction with the smoothness and speed of the bus ride they just took. We do not find a diurnal cycle with regard to the two other attributes, noise and fumes, so they are omitted here. **A.,** Mean levels in the raw data, by hour of survey, 10:00 to 19:00. **B.,** and **C.,** 95% CI on hour-of-day fixed effects (FE) of regression model (2) according to specifications reported in Table 5, columns 6 (Smoothness) and 8 (Speed), respectively. The reference category is 12:00. Source: Bus stop survey.

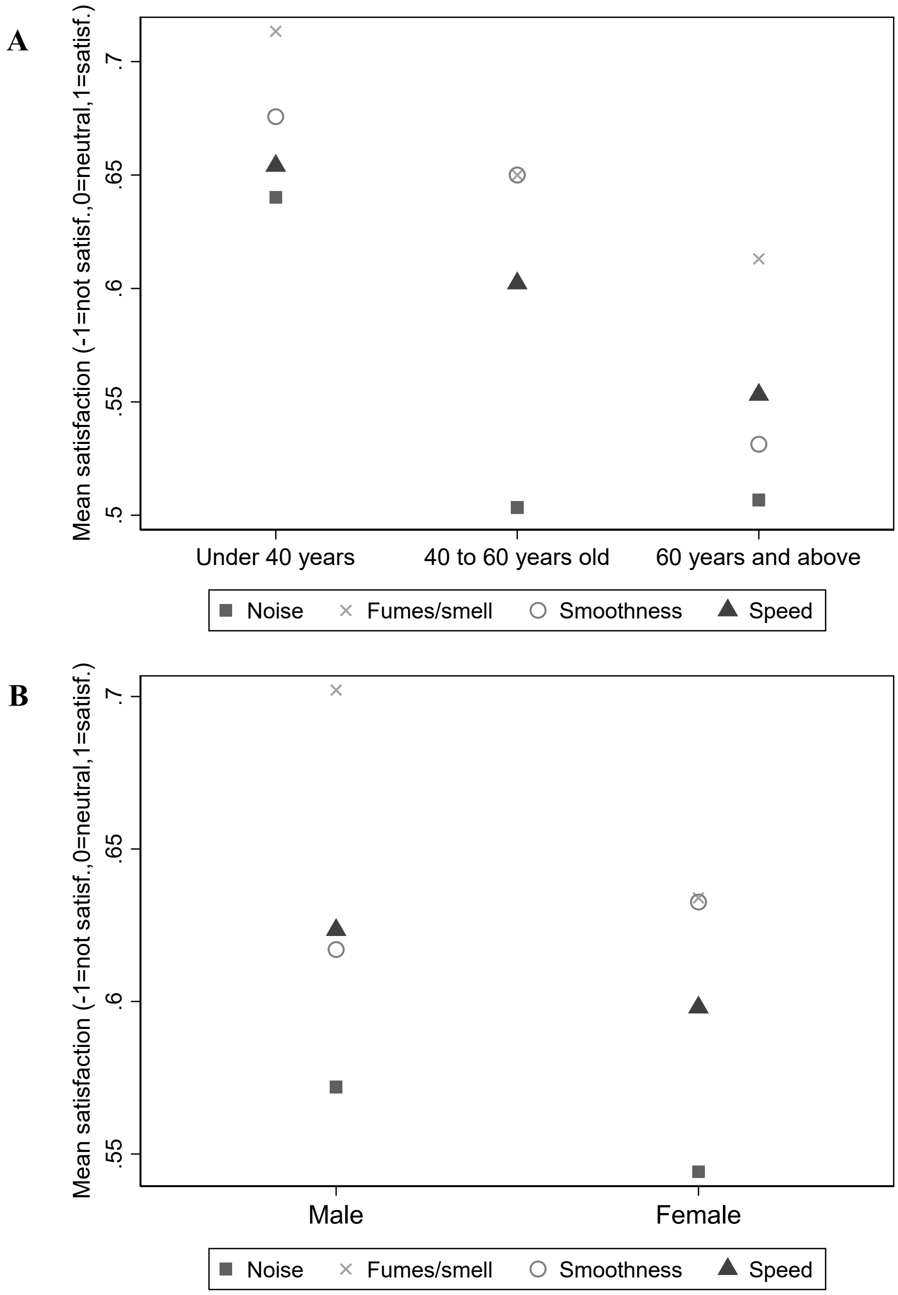



**Fig. S.11.** Stated satisfaction with different attributes of a bus ride varies with a commuter's **A.,** age group, and **B.,** gender. The plots show the mean level in the raw data, for each of four attributes of the bus ride, by demographic group. Source: Bus stop survey.

**Appendix Tables.**

**Table S.1.** Summary statistics for the bus ridership dataset

| Variable | *N* | Mean | Std.Dev. | Min. | Max. |
|---|---|---|---|---|---|
| Bus engine type: Diesel (1 = yes) | 104,248,706 | 0.97 | 0.16 | 0 | 1 |
| Bus engine type: Electric (1 = yes) | 104,248,706 | 0.03 | 0.16 | 0 | 1 |
| Number of bus decks: Double (1 = yes) | 104,248,706 | 0.49 | 0.50 | 0 | 1 |
| No. of decks is Double, if diesel bus (1 = yes) | 101,408,584 | 0.49 | 0.50 | 0 | 1 |
| No. of decks is Double, if electric bus (1 = yes) | 2,840,122 | 0.27 | 0.44 | 0 | 1 |
| Bus age (years) | 104,241,505 | 5.80 | 3.08 | 0.01 | 16.94 |
| Bus age, if diesel bus (years) | 101,401,383 | 5.94 | 3.01 | 0.01 | 16.94 |
| Bus age, if electric bus (years) | 2,840,122 | 0.87 | 0.28 | 0.24 | 1.49 |
| Tap out is observed (1 = yes) | 104,248,706 | 0.97 | 0.16 | 0 | 1 |
| Ride duration, when rider taps out (minutes) | 101,515,994 | 12.44 | 10.76 | -0.57 | 761.18 |
| Payment mode: Top-up farecard/bank card (1 = yes) | 104,248,706 | 0.93 | 0.25 | 0 | 1 |
| Payment mode: Unlimited monthly pass (1 = yes) | 104,248,706 | 0.06 | 0.24 | 0 | 1 |
| Payment mode: Cash (1 = yes) | 104,248,706 | 0.01 | 0.09 | 0 | 1 |
| Commuter category: Adult (1 = yes) | 104,248,706 | 0.66 | 0.47 | 0 | 1 |
| Commuter category: Senior citizen (1 = yes) | 104,248,706 | 0.17 | 0.37 | 0 | 1 |
| Commuter category: Student (1 = yes) | 104,248,706 | 0.12 | 0.32 | 0 | 1 |
| Commuter category: Other (1 = yes) | 104,248,706 | 0.05 | 0.23 | 0 | 1 |
| Ride starts or ends at stop with demand shift (1 = yes) | 104,248,706 | 0.07 | 0.26 | 0 | 1 |

Notes: Each observation is a time- and location- stamped individual ride made between July 1, 2019 and June 30, 2021 on the 15 more common bus lines in our bus stop survey. We drop 17,961 observations (0.02% of rides) because, due to system error, bus license plates are not available for these rides, and thus we do not know bus characteristics. There are a total of 2,877 bus license plates that appear in the 15-line dataset over the two years. Because these buses represent about half of the entire public bus fleet in Singapore serving several hundred lines, this suggests that buses are rotated across different lines often. No hybrid bus was deployed to any of the 15 lines during the 2-year period (among only 50 hybrid buses in the fleet). Bus age is the time elapsed between a new bus's first date in service and the ride. The 0.1% of observations with missing bus age are rides for which the bus license plate has a missing first date in service in the transit agency's records. The 3% of observations with missing tap outs include all cash payments. Four observations have negative ride duration values while 0.02% of rides are longer than 2 hours long. "Commuter category: Other" consists of children, persons with disabilities, and low-wage workers. We identify 24 bus stops that experience a net increase (or decrease) of at least 500 dwellings within 400 meters between 2019 and 2021, from new residential buildings opening and old ones being demolished (specifically, horizontal distance from bus stop to apartment tower/detached house centroid within a 400-meter radius). The table describes the number of rides starting or ending at these residential stops that face large exogenous demand shifts over the sample period (Table 3 considers variations in this definition). Source: Bus ridership dataset, Housing and Development Board, Urban Redevelopment Authority, Singapore Land Authority.

**Table S.2.** Electric buses and bus ridership: Further robustness tests and subsample analysis

| Except where noted, the dependent variable is log ridership and an observation is a bus line by year-week. | No. of obs. | Estimate on the proportion of buses that are electric (range in the sample is 0 to 0.92) (1) | (4) |
|---|---|---|---|
| **Table 2, columns 1** (includes bus line FE and year-week FE) **and 4** (this specification additionally controls for the proportions of buses that are double-deck and are aged at least 9 years) | 1519 | 0.14***<br>(0.03) | 0.12***<br>(0.04) |
| **Alternative clustering strategies (less conservative)…** | | | |
| …compute heteroscedasticity-robust standard errors | 1519 | 0.14***<br>(0.02) | 0.12***<br>(0.03) |
| …standard errors account for correlated demand shocks across bus lines within year-week, i.e., clustered at the year-week level | 1519 | 0.14***<br>(0.02) | 0.12***<br>(0.02) |
| **2SLS estimator assuming $propBusElectric$ is measured w/ error…** | | | |
| …and seven line-specific electrification period policy indicators instrument for the electrification rate (endogenous) | 1519 | 0.16***<br>(0.04) | 0.15***<br>(0.05) |
| **Collapse the sample to…** | | | |
| …the year-month level (with year-month FE instead of year-week FE; here we cluster standard errors at the year-month level) | 348 | 0.14***<br>(0.04) | 0.17**<br>(0.07) |
| **Drop from the estimation sample…** | | | |
| …all observations pertaining to a 12-week period from April 7 to June 28, 2020 due to COVID-19 mobility restrictions (Fig. 1) | 1351 | 0.12***<br>(0.03) | 0.11**<br>(0.04) |
| …all observations pertaining to both 2020 and 2021 (May 17 to June 14) periods with COVID-19 mobility restrictions (Fig. 1) | 1276 | 0.14***<br>(0.02) | 0.14***<br>(0.04) |
| …all observations pertaining to a bus line's first four weeks of electrification (if any) | 1491 | 0.14***<br>(0.03) | 0.13***<br>(0.05) |
| …all observations pertaining the most electrified bus line 944 | 1414 | 0.07***<br>(0.03) | 0.05<br>(0.03) |
| **Control for…** | | | |
| …the mean ride duration, a measure that is potentially endogenous to demand shocks such as the COVID-19 pandemic | 1519 | 0.09***<br>(0.03) | 0.09**<br>(0.04) |
| **Subsample analysis, to investigate heterogeneity…** | | | |
| …by time and type of day: Rides that start on workday peak hours (non-holiday Mondays to Fridays, 6:00 to 9:59 & 16:00 to 20:59) | 1519 | 0.13***<br>(0.03) | 0.11***<br>(0.04) |
| …by time and type of day: Rides that start on workday off-peak hours | 1519 | 0.18***<br>(0.04) | 0.18***<br>(0.05) |
| …by time and type of day: Rides on non-workdays (Saturday, Sunday, public holiday) | 1519 | 0.11***<br>(0.03) | 0.09**<br>(0.04) |
| …by commuter category: Adult card | 1519 | 0.13***<br>(0.03) | 0.12***<br>(0.04) |
| …by commuter category: Senior citizen card | 1519 | 0.12***<br>(0.04) | 0.09**<br>(0.04) |
| …by commuter category: Student card | 1519 | 0.18***<br>(0.06) | 0.16**<br>(0.07) |
| …by payment type: Top-up farecards & bank debit/credit cards | 1519 | 0.14***<br>(0.03) | 0.12***<br>(0.04) |

| (continued) | No. of obs. | Estimate on the proportion of buses that are electric (range in the sample is 0 to 0.92) (1) | (4) |
|---|---|---|---|
| …by payment type: Unlimited seasonal passholders | 1519 | 0.10*** | 0.05 |
| | | (0.04) | (0.03) |
| …by payment type: Cash | 1519 | 0.29*** | 0.31*** |
| | | (0.05) | (0.06) |
| **Alternative dependent variables…** | | | |
| …The dependent variable is log number of commuters (unique within bus line by year-week), to examine the extensive margin of riders | 1519 | 0.18*** | 0.15*** |
| | | (0.04) | (0.05) |
| …The dependent variable is log total passenger-hours, to examine aggregate time traveled | 1519 | 0.16*** | 0.14*** |
| | | (0.03) | (0.05) |
| …The dependent variable is log total passenger-kilometers, to examine aggregate distance traveled | 1519 | 0.12*** | 0.11*** |
| | | (0.03) | (0.04) |

Notes: The table reproduces OLS estimates from Table 2, columns 1 and 4, on the effects of varying the proportion of buses that are electric, and provides sensitivity and subsample analysis around those model specifications. Except where noted, the dependent variable is log ridership and an observation is a bus line by year-week. Except where noted, all models are estimated by OLS. For the two 2SLS models, first-stage F-statistics (Kleibergen-Paap Wald rk) are 299.66 and 253.02. To examine the extensive margin of riders, we count the number of unique commuters who ride a given bus line on a given year-week. We identify a commuter by their anonymized card number, i.e., a top-up farecard, bank debit/credit card, a seasonal pass. A commuter who pays with more than one card (e.g., a debit card and a credit card) on the same line-week is counted more than once by this procedure. Because there is no card number for cash payments, we drop 820 thousand rides paid in cash out of 104 million rides in the raw data, or 0.8% of the sample. To examine aggregate distance traveled, we exclude 3% of rides with missing tap outs for which the destination is missing. The ride duration is the time a rider is inside the cabin, from tapping in when boarding the bus to tapping out when alighting; the exit time and thus duration is missing for 3% of rides. All other comments on sample and specification in the caption to Table 2 apply here. Except where noted, standard errors in parentheses account for correlated demand shocks across bus lines within year-week (i.e., clustered at the year-week level) and serial correlation over time (Newey-West with a 4-week lag). ***Significant at 1%, ** 5%, * 10%. Source: Bus ridership dataset.

**Table S.3.** Summary statistics for the bus stop intercept survey

| Variable | *N* | Mean | Std.Dev. | Min. | Max. |
|---|---|---|---|---|---|
| A. **Satisfaction** levels: -1 = "not satisfied", 0 = "neutral", 1 = "satisfied" | | | | | |
| The **noise** when waiting, boarding and riding | 1291 | 0.56 | 0.55 | -1 | 1 |
| The **fumes/smell** when waiting, boarding and riding | 1292 | 0.66 | 0.53 | -1 | 1 |
| The **smoothness** of the ride | 1292 | 0.63 | 0.59 | -1 | 1 |
| The **speed** of the ride | 1291 | 0.61 | 0.56 | -1 | 1 |
| B. Perceived characteristics of "the bus you [the respondent] just rode on" | | | | | |
| Perceived bus age: New (1 = yes) | 1292 | 0.50 | 0.50 | 0 | 1 |
| Perceived bus age: "OK"/"Normal" (1 = yes) | 1292 | 0.38 | 0.49 | 0 | 1 |
| Perceived bus age: Old (1 = yes) | 1292 | 0.05 | 0.22 | 0 | 1 |
| Perceived bus age: Don't Know (1 = yes) | 1292 | 0.07 | 0.25 | 0 | 1 |
| Perceived bus engine type: Diesel (1 = yes) | 1291 | 0.28 | 0.45 | 0 | 1 |
| Perceived bus engine type: Electric (1 = yes) | 1291 | 0.11 | 0.31 | 0 | 1 |
| Perceived bus engine type: Hybrid (1 = yes) | 1291 | 0.07 | 0.25 | 0 | 1 |
| Perceived bus engine type: Other (1 = yes) | 1291 | 0.00 | 0.06 | 0 | 1 |
| Perceived bus engine type: Don't Know (1 = yes) | 1291 | 0.55 | 0.50 | 0 | 1 |
| Perceived number of bus decks: Single (1 = yes) | 1292 | 0.68 | 0.47 | 0 | 1 |
| Perceived number of bus decks: Double (1 = yes) | 1292 | 0.29 | 0.45 | 0 | 1 |
| Perceived number of bus decks: Bendy (1 = yes) | 1292 | 0.01 | 0.08 | 0 | 1 |
| Perceived number of bus decks: Don't Know (1 = yes) | 1292 | 0.03 | 0.16 | 0 | 1 |
| C. Actual bus characteristics, as matched by observed bus plate against the transit agency's records | | | | | |
| Actual bus age (years) | 1263 | 5.10 | 3.64 | 0.19 | 14.45 |
| Actual bus age, if diesel bus (years) | 879 | 6.90 | 2.88 | 0.27 | 14.45 |
| Actual bus age, if electric bus (years) | 384 | 0.97 | 0.15 | 0.19 | 1.23 |
| Actual bus engine: Diesel (1 = yes) | 1292 | 0.70 | 0.46 | 0 | 1 |
| Actual bus engine: Electric (1 = yes) | 1292 | 0.30 | 0.46 | 0 | 1 |
| Actual number of bus decks: Single (1 = yes) | 1292 | 0.71 | 0.45 | 0 | 1 |
| Actual number of bus decks: Double (1 = yes) | 1292 | 0.28 | 0.45 | 0 | 1 |
| Actual no. decks is double, if diesel bus (1 = yes) | 904 | 0.38 | 0.48 | 0 | 1 |
| Actual no. decks is double, if electric bus (1 = yes) | 388 | 0.06 | 0.25 | 0 | 1 |
| Actual number of bus decks: Bendy (1 = yes) | 1292 | 0.01 | 0.09 | 0 | 1 |
| D. [Extension: Bus commuter's] Perceived engine type of Singapore's MRT trains | | | | | |
| Perceived engine type of trains: Diesel (1 = yes) | 505 | 0.05 | 0.22 | 0 | 1 |
| Perceived engine type of trains: Electric (1 = yes) | 505 | 0.47 | 0.50 | 0 | 1 |
| Perceived engine type of trains: Hybrid (1 = yes) | 505 | 0.06 | 0.23 | 0 | 1 |
| Perceived engine type of trains: Other (1 = yes) | 505 | 0.00 | 0.06 | 0 | 1 |
| Perceived engine type of trains: Don't Know (1 = yes) | 505 | 0.42 | 0.49 | 0 | 1 |
| E. Respondent characteristics [education in extension] | | | | | |
| Dwelling size: 1-room apartment (1 = yes) | 1292 | 0.05 | 0.22 | 0 | 1 |
| Dwelling size: 2-room apartment (1 = yes) | 1292 | 0.11 | 0.31 | 0 | 1 |
| Dwelling size: 3-room apartment (1 = yes) | 1292 | 0.13 | 0.33 | 0 | 1 |
| Dwelling size: 4-room apartment (1 = yes) | 1292 | 0.34 | 0.47 | 0 | 1 |
| Dwelling size: 5-room apartment (1 = yes) | 1292 | 0.16 | 0.36 | 0 | 1 |
| Dwelling size: Condominium apartment (1 = yes) | 1292 | 0.18 | 0.39 | 0 | 1 |
| Respondent age: Under 20 years (1 = yes) | 1292 | 0.04 | 0.21 | 0 | 1 |
| Respondent age: 20s (1 = yes) | 1292 | 0.14 | 0.34 | 0 | 1 |

| Variable | *N* | Mean | Std.Dev. | Min. | Max. |
|---|---|---|---|---|---|
| Respondent age: 30s (1 = yes) | 1292 | 0.19 | 0.39 | 0 | 1 |
| Respondent age: 40s (1 = yes) | 1292 | 0.16 | 0.37 | 0 | 1 |
| Respondent age: 50s (1 = yes) | 1292 | 0.18 | 0.38 | 0 | 1 |
| Respondent age: 60 and above (1 = yes) | 1292 | 0.28 | 0.45 | 0 | 1 |
| Female (1 = yes) | 1288 | 0.56 | 0.50 | 0 | 1 |
| Education: No qualification/pre-primary (1 = yes) | 303 | 0.06 | 0.23 | 0 | 1 |
| Education: Primary (1 = yes) | 303 | 0.10 | 0.29 | 0 | 1 |
| Education: Secondary (1 = yes) | 303 | 0.26 | 0.44 | 0 | 1 |
| Education: Post-Secondary (non-tertiary) (1 = yes) | 303 | 0.10 | 0.30 | 0 | 1 |
| Education: Polytechnic Diploma (1 = yes) | 303 | 0.19 | 0.39 | 0 | 1 |
| Education: Bachelor's Degree (1 = yes) | 303 | 0.22 | 0.42 | 0 | 1 |
| Education: Postgraduate and above (1 = yes) | 303 | 0.07 | 0.25 | 0 | 1 |
| Lived in Singapore all their life (1 = yes) | 302 | 0.74 | 0.44 | 0 | 1 |
| Years since arrived, if lived abroad | 80 | 13.91 | 12.44 | 0.08 | 60 |
| F. Environmental conditions | | | | | |
| Hour of the day | 1292 | 15.36 | 2.42 | 10 | 19 |
| Rainy conditions (1 = yes) | 1292 | 0.28 | 0.45 | 0 | 1 |
| Male commuters who declined before this response | 1292 | 0.37 | 0.70 | 0 | 4 |
| Female commuters who declined before this response | 1292 | 0.41 | 0.77 | 0 | 6 |

Notes: Intercept survey of 1292 commuters alighting at 22 bus stops from 31 diesel-powered or partially electrified bus lines on 33 different days between December 9, 2020 and April 9, 2021. For each location-day, surveyors worked in pairs, totaling eight surveyors in all. In some instances, surveyors missed collecting the bus's license plate, so we are missing actual bus age. We extended the original questionnaire (i) to include knowledge of MRT train engine type, starting on January 4, 2021 (panel D), and (ii) to include education and time lived in Singapore, starting on January 27, 2021 (panel E). The actual engine type of all of Singapore's trains is electric. For brevity, we do not show dwelling types that were chosen by up to 2% of respondents (e.g., Landed Property, Other, Don't Know/Refused). We specify "Don't Know/Refused" dummies to account for 7 respondents who refused to declare their age and 2 respondents who did not know/refused to declare their education. A respondent's communication was deemed by the surveyor as proficient in English (70% of responses), not proficient in English (10%), or undertaken in another language than English (20%); we omit these variables for brevity. Source: Bus stop survey.

**Table S.4.** Respondents alighting from partially electrified vs. fully diesel bus lines, by month and bus engine type

| | December 2020 | | January 2021 | | February 2021 | | March 2021 | | April 2021 | | All five months | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bus Line | Diesel bus | Electric bus | Diesel bus | Electric bus | Diesel bus | Electric bus | Diesel bus | Electric bus | Diesel bus | Electric bus | Diesel bus | Electric bus | Total |
| 944 | 52 | 158 | 13 | 51 | 13 | 18 | 7 | 13 | | | 85 | 240 | 325 |
| 354 | 37 | 48 | 2 | 17 | 5 | 20 | | 14 | | | 44 | 99 | 143 |
| 189 | 42 | 29 | | | | | | | | | 42 | 29 | 71 |
| 983 | 43 | 13 | 20 | 2 | | | | | | | 63 | 15 | 78 |
| 83 | 18 | 2 | | | | | | | | | 18 | 2 | 20 |
| 162 | | | 4 | 1 | | | | | | | 4 | 1 | 5 |
| 135 | | | 2 | 2 | | | | | | | 2 | 2 | 4 |
| Partially electrified lines | 192 | 250 | 41 | 73 | 18 | 38 | 7 | 27 | 0 | 0 | 258 | 388 | 646 |
| Fully diesel lines | 345 | - | 110 | - | 26 | - | 108 | - | 55 | - | 644 | - | 644 |
| Total | 537 | 250 | 151 | 73 | 44 | 38 | 115 | 27 | 55 | 0 | 902 | 388 | 1290 |

Notes: We surveyed 1292 commuters who alighted from 31 different bus lines. At the time of the survey, seven of these lines were partially electrified and the remaining lines were fully diesel, e.g., line 990 was back to fully diesel by December 2020 (Fig. 1). For two observations, the surveyor failed to record the bus's line. We use the bus license plate recorded by the surveyor to validate their observation of actual bus engine against the transit agency's records. For brevity, we do not detail the number of respondents alighting from each fully diesel line. The three fully diesel lines we most sampled from are lines 991 (Bt Batok Int ⇄ Choa Chu Kang Int, with 26 stops), 160M (Jurong East Int ⟲ Blk 436A, with 23 stops), and 990 (Bt Batok Int ⟲ Bef Seventh-Day Advent Ch, with 28 stops) with 96, 90, and 63 respondents, respectively. Source: Bus stop survey.

**Table S.5.** Electric buses and rider satisfaction with noise: Sensitivity analysis

| Dependent variable is **Noise satisfaction** level, coded as -1 = not satisfied, 0 = neutral, 1 = satisfied | | | | | |
|---|---|---|---|---|---|
| | Restrict estimation sample: | | | | Additional controls: |
| | Bus age ≤ 7.8 y (75th pct) | Single-deck only | Single-deck & ≤ 7.8 y | Bus age ≤ 5.3 y (median) | Refusal rate (1-h mean) |
| | (1) | (2) | (3) | (4) | (5) |
| Actual bus engine: Electric | 0.19*** | 0.19*** | 0.18** | 0.16* | 0.18*** |
| (1 = yes) | (0.07) | (0.07) | (0.08) | (0.10) | (0.05) |
| Actual number of bus decks: Double | -0.04 | | | -0.36*** | 0.02 |
| (1 = yes) | (0.09) | | | (0.16) | (0.07) |
| Actual number of bus decks: Bendy | -0.04 | | | 0.33 | 0.01 |
| (1 = yes) | (0.18) | | | (0.35) | (0.18) |
| Actual bus age ≥ 9 years | | 0.04 | | | 0.04 |
| (1 = yes) | | (0.08) | | | (0.07) |
| Actual bus age (decades, to scale up the coefficient magnitude) | | | | | |
| Refusal rate (see caption; mean, min., and max. are 0.8, 0, and 3) | | | | | -0.02 |
| | | | | | (0.05) |
| Rainy conditions | 0.02 | 0.07 | 0.10 | 0.02 | 0.03 |
| (1 = yes) | (0.06) | (0.06) | (0.07) | (0.06) | (0.05) |
| Bus line FE and bus stop FE | Yes | Yes | Yes | Yes | Yes |
| Hour-of-day FE and date FE | Yes | Yes | Yes | Yes | Yes |
| Surveyor FE | Yes | Yes | Yes | Yes | Yes |
| Number of observations, *N* | 949 | 894 | 649 | 635 | 1262 |
| $R^2$ | 0.15 | 0.12 | 0.15 | 0.18 | 0.12 |
| Mean of dependent variable | 0.57 | 0.57 | 0.55 | 0.61 | 0.55 |

Notes: The table reports estimates for five OLS regressions of a commuter's stated satisfaction regarding "the noise when waiting, boarding, and riding." The point of departure is Table 5, column 2. In column 1, we restrict the estimation sample to respondents who alighted from buses aged up to 7.83 years; this is the 75th percentile of the distribution of bus age in the sample. In column 2, we restrict the estimation sample to respondents who alighted from single-deck buses. In column 3, we impose both these bus age and bus deck restrictions on the estimation sample (now with $N = 649$, or about one-half the full sample). In column 4, we restrict the estimation sample to respondents who alighted from buses aged up to the sample median of 5.33 years ($N = 635$). Column 5, based on the full sample, controls for the refusal rate, computed as the mean over all responses within each 1-hour period (e.g., 15:00 to 15:59, December 9, 2020) of the number of intercepted commuters who declined to participate before a complying commuter. This is intended to capture how "busy" commuters (general population) are on a given hour and date, to the extent this may bias satisfaction ratings. Estimates are robust to including bins 1-day wide of a surveyor's tenure in the field (one bin for a surveyor's 1st day of fieldwork, a second bin for their second day, and so on), to control for on-the-job experience. Robust standard errors are in parentheses. ***Significant at 1%, **at 5%, *at 10%. Source: Bus stop survey.

**Table S.6.** Electric buses and rider satisfaction, with demographic controls

| Dependent variable is: (level coded as -1 = not satisfied, 0 = neutral, 1 = satisfied) | **Noise satisfaction** (1) | **Fumes/smell satisfaction** (2) | **Smoothness satisfaction** (3) | **Speed satisfaction** (4) |
|---|---|---|---|---|
| Actual bus engine: Electric | 0.17*** | 0.04 | 0.01 | 0.01 |
| (1 = yes) | (0.05) | (0.05) | (0.06) | (0.05) |
| Actual number of bus decks: | 0.02 | -0.05 | 0.09 | -0.05 |
| Double (1 = yes) | (0.07) | (0.08) | (0.08) | (0.08) |
| Actual number of bus decks: | 0.04 | 0.12 | 0.02 | 0.15 |
| Bendy (1 = yes) | (0.18) | (0.18) | (0.12) | (0.17) |
| Actual bus age ≥ 9 years | 0.05 | 0.00 | -0.11 | -0.01 |
| (1 = yes) | (0.07) | (0.06) | (0.07) | (0.07) |
| Rainy conditions | 0.03 | -0.02 | -0.01 | -0.06 |
| (1 = yes) | (0.05) | (0.05) | (0.06) | (0.05) |
| Respondent lives in 1-3 room | 0.00 | -0.01 | 0.03 | 0.01 |
| apartment (1 = yes) | (0.04) | (0.04) | (0.04) | (0.04) |
| Respondent is aged up to 40 | 0.12*** | 0.09*** | 0.06 | 0.06 |
| years (1 = yes) | (0.04) | (0.03) | (0.04) | (0.04) |
| Respondent is female | -0.02 | -0.08** | 0.03 | -0.02 |
| (1 = yes) | (0.03) | (0.03) | (0.04) | (0.03) |
| Respondent is proficient in | 0.00 | -0.05 | -0.01 | -0.03 |
| English (1 = yes) | (0.04) | (0.04) | (0.04) | (0.04) |
| Bus line FE and bus stop FE | Yes | Yes | Yes | Yes |
| Hour-of-day FE and date FE | Yes | Yes | Yes | Yes |
| Surveyor FE | Yes | Yes | Yes | Yes |
| Number of observations, *N* | 1258 | 1259 | 1259 | 1258 |
| $R^2$ | 0.13 | 0.13 | 0.11 | 0.14 |
| Mean of dependent variable | 0.55 | 0.66 | 0.62 | 0.61 |

Notes: The table reports estimates for four OLS regressions of a commuter's stated satisfaction regarding different "aspects of their bus ride" on an indicator that the actual bus is electric. An observation is a bus commuter. The dependent variable is satisfaction with "the noise when waiting, boarding, and riding" in column 1, "the fumes/smell when waiting, boarding, and riding" in column 2, "the smoothness of the ride" in column 3, or "the speed of the ride" in column 4. We code "not satisfied" as -1, "neutral" as 0, and "satisfied" as 1. Specifications follow Table 5 columns 2, 5, 7, and 9 except that here we control for respondent characteristics. Robust standard errors are in parentheses. ***Significant at 1%, **at 5%, *at 10%. Source: Bus stop survey.

**Table S.7.** Electric buses and rider satisfaction: Robustness to specifying an ordered logit model

| Dependent variable is discrete: | **Noise satisfaction** level, coded as not satisfied < neutral < satisfied | | | **Fumes/smell** satisfaction level | | **Smoothness** satisfaction level | | **Speed** satisfaction level | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Actual bus engine: Electric (1 = yes) | 1.93<br>[1.34,2.78] | 2.07<br>[1.34,3.19] | 1.85<br>[0.95,3.60] | 1.31<br>[0.88,1.96] | 1.21<br>[0.75,1.94] | 1.52<br>[1.04,2.23] | 1.11<br>[0.71,1.73] | 1.18<br>[0.81,1.70] | 1.13<br>[0.73,1.77] |
| Actual number of bus decks: Double (1 = yes) | | 1.04<br>[0.61,1.79] | 0.98<br>[0.55,1.75] | | 0.78<br>[0.44,1.41] | | 1.26<br>[0.71,2.27] | | 0.82<br>[0.47,1.45] |
| Actual number of bus decks: Bendy (1 = yes) | | 1.09<br>[0.19,6.21] | 1.06<br>[0.18,6.08] | | 1.76<br>[0.27,11.34] | | 1.41<br>[0.12,15.96] | | 2.29<br>[0.34,15.64] |
| Actual bus age $\geq$ 9 years (1 = yes) | | 1.17<br>[0.72,1.90] | | | 1.03<br>[0.62,1.72] | | 0.71<br>[0.43,1.17] | | 1.01<br>[0.61,1.69] |
| Actual bus age (years) | | | 0.99<br>[0.92,1.07] | | | | | | |
| Rainy conditions (1 = yes) | | 1.24<br>[0.79,1.93] | 1.23<br>[0.79,1.92] | | 0.88<br>[0.54,1.43] | | 0.99<br>[0.62,1.58] | | 0.77<br>[0.49,1.22] |
| Bus line FE and bus stop FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Hour-of-day FE and date FE | | Yes | Yes | | Yes | | Yes | | Yes |
| Surveyor FE | | Yes | Yes | | Yes | | Yes | | Yes |
| Number of observations, *N* | 1289 | 1262 | 1262 | 1290 | 1263 | 1290 | 1263 | 1289 | 1262 |
| Log likelihood | -969.14 | -906.82 | -907.00 | -881.77 | -811.12 | -964.58 | -906.61 | -940.55 | -870.54 |
| Pseudo $R^2$ | 0.04 | 0.08 | 0.08 | 0.04 | 0.10 | 0.04 | 0.08 | 0.05 | 0.10 |

Notes: The table reports odds ratio estimates for 9 ordered logit regressions of a commuter's stated satisfaction regarding different "aspects of their bus ride" on an indicator that the actual bus is electric. The odds ratio indicates how much more likely a commuter reports a higher satisfaction level relative to a lower satisfaction level given a one-unit increase in the independent variable, all other variables held constant. An observation is a bus commuter. The dependent variable is satisfaction with "the noise when waiting, boarding, and riding" in columns 1-3, "the fumes/smell when waiting, boarding, and riding" in columns 4-5, "the smoothness of the ride" in columns 6-7, or "the speed of the ride" in columns 8-9. All other comments on sample and regressors in the caption to Table 5 apply here. Square brackets show the 95% confidence interval for the odds ratio. Source: Bus stop survey.

**Table S.8.** Electrification, controlling for actual bus age, is associated with perceived newness

| Dependent variable is: | 1 if the respondent describes the age of the bus they just rode on as "**New**," and 0 otherwise | | | **Newness** level $\in \{1, 0, -1\}$ where 1 = New, 0 = 'OK'/'normal', -1 = Old | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Actual bus engine: Electric (1 = yes) | 0.34*** | 0.35*** | 0.21*** | 0.37*** | 0.40*** | 0.21** |
| | (0.04) | (0.05) | (0.07) | (0.05) | (0.06) | (0.09) |
| Actual number of bus decks: Double (1 = yes) | | 0.19*** | 0.12* | | 0.27*** | 0.18** |
| | | (0.06) | (0.07) | | (0.08) | (0.09) |
| Actual number of bus decks: Bendy (1 = yes) | | -0.08 | -0.11 | | -0.05 | -0.09 |
| | | (0.17) | (0.18) | | (0.21) | (0.21) |
| Actual bus age $\geq$ 9 years (1 = yes) | | 0.00 | | | -0.02 | |
| | | (0.06) | | | (0.07) | |
| Actual bus age (decades, to scale up the coefficient) | | | -0.21** | | | -0.29*** |
| | | | (0.08) | | | (0.11) |
| Rainy conditions (1 = yes) | | 0.04 | 0.03 | | 0.05 | 0.04 |
| | | (0.05) | (0.05) | | (0.06) | (0.06) |
| Bus line FE and bus stop FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Hour-of-day FE and date FE | | Yes | Yes | | Yes | Yes |
| Surveyor FE | | Yes | Yes | | Yes | Yes |
| Number of observations, *N* | 1290 | 1263 | 1263 | 1120 | 1174 | 1174 |
| $R^2$ | 0.17 | 0.21 | 0.22 | 0.18 | 0.23 | 0.23 |
| Mean of dependent variable | 0.50 | 0.50 | 0.50 | 0.48 | 0.49 | 0.49 |

Note. The table reports estimates for six OLS regressions of a commuter's perception of whether the bus they "just rode on" is new on an indicator that the actual bus is electric. An observation is a bus commuter. In columns 1-3, the dependent variable is 1 if the respondent described the bus as New, and 0 otherwise (including the choice of Don't Know from the menu provided). In columns 4-6, the dependent variable is "newness," coded as 1, 0, or -1 if the respondent described the bus as New, OK/normal, or Old, respectively; for these specifications, newness is undefined if the respondent chose Don't Know. Other than a different outcome, specifications follow Table 5. Columns 2-3 and 5-6 include FE by hour of the day, date, surveyor, and rainy conditions, and control for the actual number of decks. Columns 2 and 5 include a dummy for buses aged at least 9 years, which columns 3 and 6 replace with bus age entering linearly (in decades rather than years, to scale up the magnitude of the coefficient). Robust standard errors are in parentheses. ***Significant at 1%, **at 5%, *at 10%. Source: Bus stop survey.

**Table S.9.** Illustrating the importance of controlling for location and time in surveys (bus stops)

| | Dependent variable is the number of intercepted commuters who declined to participate before a commuter agrees to participate | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Actual bus engine: Electric (1 = yes) | 0.01 | 0.07 | 0.08 | 0.07 | 0.14 | 0.08 |
| | (0.07) | (0.10) | (0.10) | (0.10) | (0.10) | (0.10) |
| Bus line FE (31) | | Yes | Yes | Yes | Yes | Yes |
| Bus stop FE (22) | | | Yes | Yes | Yes | Yes |
| Surveyor FE (8) | | | | Yes | Yes | Yes |
| Hour-of-day FE (10) | | | | | Yes | Yes |
| Date FE (33) | | | | | | Yes |
| Number of observations, *N* | 1292 | 1290 | 1290 | 1290 | 1290 | 1290 |
| $R^2$ | 0.00 | 0.04 | 0.08 | 0.09 | 0.12 | 0.15 |
| Mean of dependent variable | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 |

Notes: The table reports estimates for six OLS regressions of the number of consecutive refusing commuters approached by a surveyor before each commuter agrees to participate. An observation is a (participating) bus commuter in the bus stop intercept survey; the mean in the sample is 0.78 interceptions rejected before an agreeing commuter. In addition to an indicator equal to 1 if the bus the (participating) commuter alights from is electric and 0 otherwise, columns 2-6 progressively add FE for bus line, bus stop, surveyor, hour of the day, and date. Bus line FE and bus stop FE explain 8% of the variation in the number of commuters who declined to participate before a commuter agreed to respond (columns 3 vs. 1). Surveyor FE add little explanatory power (columns 4 vs. 3). Hour-of-day FE and date FE raise the explanatory power of the model by another 6 percentage points (columns 6 vs. 4). For example, participation drops as the day wears on, with more refusals at 18:00-19:00 and less at 10:00-11:00. Further including a rain dummy reveals that local showers do not add explanatory power to survey participation. Robust standard errors are in parentheses. ***Significant at 1%, **at 5%, *at 10%. Source: Bus stop survey.

**Table S.10.** Tests of differences in commuters' knowledge of the bus vehicle they just rode

| Bus commuters who… | Proportion accurately defining the bus engine type | Proportion stating "I Don't Know" the bus engine type | Proportion accurately stating the number of bus decks |
|---|---|---|---|
| …alight from a **diesel bus** [*N*=904] | 0.34 | 0.55 | 0.89 |
| …alight from an **electric bus** [*N*=388] | 0.24 | 0.54 | 0.95 |
| Difference in proportions (S.E.) | -0.09*** (0.03) | -0.01 (0.03) | 0.06*** (0.02) |
| Number of observations | 1,291 | 1,291 | 1,292 |
| …alight from **fully diesel line** [*N*=643] | 0.36 | 0.54 | 0.89 |
| …alight from **partly electric line** [*N*=645] | 0.25 | 0.56 | 0.92 |
| Difference in proportions (S.E.) | -0.11*** (0.03) | 0.02 (0.03) | 0.03* (0.02) |
| Number of observations | 1,288 | 1,288 | 1,288 |
| …alight **d-bus** in **fully diesel line** [*N*=643] | 0.36 | 0.54 | 0.89 |
| …alight **d-bus** in **most electrif. line** [*N*=85] | 0.25 | 0.58 | 0.87 |
| Difference in proportions (S.E.) | -0.12** (0.05) | 0.04 (0.06) | -0.02 (0.04) |
| Number of observations | 728 | 728 | 728 |
| …alight **d-bus** in **partly electric line** [*N*=258] | 0.27 | 0.59 | 0.89 |
| …alight **e-bus** in **partly electric line** [*N*=388] | 0.24 | 0.54 | 0.95 |
| Difference in proportions (S.E.) | -0.03 (0.04) | -0.06 (0.04) | 0.06*** (0.02) |
| Number of observations | 646 | 646 | 646 |
| …alight from **less electrified line** [*N*=71] | 0.25 | 0.68 | 0.86 |
| …alight from **most electrified line** [*N*=324] | 0.20 | 0.58 | 0.93 |
| Difference in proportions (S.E.) | -0.06 (0.06) | -0.10 (0.06) | 0.07* (0.04) |
| Number of observations | 395 | 395 | 395 |
| …alight from a **single-deck electric** [*N*=363] | 0.24 | 0.53 | 0.95 |
| …alight from a **double-deck electric** [*N*=25] | 0.28 | 0.60 | 0.88 |
| Difference in proportions (S.E.) | 0.04 (0.09) | 0.07 (0.10) | -0.07 (0.07) |
| Number of observations | 388 | 388 | 388 |

Notes: The table reports results for $6 \times 3 = 18$ tests of equality of two proportions, stratified by the actual bus engine or by a line's electrification rate, that compare bus commuters' knowledge/awareness of the characteristics of the bus that they had just arrived in. An observation is a bus commuter. Line 944 is the most electrified line and line 189 ("less electrified") is one-half as electrified (Fig. S.9). Most respondents alighting from electric buses did so from single-decks, but we did observe commuters alighting from double-deck electric buses in lines 983, 189, and 83, with larger and more detailed environmental labels on the sides and the rear (Fig. S.1). We use the bus license plate recorded by the surveyor to validate their observation of actual bus engine and number of decks against the transit agency's records. A test rejects equality of proportions across two subsamples ***at 1%, ** 5%, * 10% level of significance. Source: Bus stop survey.

**Table S.11.** Tests of differences in commuters' knowledge of the bus vehicle, by demographic group

| Bus commuters who… | Proportion accurately defining the bus engine type | Proportion stating "I Don't Know" the bus engine type | Proportion accurately stating the number of bus decks |
|---|---|---|---|
| …live in **1-3 room apartments** [*N*=366] | 0.260 | 0.608 | 0.893 |
| …live in **4-room aptmts or bigger** [*N*=926] | 0.326 | 0.523 | 0.916 |
| Difference in proportions (S.E.) | 0.066** (0.028) | -0.086*** (0.030) | 0.022 (0.019) |
| Number of observations | 1291 | 1291 | 1292 |
| …live in **1-2 room apartments** [*N*=200] | 0.236 | 0.633 | 0.880 |
| …live in **condominium or house** [*N*=257] | 0.354 | 0.471 | 0.907 |
| Difference in proportions (S.E.) | 0.118*** (0.042) | -0.162*** (0.046) | 0.027 (0.029) |
| Number of observations | 456 | 456 | 457 |
| …are aged **up to 40 years** [*N*=478] | 0.301 | 0.494 | 0.906 |
| …are aged **60 years and above** [*N*=367] | 0.289 | 0.621 | 0.896 |
| Difference in proportions (S.E.) | -0.012 (0.032) | 0.128*** (0.034) | 0.009 (0.021) |
| Number of observations | 845 | 845 | 845 |
| …are **female** [*N*=724] | 0.223 | 0.658 | 0.899 |
| …are **male** [*N*=564] | 0.415 | 0.408 | 0.922 |
| Difference in proportions (S.E.) | 0.192*** (0.026) | -0.251*** (0.027) | 0.023 (0.016) |
| Number of observations | 1287 | 1287 | 1288 |
| …are **proficient in English** [*N*=906] | 0.329 | 0.502 | 0.915 |
| …are **not proficient in English** [*N*=125] | 0.168 | 0.776 | 0.872 |
| Difference in proportions (S.E.) | -0.161*** (0.037) | 0.274*** (0.041) | -0.043 (0.031) |
| Number of observations | 1030 | 1030 | 1031 |
| …are **proficient in English** [*N*=906] | 0.329 | 0.502 | 0.915 |
| …spoke in **other language** [*N*=257] | 0.296 | 0.603 | 0.907 |
| Difference in proportions (S.E.) | -0.034 (0.033) | 0.101*** (0.035) | -0.008 (0.020) |
| Number of observations | 1162 | 1162 | 1163 |
| …have **up to primary education** [*N*=46] | 0.239 | 0.630 | 0.978 |
| …have **at least secondary educ.** [*N*=255] | 0.435 | 0.435 | 0.878 |
| Difference in proportions (S.E.) | 0.196*** (0.071) | -0.195** (0.078) | -0.100*** (0.030) |
| Number of observations | 301 | 301 | 301 |

Notes: The table reports results for $7 \times 3 = 21$ tests of equality of two proportions, stratified by demographic group, that compare commuters' knowledge/awareness of the bus that they had just arrived in. An observation is a bus commuter. Dwelling sizes "4-rm aptmts or bigger" include condominium apartments and houses; this stratification is the complement to "1-3 room apartments." Education was added on January 27, 2021, so tests have relatively less power. A test rejects equality of proportions across two subsamples ***at 1%, **at 5%, *at 10% level of significance. See the caption to Table S.10 for further comments. Source: Bus stop survey.

**Table S.12.** Tests of differences in bus commuters' knowledge of the engine type of Singapore's *trains*, by demographic group

| Bus commuters who… | Proportion accurately defining Singapore trains' engine type (= electric) | Proportion stating "I Don't Know" Singapore trains' engine type |
|---|---|---|
| …live in **1-3 room apartments** [*N*=141] | 0.440 | 0.482 |
| …live in **4-room aptmts or bigger** [*N*=364] | 0.478 | 0.398 |
| Difference in proportions (S.E.) | 0.038 (0.049) | -0.084* (0.049) |
| Number of observations | 505 | 505 |
| …are aged **up to 40 years** [*N*=179] | 0.419 | 0.430 |
| …are aged **60 years and above** [*N*=150] | 0.473 | 0.480 |
| Difference in proportions (S.E.) | 0.054 (0.055) | 0.050 (0.055) |
| Number of observations | 329 | 329 |
| …are **female** [*N*=267] | 0.345 | 0.539 |
| …are **male** [*N*=237] | 0.603 | 0.291 |
| Difference in proportions (S.E.) | 0.259*** (0.043) | -0.248*** (0.043) |
| Number of observations | 504 | 504 |
| …are **proficient in English** [*N*=351] | 0.462 | 0.410 |
| …spoke in **other language** [*N*=125] | 0.472 | 0.448 |
| Difference in proportions (S.E.) | 0.010 (0.052) | 0.038 (0.052) |
| Number of observations | 476 | 476 |
| …have **up to primary education** [*N*=48] | 0.396 | 0.563 |
| …have **at least secondary education** [*N*=255] | 0.522 | 0.345 |
| Difference in proportions (S.E.) | 0.126 (0.078) | -0.217*** (0.078) |
| Number of observations | 303 | 303 |

Notes: The table reports results for $5 \times 2 = 10$ tests of equality of two proportions, stratified by demographic group, that compare bus commuters' knowledge/awareness of the engine type of Singapore's MRT trains. Singapore's train fleet is fully electrified, i.e., no urban train burns diesel. An observation is a bus commuter after January 4, 2021, when we extended the bus stop survey to include a question on knowledge of MRT train engine type. Dwelling sizes "4-rm aptmts or bigger" include condominium apartments and houses; this stratification is the complement to "1-3 room apartments." Education was added on January 27, 2021, so tests have relatively less power. A test rejects equality of proportions across two subsamples ***at 1%, **at 5%, *at 10% level of significance. Source: Bus stop survey.

**Table S.13.** Summary statistics for the rail station intercept survey

| Variable | *N* | Mean | Std.Dev. | Min. | Max. |
|---|---|---|---|---|---|
| A. **Satisfaction** levels: -1 = "not satisfied", 0 = "neutral", 1 = "satisfied" | | | | | |
| The **noise** when waiting, boarding and riding | 559 | 0.45 | 0.54 | -1 | 1 |
| The **fumes/smell** when waiting, boarding and riding | 559 | 0.63 | 0.51 | -1 | 1 |
| The **smoothness** of the ride | 559 | 0.62 | 0.54 | -1 | 1 |
| The **speed** of the ride | 559 | 0.61 | 0.54 | -1 | 1 |
| B. Frequency of weekly rail use | | | | | |
| Zero day per week (1 = yes) | 559 | 0.04 | 0.19 | 0 | 1 |
| 1 day per week (1 = yes) | 559 | 0.06 | 0.24 | 0 | 1 |
| 2 days per week (1 = yes) | 559 | 0.11 | 0.31 | 0 | 1 |
| 3 days per week (1 = yes) | 559 | 0.11 | 0.31 | 0 | 1 |
| 4 days per week (1 = yes) | 559 | 0.08 | 0.28 | 0 | 1 |
| 5 days per week (1 = yes) | 559 | 0.22 | 0.41 | 0 | 1 |
| 6 days per week (1 = yes) | 559 | 0.12 | 0.32 | 0 | 1 |
| 7 days per week (1 = yes) | 559 | 0.26 | 0.44 | 0 | 1 |
| Don't know (1 = yes) | 559 | 0 | 0 | 0 | 0 |
| C. Rail commuter's perceived engine type of Singapore's MRT trains | | | | | |
| Perceived engine type of trains: Diesel (1 = yes) | 559 | 0.18 | 0.13 | 0 | 1 |
| Perceived engine type of trains: Electric (1 = yes) | 559 | 0.38 | 0.49 | 0 | 1 |
| Perceived engine type of trains: Hybrid (1 = yes) | 559 | 0.06 | 0.24 | 0 | 1 |
| Perceived engine type of trains: Other (1 = yes) | 559 | 0.00 | 0.04 | 0 | 1 |
| Perceived engine type of trains: Don't Know (1 = yes) | 559 | 0.54 | 0.50 | 0 | 1 |
| D. Respondent characteristics | | | | | |
| Dwelling size: 1-room apartment (1 = yes) | 559 | 0.01 | 0.12 | 0 | 1 |
| Dwelling size: 2-room apartment (1 = yes) | 559 | 0.04 | 0.19 | 0 | 1 |
| Dwelling size: 3-room apartment (1 = yes) | 559 | 0.21 | 0.41 | 0 | 1 |
| Dwelling size: 4-room apartment (1 = yes) | 559 | 0.27 | 0.45 | 0 | 1 |
| Dwelling size: 5-room apartment (1 = yes) | 559 | 0.19 | 0.39 | 0 | 1 |
| Dwelling size: Condominium apartment (1 = yes) | 559 | 0.18 | 0.39 | 0 | 1 |
| Dwelling size: "Landed Property," i.e., House (1 = yes) | 559 | 0.04 | 0.20 | 0 | 1 |
| Respondent age: Under 20 years (1 = yes) | 559 | 0.05 | 0.22 | 0 | 1 |
| Respondent age: 20s (1 = yes) | 559 | 0.15 | 0.36 | 0 | 1 |
| Respondent age: 30s (1 = yes) | 559 | 0.16 | 0.36 | 0 | 1 |
| Respondent age: 40s (1 = yes) | 559 | 0.16 | 0.37 | 0 | 1 |
| Respondent age: 50s (1 = yes) | 559 | 0.18 | 0.39 | 0 | 1 |
| Respondent age: 60 and above (1 = yes) | 559 | 0.29 | 0.45 | 0 | 1 |
| Female (1 = yes) | 557 | 0.53 | 0.50 | 0 | 1 |
| Education: No qualification/pre-primary (1 = yes) | 559 | 0.02 | 0.13 | 0 | 1 |
| Education: Primary (1 = yes) | 559 | 0.05 | 0.23 | 0 | 1 |
| Education: Secondary (1 = yes) | 559 | 0.26 | 0.44 | 0 | 1 |
| Education: Post-Secondary (non-tertiary) (1 = yes) | 559 | 0.06 | 0.25 | 0 | 1 |
| Education: Polytechnic Diploma (1 = yes) | 559 | 0.19 | 0.40 | 0 | 1 |
| Education: Bachelor's Degree (1 = yes) | 559 | 0.30 | 0.46 | 0 | 1 |
| Education: Postgraduate and above (1 = yes) | 559 | 0.09 | 0.29 | 0 | 1 |
| Lived in Singapore all their life (1 = yes) | 558 | 0.70 | 0.46 | 0 | 1 |
| Years since arrived, if lived abroad | 167 | 12.61 | 12.16 | 0.02 | 63 |

| Variable | *N* | Mean | Std.Dev. | Min. | Max. |
|---|---|---|---|---|---|
| E. Environmental conditions | | | | | |
| Hour of the day | 559 | 16.34 | 1.08 | 14 | 19 |
| Rainy conditions (1 = yes) | 559 | 0.15 | 0.36 | 0 | 1 |
| Male commuters who declined before this response | 559 | 1.33 | 1.86 | 0 | 15 |
| Female commuters who declined before this response | 559 | 1.44 | 1.89 | 0 | 10 |

Notes: Intercept survey of 559 commuters alighting at eight rail stations across six different MRT lines on 11 different days between January 28 and March 7, 2021. For each location-day, surveyors worked in pairs, totaling five surveyors in all. The actual engine type of all of Singapore's trains is electric. For brevity, we do not show dwelling types that were chosen by up to 2% of respondents (e.g., Other, Don't Know/Refused). We specify "Don't Know/Refused" dummies to account for two respondents who refused to declare their age and eight respondents who did not know/refused to declare their education. A respondent's communication was deemed by the surveyor as proficient in English (83% of responses), not proficient in English (7%), or undertaken in another language than English (10%); we omit these variables for brevity. Source: Rail station survey.

**Table S.14.** Tests of differences in rail commuters' knowledge of the engine type of Singapore's trains, by demographic group

| Rail commuters who… | Proportion accurately defining Singapore trains' engine type (= electric) | Proportion stating "I Don't Know" Singapore trains' engine type |
|---|---|---|
| …ride MRT **up to 1 day per week** [*N*=54] | 0.444 | 0.481 |
| …ride MRT **5 or more days per week** [*N*=336] | 0.384 | 0.536 |
| Difference in proportions (S.E.) | -0.061 (0.073) | 0.054 (0.074) |
| Number of observations | 390 | 390 |
| …live in **1-3 room apartments** [*N*=147] | 0.354 | 0.571 |
| …live in **4-room apartments or bigger** [*N*=412] | 0.396 | 0.524 |
| Difference in proportions (S.E.) | 0.042 (0.046) | -0.047 (0.048) |
| Number of observations | 559 | 559 |
| …live in **1-2 room apartments** [*N*=30] | 0.233 | 0.700 |
| …live in **condominium or house** [*N*=126] | 0.397 | 0.476 |
| Difference in proportions (S.E.) | 0.163* (0.090) | -0.224** (0.096) |
| Number of observations | 156 | 156 |
| …are aged **up to 40 years** [*N*=202] | 0.347 | 0.559 |
| …are aged **60 years and above** [*N*=162] | 0.370 | 0.531 |
| Difference in proportions (S.E.) | 0.024 (0.051) | -0.029 (0.053) |
| Number of observations | 364 | 364 |
| …are **female** [*N*=297] | 0.296 | 0.650 |
| …are **male** [*N*=260] | 0.488 | 0.408 |
| Difference in proportions (S.E.) | 0.192*** (0.041) | -0.242*** (0.041) |
| Number of observations | 557 | 557 |
| …have **up to secondary educ.** [*N*=188] | 0.266 | 0.660 |
| …have **post-secondary educ.** [*N*=360] | 0.450 | 0.467 |
| Difference in proportions (S.E.) | 0.184*** (0.042) | -0.193*** (0.044) |
| Number of observations | 548 | 548 |
| …are **proficient in English** [*N*=465] | 0.404 | 0.516 |
| …are **not proficient in English** [*N*=37] | 0.216 | 0.703 |
| Difference in proportions (S.E.) | -0.188** (0.072) | 0.187** (0.080) |
| Number of observations | 502 | 502 |
| …are **proficient in English** [*N*=465] | 0.404 | 0.516 |
| …spoke in **other language** [*N*=56] | 0.339 | 0.589 |
| Difference in proportions (S.E.) | -0.065 (0.068) | 0.073 (0.070) |
| Number of observations | 521 | 521 |

Notes: The table reports results for $8 \times 2 = 16$ tests of equality of two proportions, stratified by demographic group, that compare rail commuters' knowledge/awareness of the engine type of MRT trains. An observation is a rail commuter. A test rejects equality of proportions across two subsamples ***at 1%, **at 5%, *at 10% level of significance. Source: Rail station survey.

**Table S.15.** Summary statistics for the bus stop intercept survey *after* line 944 e-bus removal

| Variable | *N* | Mean | Std.Dev. | Min. | Max. |
|---|---|---|---|---|---|
| A. **Perceived changes in the buses** in the specifically named *X* bus line from which respondent alights | | | | | |
| I did **notice a change** in [my] line *X*'s buses (1 = yes) | 74 | 0.30 | 0.46 | 0 | 1 |
| Don't Know if I **noticed a change** in line *X* (1 = Don't Know) | 74 | 0.18 | 0.38 | 0 | 1 |
| [My] line X's **buses are noisier** now (1 = yes) | 74 | 0.16 | 0.37 | 0 | 1 |
| Don't Know if **noise level** of line *X*'s bus has changed (1 = DK) | 74 | 0.05 | 0.23 | 0 | 1 |
| [My] line X's **bus engine type** has changed (1 = yes) | 74 | 0.05 | 0.23 | 0 | 1 |
| Don't Know if **engine type** of line *X*'s bus changed (1 = DK) | 74 | 0.34 | 0.48 | 0 | 1 |
| [My] line X's **buses are older** now (1 = yes) | 74 | 0.07 | 0.25 | 0 | 1 |
| Don't Know if **age** of line *X*'s bus has changed (1 = DK) | 74 | 0.20 | 0.40 | 0 | 1 |
| B. Actual bus characteristics | | | | | |
| Actual bus engine: Diesel (1 = yes) | 74 | 1 | 0 | 0 | 1 |
| Actual number of bus decks: Single (1 = yes) | 74 | 0.74 | 0.44 | 0 | 1 |
| Actual number of bus decks: Double (1 = yes) | 74 | 0.26 | 0.44 | 0 | 1 |
| Actual number of bus decks: Bendy (1 = yes) | 74 | 0 | 0 | 0 | 1 |
| C. Weekly ridership frequency and other respondent characteristics | | | | | |
| (Omitted for brevity: Similar to Table S.3) | | | | | |
| D. Environmental conditions | | | | | |
| Hour of the day | 74 | 12.74 | 2.73 | 9 | 18 |
| Rainy conditions (1 = yes) | 74 | 0 | 0 | 0 | 0 |
| Male commuters who declined before this response | 74 | 0.45 | 0.67 | 0 | 2 |
| Female commuters who declined before this response | 74 | 0.62 | 0.98 | 0 | 4 |

Notes: Intercept survey of 74 commuters alighting at three bus stops from five fully diesel bus lines (160, 160M, 180, 944, and 991) between July 17 and July 31, 2021. Importantly, electric buses had been serving line 944 between April 2020 and May 2021; line 944 was now back to fully diesel and we surveyed 38 of its commuters on whether they perceived any changes to the de-electrified line's buses. For brevity, we omit ridership frequency and other respondent characteristics. (We will publish the data.) Source: Bus stop survey post 944 e-bus removal.

**Table S.16.** Tests of bus commuters' perceptions of changes in the buses serving specific lines, including line 944 shortly after de-electrification

| Bus commuters who… | *Compare June and July with earlier this year, have you noticed anything different about the buses in line X?* | | (Probe further regardless of earlier answer) *Specifically, has the noise level of the line X buses changed?* | |
|---|---|---|---|---|
| | **Yes, I did notice a change in [my] line *X*'s buses** (1 = yes) | **Don't Know if I noticed a change in line *X*** (1 = Don't Know) | **[My] line *X*'s buses are Noisier now** (1 = yes) | **Don't Know if noise level of line *X*'s bus has changed** (1 = Don't Know) |
| …alight from an always-diesel line [*N*=36] | 0.333 | 0.083 | 0.056 | 0 |
| …alight from line 944 (now back to diesel) [*N*=38] | 0.263† | 0.263† | 0.263† | 0.105 |
| Difference in proportions (S.E.) | -0.070 (0.108) | 0.180** (0.086) | 0.208** (0.082) | 0.105** (0.050) |
| Number of observations | 74 | 74 | 74 | 74 |
| Bus commuters who… | (Probe further regardless of earlier answer) *Has the bus engine of the line X buses changed?* | | (Probe further regardless of earlier answer) *Has the age of the line X buses changed?* | |
| | **[My] line *X*'s bus engine type has changed** (1 = yes) | **Don't Know if engine type of line X's bus changed** (1 = Don't Know) | **[My] line *X*'s buses are Older now** (1 = yes) | **Don't Know if age of line *X*'s bus has changed** (1 = Don't Know) |
| …alight from an always-diesel line [*N*=36] | 0.028 | 0.222 | 0.056 | 0.139 |
| …alight from line 944 (now back to diesel) [*N*=38] | 0.079 | 0.447 | 0.079 | 0.263 |
| Difference in proportions (S.E.) | 0.051 (0.052) | 0.225** (0.108) | 0.023 (0.059) | 0.124 (0.093) |
| Number of observations | 74 | 74 | 74 | 74 |

Notes: The table reports results for $2 \times 4 = 8$ tests of equality of two proportions, stratified by whether the respondent alighted from a bus serving an "always diesel" line (160, 160M, 180, or 991) vs. alighted from a "now back to diesel" line 944 bus. Electric buses had been serving line 944 between April 2020 and May 2021. When we conducted this survey in July 2021, line 944 was now back to fully diesel (de-electrified). An observation is a bus commuter in either of three bus stops (40351, 40361, and 43789, in the Bukit Batok neighborhood) called on by lines 160, 160M, 180, 944, and 991. A test rejects equality of proportions across two subsamples ***at 1%, **at 5%, *at 10% level of significance. †The same proportions for these cells refers in each case to 10 commuters out of 38, i.e., it is not a typographical error. Source: Bus stop survey post 944 e-bus removal.

**Table S.17.** Demographics of Bukit Batok residents in the choice experiment sample

| Variable | *N* | Mean | Std.Dev. | Min. | Max. |
|---|---|---|---|---|---|
| A. Household characteristics | | | | | |
| Nearest bus stop served by line 944 (1 = yes) | 1200 | 0.50 | 0.50 | 0 | 1 |
| Household occupancy | 1200 | 3.36 | 1.37 | 1 | 9 |
| Dwelling size: 1-room apartment (1 = yes) | 1200 | 0.03 | 0.16 | 0 | 1 |
| Dwelling size: 2-room apartment (1 = yes) | 1200 | 0.11 | 0.31 | 0 | 1 |
| Dwelling size: 3-room apartment (1 = yes) | 1200 | 0.12 | 0.32 | 0 | 1 |
| Dwelling size: 4-room apartment (1 = yes) | 1200 | 0.48 | 0.50 | 0 | 1 |
| Dwelling size: 5-room apartment (1 = yes) | 1200 | 0.27 | 0.44 | 0 | 1 |
| Story of the apartment within the housing block | 1200 | 9.07 | 4.68 | 1 | 22 |
| Household owns at least one car (1 = yes) | 1200 | 0.38 | 0.48 | 0 | 1 |
| Household employs migrant domestic helper (1 = yes) | 1200 | 0.09 | 0.28 | 0 | 1 |
| B. Respondent characteristics | | | | | |
| Rides the public bus on a typical day (1 = yes) | 1200 | 0.66 | 0.47 | 0 | 1 |
| Rides the public train on a typical day (1 = yes) | 1200 | 0.44 | 0.50 | 0 | 1 |
| Rides an owned car on a typical day (1 = yes) | 1200 | 0.24 | 0.43 | 0 | 1 |
| Rides a taxi or ride-hailed car on a typical day (1 = yes) | 1200 | 0.14 | 0.35 | 0 | 1 |
| Rides any car, owned or not, on a typical day (1 = yes) | 1200 | 0.36 | 0.48 | 0 | 1 |
| Rides a motorcycle on a typical day (1 = yes) | 1200 | 0.06 | 0.24 | 0 | 1 |
| Age (years) | 1200 | 38.57 | 11.75 | 21 | 70 |
| Female (1 = yes) | 1200 | 0.52 | 0.50 | 0 | 1 |
| Education: No qualification/pre-primary (1 = yes) | 1200 | 0.00 | 0.06 | 0 | 1 |
| Education: Primary (1 = yes) | 1200 | 0.04 | 0.20 | 0 | 1 |
| Education: Secondary (1 = yes) | 1200 | 0.20 | 0.40 | 0 | 1 |
| Education: Post-Secondary & Polytechnic Dipl. (1 = yes) | 1200 | 0.38 | 0.49 | 0 | 1 |
| Education: Bachelor's Degree & above (1 = yes) | 1200 | 0.37 | 0.48 | 0 | 1 |
| Labor force status: Employed (1 = yes) | 1200 | 0.79 | 0.41 | 0 | 1 |
| Labor force status: Self-employed (1 = yes) | 1200 | 0.04 | 0.20 | 0 | 1 |
| Labor force status: Unemployed (1 = yes) | 1200 | 0.09 | 0.29 | 0 | 1 |
| Labor force status: Not in labor force (1 = yes) | 1200 | 0.05 | 0.21 | 0 | 1 |
| Labor force status: Student (1 = yes) | 1200 | 0.03 | 0.17 | 0 | 1 |
| Labor force status: National Service (1 = yes) | 1200 | 0.00 | 0.04 | 0 | 1 |
| C. Time and day of the week of the home interview | | | | | |
| Hour of the day (when the interview started) | 1200 | 15.35 | 2.37 | 10 | 21 |
| Day of the week (0 = Sunday, 6 = Saturday) | 1200 | 2.91 | 2.04 | 0 | 6 |
| Weekday (1 = yes) | 1200 | 0.69 | 0.46 | 0 | 1 |

Notes: Sample of 1200 residents who completed choice experiments on bus engine preference between September 26 and November 11, 2021. Residents live across 39 housing blocks in the Bukit Batok neighborhood that is served by bus line 944, the line with the most intensive (80%) and extensive (over one year) electrification in this study. These blocks are high-rise apartment towers that are typical in Singapore's housing market. Our contractor Blackbox Research interviewed residents at the door of their homes; in all, 18 enumerators conducted these interviews. Source: In-residence choice experiments.

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